Journal of Educational Planning and Administration
Volume XV No. 4, October 2001, pp. 425-434

Testing for Screening Using Vocational Skills: The Case of Technological Institutes of Greece

George Psacharopoulos*
Constantinos Tsamadias**

Abstract

Empirical tests of the popular screening hypothesis in the economics of education have typically used years of schooling or completed educational cycles referring to educational levels in general, such as secondary education or university. The screening test on a special sample of tertiary technological institutes graduates of Greece against a control group of general secondary school graduates shows that the initial earning advantage of the vocational degree holders against the control group is maintained at a constant level of about 16 per cent throughout the employees' career; this advantage being only slightly higher in the private versus the public sector. Using a Mincerian earnings function with years of schooling-experience interaction term, no statistically significant convergence or divergence of the earnings profiles was detected in the public sector. In the private sector, there was a statistically weak divergence of the experience-earnings profiles.

Introduction

Following the seminal article by Arrow (1973), testing for the screening hypothesis has remained a popular research activity in economics of education during the last quarter century. In the context of human capital theory, education is viewed as a productivity augmenting process (Becker, 1964). Contrarily, screenists argue that education serves to filter individuals as opposed to enhancing their productivity (Berg,1970; Arrow, 1973; Spence, 1973; Stiglitz, 1975). This may be true, especially at the initial hiring point. A number of empirical studies, designed to test the validity of the screening hypothesis have employed diverse data sets and techniques, suggesting no clear consensus on the matter by reporting contradictory results (see Taubman and Wales 1973, Cohn, Kiker and Mendes de Oliveira 1987, Ziderman 1992).

* University of Athens, 5 Kasou Street, Athens, O 11364 Greece.
E-mail: gpsach@erols.com
** Harokopio University, Ag. Anargyron 28B, Galatsi 11147, Greece.

One particular method of testing for the sceening hypothesis is the distinction between a 'strong version' and a 'weak' version (Psacharopoulos 1979) applied to U.K. data, with negative conclusions. Under the weak version, employers could initially offer higher wages to the more educated because of the absence of information on their prospective productivity. But if education were really used as a screening device, and the more educated were not more productive relative to their less educated counterparts, private employers would adjust downwards the initial wage premium they offered. Or, the observed experience-earnings profiles of people with different levels of education would converge, rather than diverge, overtime.

Based on these considerations, it is suggested that the following empirical results would fail to reject the screening hypothesis:

- Lower returns to education in the competitive sector, relative to the non-competitive public sector.
- A decrease in the mid-to-early career earnings ratio, for a given sector, as years of schooling increases
- A lower mid-to-early career earnings ratio in the competitive sector, for a given level of education, relative to the non-competitive sector.

In Greece, empirical studies have failed to support the existence of screening, even the strong version. (Lambropoulos, 1992; Magoula and Psacharopoulos, 1999).

In this study we use a special sample of secondary (control group) and tertiary technological education graduates to test for the existence of screening.

Data

During the last 25 years, and starting with a World Bank education loan, Greece has put high emphasis on non-university technological education by means of initially two, later three, and now contemplated four-year tertiary technological education technical colleges (TTE), better known by their Greek acronyms as KATEE and TEL

The population is comprised of two sub-populations: sub-population I, which includes the TTE graduates who are in full-time dependent employment in the private or public sector; and sub-population II, which includes a control group of secondary education graduates (SE) who work as full-time employees in the private or the public sector in the economy. According to the labour force survey of the National Statistical Services of Greece (NSSG, 1997), the size of the two sub-populations in 1997 was N| = 82,063 individuals, and Nn = 686,147 individuals respectively.

Based on the structure and the categorisation of the two sub-populations, these were divided into six sub-groups (strata) according to the sector of production (primary, secondary, tertiary) and to the sector of employment (public, private). The

stratified sampling not only gives increased accuracy, but also allows separate estimates for each stratum. We determine the minimum size of the sample by the formula

$$n_{oh} = \frac{Z^2_{a/2} \cdot S^2_h}{d^2_o + \frac{Z^2_{a/2} \cdot S^2_h}{N_h}}$$

where, Z is the statistic of the standard normal distribution; *a* is the level of significance; S_h^2 is the real variance of stratum *h* (derived from a pilot estimate); and *Nt,* is the size of stratum *h.* The random sample of each stratum of the two sub-populations has been determined so that the estimation of their mean earnings (*Y* i,) to have maximum sampling error

$$do = | y_i - Y_h | = Z_{a/2} .se (y_h) = 200{,}000 \text{ drs.}$$

where Y_h and y_h are the average earnings of stratum h and the sample respectively. In practice, Y_h takes the value that arises from the pilot survey.

Table 1 shows the structure of the total population and the sample. It also shows that the majority of the TTE graduates are working in the public sector, while the SE graduates in the private sector of the economy.

TABLE 1

Structure of the Population and the Sample by Level of Education and Sector of Employment, 1997

Educational Level	*Population*			*Sample*		
	Public Sector	*Private Sector*	*Country Total*	*Public Sector*	*Private Sector*	*Country Total*
Secondary Education Graduates (SE) Tertiary Technological Education Graduates (TTE)	270,004	416,143	686,147	526	741	1,267
	42,341	39,722	82,063	469	590	1,059
All	312,345	455,865	768,210	995	1.331	2,326

Source: Population, from NSSG (1997). Sample from the authors' survey.

The aim of our questionnaire survey was to collect annual earnings from dependent employment of TTE and SE graduates. Productivity bonuses are included in the

annual earnings. Self-employed TTE and SE graduates are not included, since it is difficult to separate the part of income that comes from their personal employment from that arising from other factors which are used in the production process. Also, part-time employees are excluded.

Returns to Education

Table 2 presents the mean earnings of people in the sample, and Figure 1 the general shape of the age-earnings profiles. A more detailed earnings distribution is given in Appendix Table A-1.

TABLE 2

Mean Annual Earnings by Level of Education and Sector of Employment (Drs/Year)

Educational Level	*All Employees*		*Employees in the Public Sector*		*Employees in the Private Sector*	
	Mean Gross Earnings	*N*	*Mean Gross Earnings*	*N*	*Mean Gross Earnings*	*N*
Secondary Education Graduates (SE) Tertiary Technological Education	4,248,995	1,267	4,626,776	526	3,980,862	741
Graduates (TTE)	4,937,136	1,059	5,369.578	469	4,593,381	590
All	4,562,297	2,326	4.976.901	995	4,252.356	1,331

Notes: N: number of observations.

It is worth noting that the mean earnings of TTE graduates is about 16% higher when compared to those of SE graduates, regardless of the sector of employment. The earnings advantage of TTE graduates is statistically significant at the 1% or better level of significance. These findings are in accordance with the human capital theory and the findings of empirical work that has been carried out in Greece and abroad (see Magoula and Psacharopoulos, 1999).

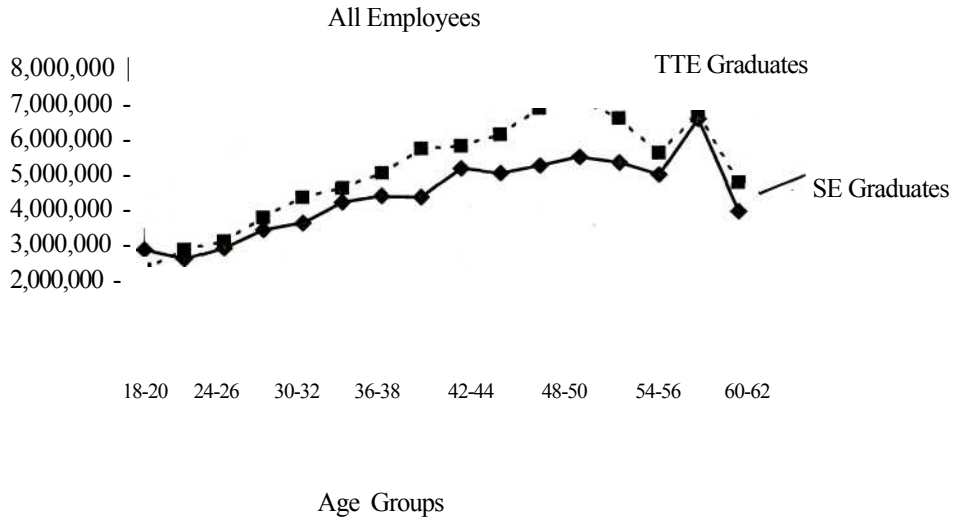
When combined with cost data (Table 3), the above earnings differences can be translated into private and social returns to education.

TABLE 3 **Annual Direct Cost of Tertiary Technological Education [Drs]**

Average Private Cost	400,000
Average Social Cost	575.000

Source: Based on Papas and Psacharopoulos (1987).

Figure 1 **Age-Earnings Profiles by Educational Level (3-years Moving Average)**



Using the 'elaborate method' (see Psacharopoulos and Matson, 1998), and two alternative assumptions on the length of study, real returns of the order 4.3% to 6.0% were estimated (Table 4). These returns are respectable and give a clue as to why there is such a high social demand for tertiary education in Greece.

TABLE 4

Private and Social Rates of Return to Investment in Tertiary Technological Education

Years of Study	*Private Rate of Return (%)*	*Social Rate of Return (%)*	
	All Employees	*All Employees*	*Employees in Private Sector*
3.5	**5.7**	**4.9**	6.0
4.0	**5.0**	**4.3**	5.4

Note: Based on the Elaborate Method.

Testing for Screening

But could the above returns be due to screening? Table 5 presents earnings ratios by year of actual experience, and Figure 2 depicts an overall constancy of the earnings ratios over time, regardless of the sector of employment.

TABLE 5 **Earnings Ratios by Years of Experience**

Years of Experience	*Earnings Ratio* $[Y_{nv}J\ Y_S,J$	
	Public Sector	*Private Sector*
1-3	1.17	1.34
4-6	1.17	1.28
7-9	1.12	1.18
10-12	1.12	1.13
13-15	1.13	1.28
16-18	1.29	1.34
19-21	1.34	1.34
22-24	1.10	0.97
25-27	1.30	1.47
28-30	1.03	1.19
31-33	0.96	1.75
34-36	1.08	1.29
All	*1.16*	*1.15*

Notes: Y_{SE} and YTTE stand for the average annual earnings of Secondary and Tertiary Technological Education workers respectively.

Given the erratic behaviour of the earnings ratios for older ages (given the small size of the earnings-education-age cells), Table 6 presents mid-to-early career ratios. The earnings advantage of the those working in the private sector is significantly higher than those in the public sector. This finding gives *prima facia* evidence against the screening hypothesis, because if TTE education had no productivity counterpart, it would be the private sector employers that would adjust downwards the earnings advantage of vocational graduates.

TABLE 6

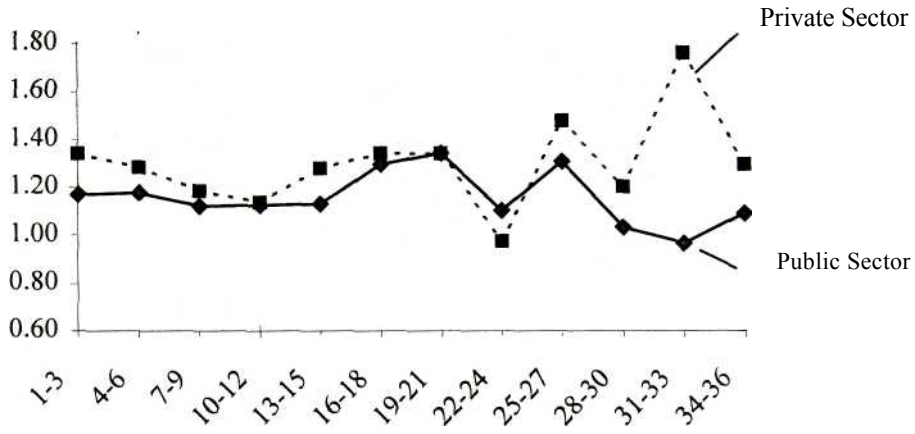
Mid-to-Early Career Earnings Ratios by Level of Education and Economic Sector

Educational Level	Public Sector	Private Sector
Secondary Education Graduates (SE)	1.48	1.98
Tertiary Technological Education Graduates (TTE)	1.69	1.97

Notes: Mid-to-Early Career corresponds to groups with 19-21 and 0-3 years of real experience respectively

Figure 2

Earnings Ratios by Years of Experience



In order to conduct a more rigorous test of the non-convergence of experience-earnings profiles, we fitted the Mincerian earnings function

$$LnY = a + b\,S + c,\,EX + c_2\,EX^2 + u$$

with an interaction term,

$$LnY = a + b\,S + c,\,EX + d\,(S\,EX) + u$$

where Tis the gross annual earnings, *S* is the years of study, *EX*\s the number of years of actual work experience, *S.EX* is an interaction term, *a* is a constant, *b, C*_ and *ci* are regression coefficients, and w is the disturbance term.

The sign of coefficient c/and its statistical significance, determine whether we have a case of filtering or not, i.e., earnings convergence (-) or divergence (+) respectively. If *d* were negative and significant, it would indicate convergence of the two profiles, hence lending support to the screening hypothesis.

Table 7 presents the standard Mincerian equations and a test for the sign and significance of the *S.EX* interaction term.

TABLE 7 **Testing for Screening**

Independent Variable	*Public Sector*		*Private Sector*	
	Basic Mincerian	*With Interaction*	*Basic Mincerian*	*With Interaction*
Constant	14.447 (237.56)	14.482 (124.51)	14.065 (241.15)	14.263 (159.43)
S	0.039 (9.88)	0.041 (4.84)	0.054 (13.88)	0.0479 (7.49)
EX	0.032 (8.44)	0.024 (3.40)	0.054 (15.88)	0.019 (2.57)
EX^2	-0.00028 (-2.50)	- -	-0.00089 (-8.52)	- -
SEX	- -	-0.000096 (-0.19)	- -	+0.000662 (1.24)
R^2	- 38.22	0.8 37.80	- 40.78	0.217 37.90
N	995	995	1,331	1,331

Notes: Dependent variable: LnY_G
Numbers in parenthesis are t-ratios

For the sample as a whole, the test is inconclusive, given the fact that the critical interaction term coefficient *d,* although positive, is not significant. Splitting the sample, we get an even lower significance of *d* for the private sector.

Conclusions

The initial earnings advantage of the vocational degree holders against the control group is maintained at a constant level of about 16 per cent throughout the employees' career. The earnings advantage is only slightly higher in the private versus the public sector. Using a Mincerian earnings function with years of schooling-experience interaction te,rm, no statistically significant convergence or divergence of the earnings profiles were detected in the public sector. In the private sector, there was a statistically weak (P= 0.22) divergence of the experience-earnings profiles in the private sector.

This result might be a reflection of the poor quality of instruction provided in Higher Technological Institutes of Greece.

References

Arrow, K.J. (1973), "Higher Education as a Filter", *Journal of Public Economics, Vol.2,* pp. 193-216

Becker, G. *Human Capital.* NBER, 1964

Berg, I. (1970), *Education and Jobs: The Great Training Robbery,* New York: Praeger

Cohn, E. Kiker, B., and Mendes de Oliveira (1987), Further Evidence on the Screening Hypothesis, *Economics Letters,* vol. 25, pp. 289-294. Lambropoulos, H.S (1992), "Further Evidence on the Weak and the Strong Versions of the Screening hypothesis in Greece", *Economics of Education Review,* Vol. 11, N $_0$ i, pp. 61-65

Magoula, Th and Psacharopoulos, G. (1999), "Schooling and Monetary Rewards in Greece: an Over education False Alarm", *Applied Economics,* Vol. 31, pp. 1589-1597

National Statistical Service of Greece, (NSSG), *Labor Force Survey,* 1997 Papas G and Psacharopoulos G. (1987), "The Transition from School to the University under Restricted Entry: A Greek Tracer Study", *Higher Education,* Vol. 16, pp. 481-501

Psacharopoulos, G. (1979), "On the Weak versus the Strong Version of the Screening Hypothesis", *Economics Letters,Vo*\. 4, pp. 181-185

Psacharopoulos, G and R. Mattson (1998), "Estimating the Returns to Education: A Sensitivity Analysis of Methods and Sample Size", *Journal of Educational Development and Administration,* Vol. 12, N. 3, pp. 271-287 Spence, M.A. (1973), *Market Signaling: "Informational Transfer in Hiring and Related Screening Processes,* Cambridge MA :Harvard University Press. Stiglitz, J.E (1975), "The Theory of Screening, Education and the Distribution of Income", *American Economic Review, Vol.* 65, pp. 283-300 Taubman, P.J. and Wales, T.J. (1973), "Higher Education, Mental Ability and Screening", *Journal Political Economy,* Vol. 81, pp. 28-55 Ziderman, A. (1992), "Evidence on Screening: P Tests for Israel", *Economics of Education Review,* Vol. 11, N$_o$ 1, pp.67-69

APPENDIX

TABLE A-l

Mean Gross Annual Earnings by Age and Educational Level (Drs)

	All Employees			
Age	*TTE Graduates*		*SE Graduates*	
	Mean	*N*	*Mean*	*N*
18-20	2,442,000	1	2,998,605	16
21-23	2,998,034	11	2,732,700	**61**
24-26	3,238,819	83	3,039,460	**103**
27-29	3,892,660	**155**	3,543,085	**140**
30-32	4,451,541	224	3,733,687	**164**
33-35	4,700,279	128	4,304,762	**144**
36-38	5,110.569	99	4.469,896	142
39-41	5,800,403	112	4,437,802	146
42-44	5,866,220	77	■ 5,237,206	96
45-47	6,198,139	57	5,106,433	**74**
48-50	6,918,646	**41**	5,301,144	62
51-53	7,181,457	32	5,546.095	55
54-56	6,629,529	. 25	5.383,960	30
57-59	5.648,269	8	5,038,901	20
60-62	6,720,875	4	6,599,051	9
63-65	4,805,360	2	4.002,100	5
Entire Sample	4,937,136	1.059	4,248,995	1,267

TABLE A-2

Mean Gross Annual **Earnings by Experience, Educational Level and Employment Sector** • (Drs)

Years of	*Employees in Public Sector*				*Employees in Private Sector*			
Experience	*TTE Graduates*		*SE Graduates*		*TTE Graduates*		*SE Graduates*	
	Mean	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	/V
1-3	3,771,167	25	3,223,729	25	3,557,809	164	2,653.073	134
4-6	4,057,363	44	3,455,690	68	4,216,354	123	3,288,460	152
7-9	4,573,569	79	4,087,720	54	4,570,739	103	3,869,956	108
10-12	4,895,818	56	4,365.450	81	4,605,584	86	4,061,914	86
13-15	5,221,502	82	4,635,446	92	5,527,663	33	4.333.343	69
16-18	5,817,194	49	4.504,762	61	6.896,072	24	5,156,584	50
19-21	6,390,961	47	4,779,152	38	7.019,222	16	5,256,384	•47
22-24	6,263,981	28	5,708,936	39	5.252.362	13	5,409,974	27
25-27	7,695,641	30	5,915,266	29	7,743.262	11	5,268,393	26
28-30	6,806,062	17	6,621.253	20	6.990,629	13	5,848,485	20
31-33	6,220.350	10	6,513,816	14	9.951.667	3	5,685,262	12
34-36	6,151,658	2	5,676,429	3	6,720,000	1	5.218,839	8
37-39			5,421,800	1			6,545,308	1
40-42			20,645,872	1			6.738,000	1
Entire Sample	5,369,578	469	4.626,776	526	4.593,381	590	3,980,862	741