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Carolina Castagnetti
(Università di Pavia)

Silvia Dal Bianco
(Università di Pavia)

Luisa Rosti
(Università di Pavia)

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Dipartimento di economia politica
e metodi quantitativi
Università degli studi di Pavia
Via San Felice, 5
I-27100 Pavia

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Carolina Castagnetti*
University of Pavia
castca@eco.unipv.it

Silvia Dal Bianco
University of Pavia
silvia.dalbianco@eco.unipv.it

Luisa Rosti
University of Pavia
lrosti@eco.unipv.it

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Abstract

Italian university system was reformed in 2001. This paper tests the screening role of degree scores for 2004-Italian graduates. We find support of the strong screening hypothesis for pre-reform type degrees, while we do not find any evidence of signalling effects for post-reform 3-years degrees. We gauge that the shutting down of the signal can be partially ascribed to the poor quality of students who obtained a 3-years degree without taking any further education.

Keywords: Screening, Italy, Higher Education.
JEL - Classification: I23, J08.

1 Introduction

Educational performance is expected to increase earnings for at least two reasons. First, according to the human capital theory, education directly enhances individual productivity augmenting the skills of the agents: Becker [1964]. Second, the screening hypothesis predicts that education acts a signal of productivity: Arrow [1973].Distinguishing between the two approaches has important policy implications: see Chevalier et al. [2004] for a discussion.

In this brief paper we analyze the effects of students' performance at university on remunerations.[1] In particular, we consider the cohort of 2004 Italian graduates, whose information on earnings was gathered three years after graduation (i.e. in 2007), and we empirically test the screening role of education. Such a sample is particularly interesting because Italian university was reformed in 2001.[2] The traditional one-tier model of a 4/6-years degree has been changed into a two-tier one. The new system is characterized by a 3-years degree (i.e. first cycle), also known as "short degree", and a sub-sequent 2-years degree (i.e. secondary cycle), called "master degree". The overall 5-years degree takes the name of "long degree". So that, our sample is

*Dipartimento di Economia Politica e Metodi Quantitativi, Via San Felice 5, 27100 Pavia, Italy, castca@eco.unipv.it, tel.++390382986217, fax.++390382304226, corresponding author.

[1]Full details on our measure of students' performance (i.e. *Edperf*) can be found in Section 2.

[2]The 2001 reform of Italian university system pertains to the so-called "Bologna process". The latter is aimed at building the European Higher Education Area and, thus, at facilitating the mutual recognition of degrees across the higher education institutions of the 47 participating countries. For further details, see: http://www.ond.vlaanderen.be/hogeronderwijs/bologna/

made by the first Italian cohort of "short graduates" and the last cohort of pre-reform students, which we call "old graduates".

The present work fits into the recent and enlarging literature that analyzes distinct aspects of the Italian university reform: see among others Bosio and Leonardi [2010], Bratti et al. [2010], Cappellari and Lucifora [2009], Cutillo and Di-Pietro [2006], Boero et al. [2005]. In particular, the aim of this paper is assessing both the "strong" (SSH) and the "weak" screening hypotheses (WSH), for both short and old degrees. According to the SSH, schooling is merely a signal of (potential) employee's productivity; conversely, the WSH states that education is both a signalling and an enhancing-productivity device: Psacharopoulos [1979] and Heywood and Wei [2004]. Consistently with Castagnetti et al. [2005], we find supportive evidence for the SSH for old graduates[3] while no evidence of signalling is provided for the short ones. This kind of evidence can be interpreted in the light of Bratti et al. [2010], which shows a reduction of university standards for short degrees, and on the basis of Cappellari and Lucifora [2009] and Cutillo and Di-Pietro [2006], which document higher enrollment and lower drop-out rates for short degrees compared to old ones. Thus, after the reform, the quantity of low ability graduates might have increased. Moreover, the inflation of short degrees grades found by Bratti et al. [2010] might have reduced the signalling function of college performance, so that firms might find more difficulties in selecting high-ability job applicants on the basis of university's grades. Our exercise will show that these lines of explanation hold in the present case. Finally, it is worth underlying that the fading of the signal for short degrees does not necessarily imply a null graduate wage premium. In fact, the recent work of Bosio and Leonardi [2010] documents that such a premium has shrunk for short graduates relatively to the old ones but it has not disappeared.

The present work adds to the existing literature on screening in at least two ways. First: our measure of students' performance combines information on both grades and degree-completion time. As recently underlined by Brodaty et al. [2009], in order to capture the true signalling function of grades, both grade and time dimensions must be taken into account. As a matter of fact, individuals who complete their academic career slowly and/or achieve low test scores send a poor ability signal to employers. Second: we employ the earnings information which were registered at the early stage of graduates' career (i.e. three years after graduation). This fact makes the signalling function of grades retrievable. This is because, as the employers discover the (unobserved) ability of employees after few years only, the impact of job-market signalling effects is limited to the beginning of workers' professional life: Lange [2007] and Altonji and Pierret [2001].

2 Data

Our data come from the 2007-wave of the "Survey on Labor Market Transitions of University Graduates" carried out by the Italian National Statistical Office (i.e. ISTAT). As already mentioned, the cohort of 2004 Italian graduates was interviewed. The retrospective information gathered allows us to analyze both academic performance (i.e. final degree grades) and earnings at first labor market entry (i.e. three years after graduation). The population of 2004-graduates amounts to 260.070 individuals (167.886 old graduates and 92.184 short graduates). The response rate was about 69.5%, so that the surveyed individuals are 47.300 (26.570 old and 20.730 short). The Survey contains a wide range of information on (i) university career and high

[3]The data analyzed in Castagnetti et al. [2005] were derived from the "Survey on Labour Market Transitions of University Graduates" carried out in 2001 by the Italian National Institute of Statistics. The graduate students considered were those who completed in 1998 a course whose duration was four years or more, because the Italian university system was based on a one-tier model, without any possibility of intermediate exit.

school background; (ii) work experience; (iii) job search; (iv) family information; (v) personal characteristics.[4] We exclude individuals who graduated in medical fields, because their career is very different from that of all other graduates.[5] Further, we restrict the estimating sample to full-time workers, defined as those who work more than 30 hours per week. This choice is motivated by the lack of hourly-wages information. After these corrections, the sample reduces to 10.153 and 9.604 individuals, for old and short degrees respectively.

As already mentioned, our measure of students' performance combines information on grades and completion time. This variables is called *Edperf* and it is calculated as the product of the final degree mark and the inverse of the degree-completion time. Formally, $[Edperf = (dscore)/(1 + 0.1 * years)]$ where $dscore$ is the degree mark and $years$ is the number of years used to get the degree. The degree scores have been normalized to take into account that different faculties might employ different marking scale and different duration. Finally, the upper bound limit of *Edperf* is set to 113, which corresponds to honors degree with no delay in completion.

3 Methodology and Results

Employing the Heckman [1979] two-step procedure to control for self-selection,[6] we estimate the earnings functions for full-time employees and the self-employed, for both old and short degrees. Following the seminal ideas of Wolpin [1977] and Riley [1979], we assume that self-employed workers have no need to signal innate ability to a future employer, so that the returns to education in this case are nothing but true returns to human capital. Then, if the WSH holds, we expect a significant positive return on education for the self-employed, but a significantly higher positive return for employees. The SSH, in contrast, implies an insignificant return on education for the self-employed, but a significantly positive return for employees: Brown and Sessions [1998] and Brown and Sessions [1999].
The estimated earnings functions are reported in Table 1.[7] Looking at the first row of the table, it is easy to see that our estimates support the SSH for old graduates only. In fact, the educational performance proxy (i.e. *Edperf*) is statistically insignificant for the old self-employed but it is positive and significant for the employees. Turning to short graduates, as the *Edperf* coefficient is always insignificant, we do not find evidence for either the SSH or the WSH. This result is robust under different specifications. Here, we report just the most complete ones. Moreover, it is worth noting that Castagnetti et al. [2005] find the same result for the cohort of pre-reform Italian 1998-graduates. So that, the SSH for old Italian graduates seems to be quite well established.

At this point, it is compelling to ask why the signalling mechanism does not work for short graduates. We start tackling this issue looking to the distributions of *Edperf* for old and short 2004-cohort graduates and for the 1998-cohort, reported in Figure 1. It is important to stress that we considered only the short graduates who did not take any further education (i.e. master,

[4] More precisely, the number of variables reported is the following: 64 for category (i), 67 for (ii), 7 for (iii), 13 for (iv) and 14 for (v).

[5] After having obtained their degree in medicine, students usually carry out a specializing medical school which lasts 3 years at least.

[6] The Heckman [1979] procedure allows to obtain consistent estimates when individuals take their choice (i.e. employee *vs* self-employed, in this case) because they have a comparative advantage, flawing the hypothesis of a randomly selected sample (i.e. selection bias). In our data, we observe a negative selection bias for short employees only. See *Lambda* coefficients in Table 1.

[7] Please note that, due to space reasons, we omit the first-step estimates, which are available upon request.

specialization course,...) after obtaining the 3-years degree. From the graph, it is evident the anomalous concentration around the highest values in the short graduates' distribution. It could also be seen that both distributions of old degrees are more bell-shaped. Moreover, the median values of *Edperf* are: 92 for 2004-old degrees, 87 for 1998-old degrees and 102 for 2004-short degrees. From the results on the screening hypotheses, we know that the outstanding performance of short graduates is not remunerated in the labor market. We propose to explain these findings through the post-reform reduction of university standards found by Bratti et al. [2010]. Following Chevalier [2003], we take High School Marks as a proxy for students' ability and we evaluate the probability of enrolling in a short degree. Table 2 reports the results. The first row of the table shows the inverse correlation between ability and the probability of attending a short degree course, while the second row reinforces such a finding employing the *Liceo Classico-Scientifico* dummy variable, which is equal to one in the case the students attended these type of high schools, which are traditionally the most demanding. Thus, we can conclude that the signalling value of *Edperf* was shut down by the low quality of the students who completed a short degree and who did not take any further education.

4 Concluding remarks

This brief paper has shown that the signalling value of students' performance at university has faded away for the first cohort of "short" Italian graduates, while such a device appears as effective as before for pre-reform type graduates. Consistently with the established literature, we also find evidence that the shutting down of the signal can be partially ascribed to the poor quality of students who obtained a short degree, without taking any further education.
Some further research questions appear as very interesting and they will be tackled as soon as the 2011 release of the ISTAT Graduate Survey will be available. In particular: does the screening hypotheses hold for long degrees? Are there any differences in the graduate premium for short and long degrees? If yes, why? Has the signalling device changed from degree grades to degree duration?

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References

J. Altonji and C. Pierret. Employer learning and statistical discrimination. *Quarterly Journal of Economics*, 116:313–50, 2001.

K. J. Arrow. Higher education as a filter. *Journal of Public Economics*, 3:193–216, 1973.

G. S. Becker. *Human Capital*. Columbia university press; 3d edition edition, 1964.

G. Boero, T. Laureti, and R. Naylor. An econometric analysis of student withdrawal and progression in post-reform italian universities. Technical report, CRENOS, W.P. 04, 2005.

G. Bosio and M. Leonardi. The effect of 3+2 on the graduate labor market: demand and supply. mimeo, November 2010.

M. Bratti, C. Broccolini, and S. Staffolani. Higher education reform, student time allocation and academic performance in italy: Evidence from a faculty of economics. *Rivista Italiana degli Economisti*, (15):275–304, 2010.

O. Brodaty, R.J. Gary-Bobo, and A. Prieto. Does speed signal ability? a test of spence's theory. Technical report, Centre de Recherche en Economie et Statistique. Working Papers No 2009-02, 2009.

S. Brown and J.G. Sessions. Education, employment status and earnings: a comparative test of the strong screening hypothesis. *Scottish Journal of Political Economy*, 45(5):586–591, 1998.

S. Brown and J.G. Sessions. Education and employment status: a test of the strong screening hypothesis in italy. *Economics of Education Review*, (18):397–404, 1999.

L. Cappellari and C. Lucifora. The bologna process and college enrolment decisions. *Labour Economics*, 16(6):638–647, 2009.

C. Castagnetti, F. Chelli, and L. Rosti. Educational performance as signalling device: Evidence from italy. *Economics Bulletin*, 9(4):1–7, 2005.

A. Chevalier. Measuring over-education. *Economica*, (70):509–531, 2003.

A. Chevalier, C. Harmon, I. Walker, and Y. Zhu. Does education raise productivity, or just reflect it? *The Economic Journal*, (114):499–517, 2004.

A. Cutillo and G. Di-Pietro. University quality and labour market outcomes in italy. *Labour*, 20(1):37–62, 2006.

J. J. Heckman. Sample selection bias as a specification error. *Econometrica*, 1(47):153–161, 1979.

J. S. Heywood and X. Wei. Education and signaling: Evidence from a highly competitive labor market. *Education Economics*, 12:1–16, 2004.

F. Lange. The speed of employer learning. *Journal of Labor Economics*, 25:1–35, 2007.

G. Psacharopoulos. On the weak versus strong version of the screening hypothesis. *Economic Letters*, 4:181–185, 1979.

J. G. Riley. Testing the educational screening hypothesis. *Journal of Political Economy*, 5: S227–S252, 1979.

K. Wolpin. Education and screening. *The American Economic Review*, 67:949–958, 1977.

Figure 1: Educational Performance Distribution

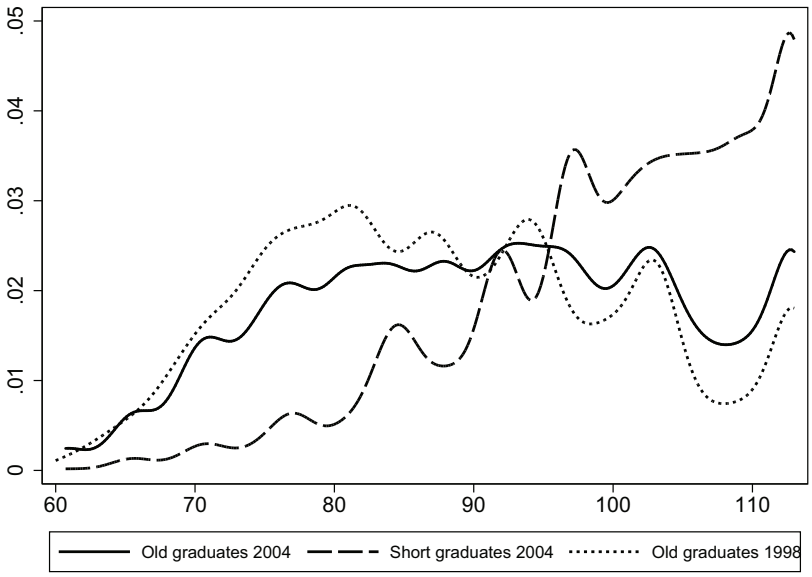

Table 1: **Monthly earnings equations**

	Specification 1				Specification 2			
	Old Self	**Old Employees**	**Short Self**	**Short Employees**	**Old Self**	**Old Employees**	**Short Self**	**Short Employees**
Edperf	**0.001**	**0.002*** **	**-0.001**	**0.000**	**0.001**	**0.001*** **	**-0.001**	**0.000**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
High School Grade					0.001	0.001***	0.003	0.000
					(0.001)	(0.000)	(0.002)	(0.001)
Female	-0.146***	-0.099***	-0.186***	-0.158***	-0.145***	-0.100***	-0.217***	-0.152***
	(0.033)	(0.011)	(0.055)	(0.027)	(0.028)	(0.008)	(0.053)	(0.024)
Working student	0.078***	0.034***	0.106***	0.010	0.073***	0.029***	0.102***	0.011
	(0.018)	(0.006)	(0.027)	(0.018)	(0.018)	(0.005)	(0.028)	(0.017)
Father self-employed	0.044	0.005	0.053	0.067**	0.037	0.005	0.077	0.062**
	(0.032)	(0.012)	(0.059)	(0.030)	(0.029)	(0.010)	(0.058)	(0.027)
Father Degree	-0.007	0.032***	0.040	0.068**	-0.012	0.022***	0.051	0.056**
	(0.022)	(0.007)	(0.050)	(0.030)	(0.021)	(0.007)	(0.050)	(0.027)
Married	0.045**	0.036***	0.051	0.021	0.041**	0.032***	0.045	0.023
	(0.018)	(0.006)	(0.037)	(0.020)	(0.018)	(0.005)	(0.037)	(0.019)
Previous Enrollment	0.003	0.018**	0.009	0.033*	0.008	0.023***	0.038	0.033**
	(0.023)	(0.008)	(0.032)	(0.018)	(0.023)	(0.007)	(0.031)	(0.017)
City of Residence	0.041**	0.001	0.038	0.008	0.042**	-0.001	0.031	0.009
	(0.017)	(0.005)	(0.025)	(0.016)	(0.017)	(0.005)	(0.026)	(0.015)
Further Education	-0.039**	-0.023***	0.038	0.007	-0.033*	-0.024***	0.039	0.006
	(0.020)	(0.006)	(0.026)	(0.016)	(0.019)	(0.005)	(0.026)	(0.015)
Liceo Scientifico	-0.008	0.015***	-0.058*	0.022	-0.012	0.011**	-0.044	0.014
	(0.018)	(0.006)	(0.035)	(0.020)	(0.018)	(0.005)	(0.035)	(0.019)
Liceo Classico	0.041	0.015*	-0.113**	0.005	0.033	0.005	-0.116**	0.001
	(0.028)	(0.008)	(0.048)	(0.030)	(0.028)	(0.008)	(0.049)	(0.028)
Science	0.148	0.084***	-0.107	-0.053	0.153	0.075***	-0.126	-0.047
	(0.105)	(0.021)	(0.128)	(0.081)	(0.099)	(0.018)	(0.129)	(0.075)
Chemistry-Pharmacy	0.094	0.137***	-0.131	-0.019	0.106	0.140***	-0.126	-0.009
	(0.088)	(0.018)	(0.128)	(0.080)	(0.084)	(0.016)	(0.127)	(0.074)
Biology	-0.076	0.072***	-0.044	0.000	-0.067	0.079***	-0.019	0.009
	(0.066)	(0.018)	(0.101)	(0.082)	(0.064)	(0.016)	(0.103)	(0.077)
Nursing	0.434**	0.102	0.085	0.132**	0.415***	0.187	0.107	0.144**
	(0.175)	(0.164)	(0.079)	(0.061)	(0.149)	(0.131)	(0.079)	(0.057)
Engineering	0.089*	0.164***	-0.093	-0.040	0.094*	0.154***	-0.145	-0.038
	(0.052)	(0.013)	(0.134)	(0.078)	(0.052)	(0.012)	(0.131)	(0.072)
Architecture	0.001	0.020	-0.138	0.166*	-0.010	0.024	-0.076	0.153*
	(0.119)	(0.058)	(0.110)	(0.094)	(0.105)	(0.046)	(0.112)	(0.087)
Agricultural Studies	0.028	0.005	-0.115	-0.063	0.046	0.007	-0.100	-0.063
	(0.082)	(0.027)	(0.122)	(0.088)	(0.077)	(0.024)	(0.123)	(0.082)
Economics and Statistics	0.069	0.132***	-0.101	0.029	0.067	0.120***	-0.129	0.033
	(0.062)	(0.015)	(0.125)	(0.074)	(0.058)	(0.013)	(0.121)	(0.068)
Political Science and Sociology	0.074	0.083***	-0.125	0.020	0.076	0.079***	-0.134	0.022
	(0.062)	(0.015)	(0.100)	(0.069)	(0.060)	(0.013)	(0.100)	(0.064)
Law	0.007	0.114***	0.052	0.152*	-0.016	0.122***	0.069	0.158**
	(0.069)	(0.022)	(0.095)	(0.082)	(0.064)	(0.019)	(0.098)	(0.078)
Foreign Languages	-0.113	0.063***	-0.054	-0.042	-0.133*	0.032**	-0.093	-0.056
	(0.074)	(0.016)	(0.137)	(0.085)	(0.073)	(0.015)	(0.136)	(0.079)
Teachers College	-0.264**	0.001	-0.199	-0.125	-0.259**	0.008	-0.234	-0.111
	(0.122)	(0.020)	(0.148)	(0.082)	(0.118)	(0.018)	(0.143)	(0.075)
Psychology	-0.044	-0.015	-0.136	-0.028	-0.034	-0.012	-0.159	-0.018
	(0.085)	(0.025)	(0.138)	(0.108)	(0.084)	(0.023)	(0.140)	(0.102)
Physical Education	0.092	-0.049	-0.117	0.087	0.074	-0.027	-0.060	0.087
	(0.086)	(0.031)	(0.108)	(0.092)	(0.078)	(0.026)	(0.108)	(0.085)
Constant	7.008***	6.881***	7.137***	7.296***	7.219***	7.275***	7.079***	7.692***
	(0.167)	(0.042)	(0.344)	(0.132)	(0.167)	(0.042)	(0.344)	(0.132)
Regional Dummies	No	No	No	No	Yes	Yes	Yes	Yes
Lambda	0.059	0.068	0.129	-0.738***	0.045	0.035	0.238	-0.691***
	(0.121)	(0.079)	(0.206)	(0.267)	(0.101)	(0.061)	(0.197)	(0.230)
Observations	10253	10253	9604	9604	10253	10253	9604	9604
Censored Observations	8112	2141	8689	915	8112	2141	8689	915
Prob> Wald Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*The dependent variable is log monthly wage. Robust standard errors in parenthesis. *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table 2: Probit Simple

	(1)	(2)	(3)	(4)
High School Grade	**-0.027*** **	**-0.027*** **	**-0.028*** **	**-0.027*** **
	(0.001)	(0.001)	(0.001)	(0.001)
Liceo Classico-Scientifico	**-0.352*** **	**-0.341*** **	**-0.350*** **	**-0.339*** **
	(0.019)	(0.019)	(0.019)	(0.019)
Father self-employed	-0.066***	-0.068***	-0.078***	-0.080***
	(0.020)	(0.020)	(0.020)	(0.020)
Female	0.092***	0.089***	0.090***	0.088***
	(0.019)	(0.019)	(0.019)	(0.019)
Father Degree	-0.348***	-0.285***	-0.354***	-0.294***
	(0.025)	(0.028)	(0.026)	(0.028)
Mother Degree		-0.164***		-0.158***
		(0.031)		(0.032)
Constant	0.486***	0.471***	0.252*	0.242*
	(0.075)	(0.075)	(0.104)	(0.104)
Regional Dummies	No	No	Yes	Yes
Uni Course	Yes	Yes	Yes	Yes
Observations	30123.000	30123.000	30123.000	30123.000
LR Chi2	11517.369	11545.079	11944.675	11969.820
Prob>Chi2	0.000	0.000	0.000	0.000
Pseudo-R2	0.314	0.315	0.326	0.327
Log Likelihood	-1.26e+04	-1.25e+04	-1.23e+04	-1.23e+04