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The progressivity of public education in Greece: empirical findings and policy implications

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This paper examines the short-run distributional effects of publicly provided education services in Greece using static incidence analysis. Public education is found to be inequality-reducing but the progressivity of the system withers away as we move up to higher educational levels. We employ a framework of both relative and absolute inequality measurement and discuss the merits of the latter. Under this alternative setting, primary education transfers retain their progressivity, the progressivity of secondary education transfers diminishes and tertiary education becomes clearly regressive. Lastly, we simulate the first-round fiscal and distributional effects of a hypothetical graduate tax imposed on current graduates.

Keywords: education and inequality; personal income and distribution

1. Introduction

States choose to redistribute economic resources either in-cash or in-kind. This long-standing policy dilemma has vast implications for efficiency and equity. In certain policy fields, such as education, both theory and practice have tipped the scales in favour of in-kind benefits. In praise of publicly provided services stand pro-efficiency arguments, such as the existence of informational failures, as well as ideologically fuelled attitudes like paternalism and specific egalitarianism. As a result, over the last couple of decades, the share of public services in total social spending has increased in many European countries. This development has provided the impetus to investigate to what extent these services contribute to equality or are captured disproportionately by the wealthy (as it is sporadically claimed).

Specifically, the field of education has been proved immensely fruitful, generating a plethora of studies that attempt to answer these questions and at the same time tackle the many conceptual difficulties, methodological pitfalls and data limitations, the empirical study of in-kind benefits entails (Jimenez 1986; James and Benjamin 1987; Evandrou et al. 1993; Smeeding et al. 1993; Selden and Wasylenko 1995; Tsakloglou and Antoninis 1999; Antoninis and Tsakloglou 2001; Garfinkel, Rainwater, and Smeeding 2006; Callan, Smeeding, and Tsakloglou 2008; Paulus, Sutherland, and Tsakloglou 2010). What it all boils down to is that free (or highly subsidized) provision of public education reduces inequality but the effect varies by the educational level, with compulsory schooling typically exhibiting the largest 'pro-poorness'. Nevertheless, several

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subtleties are often hidden below this overarching result. For example, quality of studies may differ substantially across education institutions. Geographical disparities (typically not reflected in the data) may persist and underlying, often indiscernible, inequities in compulsory education may be quietly transmitted to the later stages of children's educational development. In brief, meritocracy in education is often violated (Simister 2011); a problem not always straightforward to identify, measure and extract from the data.

The Greek context is interesting for several reasons. In Greece, education services are provided free of charge by the state at all levels, while the role of formal private institutions is limited. The social status of formal education is strongly embedded in the perceptions of Greek families and the public education system is viewed as progressive. In general, social perceptions are predisposed towards considering the free provision of public goods as the sole prerequisite for promoting equality. Meanwhile, issues of inefficiency as well as the underlying inequities of the system are beclouded in the public dialogue.

The first authors who analysed the distributional consequences of public education in Greece were Tsakloglou and Antoninis (1999) and Antoninis and Tsakloglou (2001) using static incidence analysis for the late 1980s and the early 1990s. They showed that the observed progressivity of public education subsidies is due exclusively to the effect of primary and secondary education transfers. Public education in Greece was recently analysed by Callan, Smeeding, and Tsakloglou (2008), too. Our contribution is justified on several grounds. First, the implementation of the concept of absolute inequality for the measurement of the distributional impacts of publicly provided services is a fresh idea.[1] Furthermore, Callan, Smeeding, and Tsakloglou's (2008) analysis focused only on tertiary education and their approach is strictly comparative. They find that in the countries of their sample, in-kind transfers in the field of tertiary education exert an ambiguous effect on inequality and Greece is not an exemption. Yet in their analysis, they use aggregate cost data that do not distinguish between high-cost and low-cost higher education institutions. This distinction is important because, as we show, students from wealthier households tend to concentrate in high-cost institutions which provide better occupational opportunities and higher social status. Policy implications receive considerable attention in the study. An *ex post* remedy of the underlying inequities, diagnosed in the analysis, is proposed in the form of a graduate tax. The distributional and fiscal effects of this policy instrument are analysed using microsimulation techniques.

The structure of the paper unfolds as follows; the next section provides a short description of the institutional surroundings. Section 3 is concerned with methodological issues, while Section 4 presents the empirical results including both a 'traditional' analysis as well as the results of an alternative approach. Section 5 is devoted to the effects of a hypothetical graduate tax, and finally, the last section concludes.

2. The institutional landscape

The most salient characteristic of the Greek education system is state dominance in all aspects of its functionings, while the role of private sector is restricted, limited and supplementary. Enrolment rates in private schools fluctuate around 6% of the student population, while at the tertiary level the degrees offered from private institutions are not officially recognized as equivalent to those of public institutions. According to Greek

Constitution, higher education shall be provided only by the state. Pre-primary education is not compulsory, while primary and lower secondary (*Gymnasium*) are. The great majority of lower secondary education graduates continues to upper secondary education (*Lyceum*), which is diversified to general and technical vocational educational schools. Graduates of upper secondary schools are eligible to take part in the nationwide general examinations for gaining access to higher education. The latter operate in a *numerus clausus* status. The number of available slots is predetermined and the successful candidates are allocated to them according to their performance in examinations.Tertiary education is diversified between universities (denoted by the acronym AEI as they are known in Greece) and Technological Education Institutes (TEI). Graduates of vocational schools may enter in TEIs (by participating in the general examinations and on the basis of their school certificate record) but they cannot enrol in AEIs. Secondary education graduates have also the option to enrol in post-secondary non-tertiary institutions (IEK). These institutions have a hybrid educational–vocational character and they are unclassified. Households' demand for higher education studies is very strong. Traditionally, the acquisition of a university degree has been considered as a safe way to step up the social ladder (Tsoukalas 1987). Because the demand for higher education exceeds the available supply, most households spend large amounts on costly private crammer schools and tutors who provide assistance to university candidates.[2] These private sector activities, which lie in the margins of the formal educational system, have expanded extraordinarily during the last decades. This peculiar situation gave rise to the neologism *parapaedeia* which means in Greek 'parallel education' (Kanellopoulos and Psacharopoulos 1997). The term *parapaedeia* is tinged with negative connotations. It is straightforward that under these circumstances the equity of the system is compromised (Patrinos 1995; Psacharopoulos and Tassoulas 2004; Psacharopoulos and Papakonstantinou 2005). For low-income families cannot easily afford to hire a tutor and consequently their offspring has a lower probability of scoring high in the general examinations. On top of that, the poor are more likely to drop out of school. Indeed, as it can be seen in the first row of Table 1, non-participation in upper secondary education (Lyceum) is negatively related with income. Over 40% of the persons aged 15–17 who do not participate in formal education belong to the poorest quintile and this figure decreases monotonically as we move up to richer quintiles. The second row focuses on vocational school students and shows that they are usually located at the lower part of the income

Table 1. Participation in secondary education and private spending for crammer schools and tuition per quintile.

	Quintiles				
	1(poorest)	2	3	4	5(richest)
Persons aged 15–17 not in education (%)	40.8	23.5	14.6	11.8	9.3
Vocational schools students (%)	32.3	31.7	20.4	8.8	6.8
Share of HHs per quintile spending on crammer schools and private tutors (%)	50.2	42.5	59.9	72.2	78.3
Monthly mean spending per lyceum student for crammer school or private tuition (in euro)	141.7	129.2	208.3	232.6	296.4

Source: GHBS.

distribution. Finally, the last rows indicate that even the poorest households spend for private tuition. Yet, the well-off are more frequent and heavier spenders.

Finally, we proceed with a description of the cost structure of the Greek education system, a core element of our methodology. Table 2 provides an overview of the education system in 2004/2005 in terms of number of students (in both public and private schools), total expenditure (separated between current and investment expenditures) and average yearly cost per student attending a public school for each level of the education system. The estimates of investment expenditures reported in the table have been computed as the average of realized investments during the period 1998–2004.

Spending per student in secondary education is almost 50% higher than the corresponding figure in primary education. Note also the substantial differences between the two branches of tertiary education. While yearly spending per AEI student is more than twice the corresponding figure for primary and secondary education, annual spending per TEI student is even lower than spending per primary school student. The cost differential between AEI and TEI is in line with the higher perceived status of universities vis-à-vis technological institutes (Giamouridis and Bagley 2006).

3. Data and methods

The analysis is based on the micro-data of the 2004/2005 Greek Household Budget Survey (GHBS), which was carried out by the National Statistical Service of Greece. The survey covers all the private households of the country and its sampling fraction is 2/1000 (6555 households/17,386 individuals). The benchmark for inequality comparisons is the distribution of equivalized disposable income (derived using the 'modified' OECD equivalence scales that assign weights of 1.00 to the household head, 0.50 to each of the remaining adults and 0.30 to each child aged below 14).

The paper employs static incidence analysis, as it is typical in the literature. The beneficiaries of public transfers are assumed to be the recipients of the public education services. Moreover, it is assumed that the value of the transfer to the beneficiary is equal to the average cost of producing the public education services in the corresponding level of education. In contrast to Callan, Smeeding, and Tsakloglou (2008) and Paulus, Sutherland, and Tsakloglou (2010), we do include R&D expenditures in the per capita cost estimates. It may be argued that these expenditures do not directly benefit the students but they do benefit them indirectly and in the long run.[3]

The empirical analysis relies on standard tools of inequality measurement, namely simple quintile-based statistics and two inequality indices: the Gini and the Atkinson Index. The former is a measure of statistical origin, the latter derives explicitly from a social welfare function and both satisfy the basic axioms of inequality measurement (symmetry, scale invariance, population invariance and the principle of transfers). The Atkinson Index captures a variety of distributional preferences. Setting the index parameter at 0.5 and 1.5, greater emphasis is placed on the upper (lower) part of the income distribution, respectively. When the analysis comes to absolute inequality measurement, we use the absolute Gini Index. The absolute Gini is derived as the product of relative Gini multiplied by the mean of the corresponding distribution. The absolute Gini satisfies the basic axioms of inequality measurement (anonymity, population axiom and principle of transfers) as well as the property of translation invariance which is the 'absolute' counterpart of the scale invariance property. The absolute Gini can be made sensitive to different parts of the distribution by using the 'parameterized' version of the ordinary Gini (Donaldson and Weymark 1980). Again, the

Table 2. Number of students and the structure of public expenditure in the Greek education system (2004–2005).

		Number of students	%	Current expenditure	Capital expenditure[a]	Ratio of current to capital expenditures	Total expenditure	Annual average cost per student	
								Current	Total
Primary	Public	740.167	94.0	1,634,948.193	160,121,571	10.2	1,795,069.764	2209	2425
	Private	47.134	6.0						
	All	787.301	100.0						
Secondary	Public	652.346	94.3	2,072,791,866	246,178,877	8.4	2,318,970,742	3177	3555
	Private	39.572	5.7						
	All	691.918	100.0						
IEK	Public	16.233	43.3	40,055,952	33,824,609	1.2	73,880,561	2468	4551
	Private	21.229	56.7						
	All	37.462	100.0						
AEI		225.265[b]	56.0	919,690,761	508,287,388	1.8	1,427,978,149	4083	6339
TEI		177.229[c]	44.0	309,708,442	52,807,226	5.9	362,515,667	1748	2045
	All	402.494	100.0						

Sources: Ministry of Education, National Statistic Service of Greece-Education Department.
Note: All amounts are in euros.
[a]Average spending of six preceding years in 2004 euros.
[b,c]Normal duration students.

higher the value of the parameter, the higher the sensitivity of the index to transfers directed at the lower part of the income distribution.

4. Empirical results

In general, the distributional effect of public transfers is the outcome of two factors: the location of the beneficiaries in the income distribution and the size of the transfers. The position of the direct beneficiaries (pupils/students) in the income distribution is reported in Table 3. Primary and secondary education beneficiaries are disproportionately concentrated in the lower half of the income distribution. This is because households with children are less likely to have reached the top of their earnings capacity and/or have a lower share of earners. Similarly, the distribution of IEK students is more skewed towards the low part of the income distribution, but due to their small number the pattern is erratic. Regarding tertiary education students, a clear difference between AEI and TEI students is evident. TEI students are mostly found in low quintiles, while AEI students are concentrated in the middle and upper part of the income distribution. The last column reports the distribution of all beneficiaries, irrespective of the educational level, and shows that beneficiaries of public education are mildly over-represented in the lower half of the income distribution.

Table 4 reports the average monthly transfers per capita calculated as the sum of transfers accrued to a quintile divided by its population (columns labelled 'A'), while the average percentage change in equivalized disposable income resulting by the addition of transfers is presented in columns labelled 'B'. These measures can be interpreted as the absolute and relative size of transfers, respectively. In the cases of primary, secondary and TEI education levels, average transfers are higher for the low quintiles compared to the richer quintiles. Average IEK transfers are very modest in size and almost evenly spread across quintiles. AEI transfers differ in the sense that the low-income quintiles receive the lowest transfers in absolute terms.

The remaining part of the table (columns 'B') shows how much, on average, disposable income has increased due to the addition of education transfers in the concept of income. On average, in-kind transfers increase disposable income by 8.8% but this figure varies considerably across quintiles the rule being that the percentage increase is negative correlated with income. In that sense, the relative importance of public education is very large for the poorest quintile (poor's income increases by 24% after taking account all education transfers). A 'declining with income' relative size of transfers is observed across all education levels but the pattern is more protruding for primary and secondary education.

The redistributive effect of public education is quantified through the use of indices of inequality. Table 5 reports the percentage change in relative inequality when we move from the initial pre-benefit distribution to the post-benefit distribution. When all education transfers are added in the concept of income, Gini Index declines by 6.4%. The Atkinson Index declines by 12.1% and 10.8%, respectively. Almost the entire inequality reducing effect is driven by the redistributive impact of primary and secondary education transfers, whereas transfers to TEI and IEK students have a marginal impact. The characterization of the effect of AEI transfers depends on the value of the inequality aversion parameter. This implies that the Lorenz curve for the initial distribution intersects with the Lorenz curve for the post-benefit distribution. Consequently, AEI transfers exert an ambiguous effect on inequality. Ultimately, their

Table 3. Distributions of beneficiaries per quintile (%).

Quintile	Primary education	Secondary education	IEK	TEI	AEI	All public education institutions
1	19.5	23.8	23.8	21.5	16.4	21.0
2	21.6	22.4	18.2	28.5	19.7	22.1
3	23.0	20.8	24.8	25.0	19.3	21.9
4	19.4	20.1	23.5	17.1	23.1	20.0
5	16.5	12.9	9.6	7.9	21.5	15.0

Source: GHBS.

Table 4. Mean transfers and percentage increases (%) in equivalized disposable income per quintile due to transfers.

Quintile	Primary education		Secondary education		IEK		TEI		AEI		Total transfers	
	A	B	A	B	A	B	A	B	A	B	A	B
1	14.8	8.2	22.6	11.3	1.1	0.5	2.2	0.9	8.7	3.2	44.9	24.0
2	16.3	5.3	21.2	6.2	0.8	0.2	2.9	0.7	10.5	2.4	46.4	14.9
3	17.3	4.2	19.7	4.3	1.1	0.2	2.5	0.5	10.2	1.8	45.8	11.0
4	14.7	2.6	19.0	3.1	1.1	0.2	1.7	0.3	12.3	1.8	42.9	8.0
5	12.5	1.3	12.2	1.1	0.4	0.0	0.8	0.1	11.4	1.0	32.1	3.5
All	15.1	3.1	19.0	3.5	0.9	0.2	2.0	0.3	10.6	1.6	42.4	8.8

Source: GHBS.
Note: Columns labelled ‘A’ report mean transfers (in euro) and columns ‘B’ report percentage changes in equivalized disposable income (%).

Table 5. Changes in aggregate inequality due to public transfers.

Index	Distribution of monetary income	% Change in inequality due to the inclusion of: Primary education transfers	Secondary education transfers	IEK transfers	TEI transfers	AEI transfers	All transfers
Gini	0.3217	−2.7	−3.4	−0.3	−0.4 (−0.2)	0.0 (0.3)	−6.4 (−6.1)
Atkinson ($e = 0.5$)	0.0849	−5.2	−6.4	−0.4	−0.6 (−0.4)	−0.1 (0.4)	−12.1 (−11.5)
Atkinson ($e = 1.5$)	0.2406	−5.0	−5.3	−0.6	−0.5 (−0.3)	0.3 (0.7)	−10.8 (−10.5)

Source: GHBS.

characterization as progressive or regressive depends on the specific value of the inequality aversion parameter.

Tertiary education students may live outside their parental home, forming separate households whose reported income may not be an accurate proxy of their real economic background. For this reason, it is necessary to test the sensitivity of the results in relation to this factor. Thus, in Table 5, we also report (in parentheses) estimates having excluded them from the sample. Their removal tames the progressivity of total public transfers (but with no dramatic effects); the already marginal effect of TEI transfers is diminished and the effect of AEI transfers becomes regressive. However, we note that the impacts of IEK, TEI and AEI transfers are not statistically significant at the 5% level. Moving beyond statistical significance, in this setting, we still can assert that all these transfers are distributed 'almost' as unequally as disposable income. So it may be argued that the society should not be content if public transfers are distributed as unequally as monetary income when pre-benefit inequality is considered to be already high as it is the case in Greece.

Table 5 epitomizes the standard approach in distributional studies, namely to employ a relativist framework of inequality measurement. This choice predisposes the answer of a very fundamental question in inequality measurement; should inequality remain unaltered when all incomes are increased in the same proportion or when an equal amount is added to all incomes? In the end, the answer depends on our value judgement. The issue has received considerable theoretical attendance (Kolm 1976; Blackorby and Donaldson 1980) but at the empirical level the dominance of the relativist framework is overwhelming (Atkinson and Brandolini 2008). Perhaps this asymmetry between theory and practice should be questioned. Furthermore, in some settings, perverse effects may be produced in the analysis as we demonstrate in the following paragraphs.

First, we should underline that working with the entire sample of the population (as in Table 5) bears a weakness; there are households that by definition do not benefit from public subsidies (e.g. childless couples or elderly people). Therefore, it makes sense to confine the analysis only to potential beneficiaries. This approach has an additional advantage as it limits the analysis to individuals with homogeneous educational needs. Thus, by focusing on these groups, we bypass the well-known problem of equivalence scales that arises in the context of in-kind public transfers (Radner 1997; Aaberge et al. 2010; Paulus, Sutherland, and Tsakloglou 2010). Yet, if we proceed with the typical mode of operation, namely to keep the analysis based on income relativities, we come across a paradox. If public subsidies were allocated equi-proportionally to all potential beneficiaries (i.e. each transfer is equal to a fixed per cent of the income of the beneficiary), relative inequality would remain unchanged. It is highly improbable that any reasonable individual would perceive such allocation as distributionally neutral when it would entail the rich beneficiaries receiving larger transfers than the poor. On the basis of these thoughts, our choice was to depart from the property of scale invariance and call on the translation invariance axiom under which inequality remains stable if all incomes are increased by the same amount. This gives rise to indices of absolute inequality.

The analysis is based on the absolute Gini Index which is computed as the product of the relative Gini Index by the mean of the corresponding distribution. In Table 6, the analysis focuses on homogeneous (with respect to educational needs) groups of potential beneficiaries. The population groups are defined in such a way as to include the potential beneficiaries of each level of the education system (5–12,

Table 6. Changes in absolute inequality (distributions of potential beneficiaries).

	5–12		12–18		18–24			
	A1	A2	B1	B2	C1	C2	C3	C4
Mean	915.2	1099.6	836.7	1099.4	831.7	859.8	970.0	1013.4
Gini 1.5	0.2107	0.1715	0.2052	0.1551	0.1993	0.1933	0.2033	0.1920
Gini 2.0	0.3150	0.2566	0.3098	0.2364	0.2984	0.2901	0.3081	0.2917
Gini 4.0	0.4934	0.4038	0.4909	0.3843	0.4734	0.4644	0.4905	0.4697
AbsGini 1.5	192.9	188.5	171.7	170.5	165.7	166.2	197.2	194.6
AbsGini 2.0	288.3	282.2	259.2	259.9	248.1	249.5	298.9	295.7
AbsGini 4.0	451.5	444.1	410.7	422.5	393.8	399.3	475.8	476.0
Percentage changes								
Gini 1.5		−18.6		−24.4		−3.0	2.0	−3.7
Gini 2.0		−18.5		−23.7		−2.8	3.3	−2.2
Gini 4.0		−18.2		−21.7		−1.9	3.6	−0.8
AbsGini 1.5		−2.2		−0.7		0.3	19.0	17.4
AbsGini 2.0		−2.1		0.3		0.5	19.8	19.2
AbsGini 4.0		−1.7		2.9		1.4	19.2	20.9

Source: GHBS.

Notes: A1, distribution of equivalized disposable income (persons aged 5–12); A2, distribution of equivalized disposable income plus education transfers (5–12); B1, distribution of equivalized disposable income (persons aged 12–17); B2, distribution of equivalized disposable income plus education transfers (12–18); C1, distribution of equivalized disposable income (persons aged 18–24); C2, distribution of equivalized disposable income plus TEI education transfers (18–24); C3, distribution of equivalized disposable income plus AEI education transfers (only aged 18–24); C4, distribution of equivalized disposable income plus all education transfers (18–24).

12–18 and 18–24 for primary, secondary and tertiary education, respectively).[4] Furthermore, it is assumed that the benefits of public education are captured exclusively by the students/pupils. For reasons of comparison and completeness, changes in indices of relative inequality are also reported in the table. Our focus is, however, placed on absolute inequality. The lower panel of the table provides estimates of the changes in absolute inequality as a result of public education transfers. Note, as a benchmark scenario, that if the transfer was given to all the potential beneficiaries,[5] the distributive impact would be exactly neutral due to the property of translation invariance. In reality, we depart from this counterfactual due to pupils who drop out from school and students who study in private schools. Both groups do not receive the benefit and therefore the allocation of the transfers departs from neutrality. The larger the number of drop-outs (given that they usually come from low-income families), the less progressive public education is and the larger the number of private schools students (usually the offspring of relatively wealthy families), the stronger the progressive impact of education is expected to be. It is the combined effect of those two factors that determines the distributional outcome.

According to our estimates, primary education transfers appear to reduce absolute inequality (by 1.7–2.2%). This is due to the rather small number of dropouts at the primary level. But as we move to higher echelons of the education system, the number of pupils/students opting out of the system increases. Thus, secondary education transfers cause an ambiguous effect on absolute inequality (a mild rise in absolute inequality except when the value of the inequality aversion parameter is set at 0.5). Transfers to tertiary education students clearly increase absolute inequality among population members aged 18–24. Here, the distinction between TEI and AEI students

really matters. The regressive distributional impact of tertiary education transfers is exclusively due to transfers to AEI students, while transfers to TEI students affect inequality little. However, a certain degree of caution is needed when interpreting the results. The concept of potential beneficiaries is less concrete in the case of tertiary education compared to primary and secondary levels. For a number of secondary education graduates choose to participate in the labour market instead of continuing their studies. That line of argument implies that these students should not be treated as 'potential beneficiaries' of public tertiary education. The counterargument is that it is extremely difficult to distinguish between those that, consciously, choose not to continue their studies and those who are deprived of the opportunity.

5. The case for a graduate tax

The results show that public education, as a whole, exerts a levelling effect on the income distribution, but in parallel there is also evidence of the existence of education inequalities which are likely to reproduce further inequalities through the operation of labour markets. Figure 1 shows the distribution of tertiary graduates per quintile and confirms the association of tertiary qualifications with a favourable economic position.

Tertiary education graduates are concentrated in the upper part of the distribution and this is more evident for AEI graduates. Over half of them are located at the top quintile. In the light of this evidence and aiming at correcting the regressive effect of higher education, the idea of a progressive graduate tax is examined. The seeds of this idea go back in time (Friedman and Kuznets 1945). More recently, the graduate tax was examined by Barr (2004) and Barr and Crawford (2005).

Our analysis assumes a hypothetical graduate tax scheme, in which graduates pay a special tax in order to cover part of the cost of their studies. The tax takes the form of a supplementary income tax rate. The repayment rearrangements do not interfere with the decisions of individuals for investing in their human capital, for students do not pay anything during their studies but only after their graduation, conditionally to their successful entrance in the labour market. The repayments are made via the income tax system and, consequently, they are linked to graduates' ability to pay. Our approach involves the imposition of a simulated tax on the current stock of

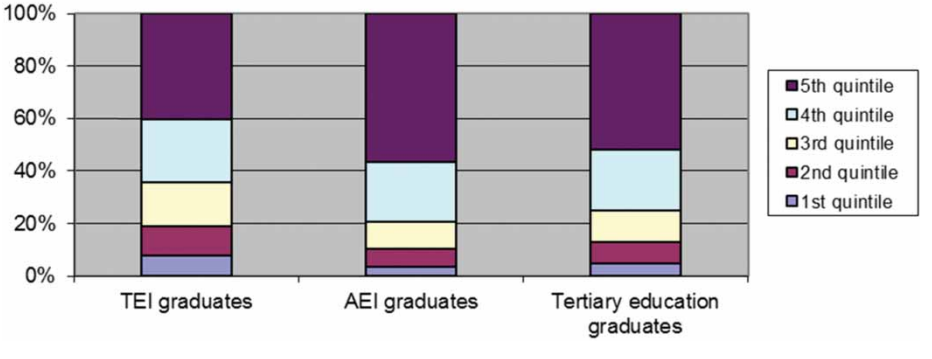

Figure 1. Distribution of TEI and AEI graduates per quintile.
Source: GHBS.

graduates, treating the scheme as if it had been in effect for several years already. The simulations are implemented using the EUROMOD model.[6] The graduate tax is modelled as an increase in the existing income tax rates according to different scenarios. The level of the tax rate increase is differentiated between AEI and TEI students. The scheme is open-ended. This means that the graduate tax is payable by all graduates whose taxable income lies above the tax threshold. Policy simulations labelled 1a, 1b and 1c in Table 7 do not distinguish between TEI and AEI graduates; the same tax rate increase is imposed to all. Simulations 2a, 2b, 2c apply lower tax rates on TEI graduates on the basis that their cost of studies is significantly lower and finally simulations 3a, 3b and 3c exclude entirely TEI graduates from the paying population. The mechanism of implementing the tax is very simple; the supplementary rates are added to the existing tax rates of the income brackets of the tax schedule. For example, the marginal income tax rates of 15%, 30% and 40% of the actual 2004 tax system are increased to 16%, 31% and 41% (simulation 1a) and similarly for all the other scenarios.

After having applied the supplementary tax rates on the current stock of graduates, the analysis proceeds on the evaluation of the first-round fiscal and distributional impacts of the tax. Additional tax revenues are reported as a percentage of disposable income/income tax revenues/public expenditure, respectively.

As one might expect, graduate tax revenues represent a small part of disposable income, but a larger of total income tax revenues. Across all simulations their relative size varies from 0.13% to 0.38% of disposable income and from 1.7% to 5.1% of total income tax revenues. The latter figure can be attributed to the fact that the graduate tax is imposed mostly on affluent taxpayers. An additional aim of the graduate tax is to cover part of public expenditures. The respective column of the table shows that the share of public tertiary expenditures covered varies from 5% to 18.3% across the various simulations. Estimates of simulation 1c (that impose the highest tax rate) demonstrate that graduate taxes could easily cover up to 18.3% of public expenditures.

The comparison of simulations 1a, 1b and 1c with 3a, 3b and 3c reveals the dependence of graduate tax revenues on AEI graduates. When we impose a lower (or zero) graduate tax rate on TEI graduates, the reduction in revenues is small. This is due to the fact that TEI graduates are less well-off compared to AEI graduates. Furthermore, the share of current tertiary education students is substantially higher than the corresponding share of earlier generations of tertiary education students. Hence, it may be expected that tax revenues will increase as the number of graduates who enter the scheme is higher than the number of graduates who exit.

Finally, the table provides a first picture of the short-run distributional effects of a graduate tax. These estimates should be read with caution for they are the product of many simplistic assumptions. Moreover, the results are not statistically significant at the 5% level. This is because of the small size of the tax. A higher tax would have rendered the results statistically reliable from a technical point of view. But higher tax rates would certainly have induced considerable behavioural responses which our model cannot capture as it is. Despite these apparent limitations, the microsimulation still provides a first evidence of the impact of the tax on inequality. Exactly because graduate tax payers belong mostly at the middle and upper part of the distribution, inequality mildly narrows. The higher the tax rate, the more progressive the effect becomes. Expectedly, when we differentiate the tax rates for AEI and TEI graduates the redistributive effect shrinks.

Table 7. Fiscal and distributional effects of a graduate scheme.

	Tax rate increase		Additional tax revenues			% Changes in inequality		
Simulation	AEI graduates (%)	TEI graduates (%)	As % of disposable income	As % of baseline income tax revenues	As % of gvt expenditures on tertiary education	Gini	Atkinson 0.5	Atkinson 1.5
1a	1	1	0.13	1.70	6.10	−0.18	−0.34	−0.21
1b	2	2	0.26	3.40	12.20	−0.37	−0.68	−0.43
1c	3	3	0.38	5.10	18.30	−0.55	−1.02	−0.64
2a	1	0.5	0.12	1.60	5.60	−0.17	−0.32	−0.20
2b	2	1	0.23	3.10	11.10	−0.34	−0.64	−0.40
2c	3	1.5	0.35	4.70	16.70	−0.51	−0.96	−0.59
3a	1	0	0.11	1.40	5.00	−0.16	−0.30	−0.18
3b	2	0	0.21	2.80	10.10	−0.31	−0.60	−0.36
3c	3	0	0.32	4.20	15.10	−0.47	−0.89	−0.54

Source: Greek version of EUROMOD model.

6. Discussion and conclusions

Our findings show that the progressivity of public education transfers withers away as we move up to higher educational levels. More detailed information about either the cost of post-graduate levels (master, Ph.D. studies) or the cost of highly esteemed faculties (e.g. medicine and engineering) could have revealed even more intriguing distributional patterns. One conjecture is that at the top of the educational pyramid the system is increasingly captured by the elites. The analysis shows that this indeed happens as far as the distinction between universities and TEIs is concerned. But admittedly, more disaggregated data would have allowed for a subtler analysis in that respect.

The use of absolute inequality indices in the literature of the distributional effects of publicly provided services is a fresh idea. The adoption of the 'absolutist' perspective to inequality does not contradict the general findings stemming from traditional analysis but yields more stirring results. The analysis, which operationalized this analytical framework on distributions of potential beneficiaries, shows that primary education transfers decrease (absolute) inequality, secondary education transfers have an ambiguous effect and tertiary education transfers appear to be clearly regressive.

Our approach is not free of caveats. The limitations of benefit incidence analysis have been well documented in the literature (Verbist, Förster, and Vaalavuo 2012). What is of particular importance in our context of analysis is that our cost estimates do not take into account public sector inefficiency, thus implicitly assuming that the government makes best use of taxpayers' money. This assumption is questionable. However, ignoring public sector inefficiency is the standard practice in the relevant literature and until now, according to our knowledge, the literature has not suggested a robust methodology to address this problem. Practically, this means that we may overestimate the 'true' value of the public benefit.

Furthermore, a life-cycle framework is more appropriate for analysing public education. The main reason is that educational needs are mostly age-related. Nevertheless, the informational requirements of inter-temporal empirical analysis are formidable. However, a recent attempt by Ter Rele (2007) to analyse public transfers from a life-cycle perspective (using simulation techniques) suggests that the results, at least in qualitative terms, are close to that obtained by static incidence analysis. In that respect, cross-sectional analysis offers a very good approximation of the 'truth' with few compromises.

Finally, it is interesting to interpret these results in the light of the institutional surroundings and corresponding public debate that has taken place in Greece over the past decade. One distinct feature of the education system in Greece is the lack of an officially recognized private sector in the field of tertiary education. What would be the distributional results of an institutional reform that would have allowed the parallel operation of private universities? According to the theoretical model of Besley and Coate (1991), it could improve the distributive capacity of the entire system under some conditions. This highly influential model is based on the operation of a process of self-selection; the poor select the low-quality public good and the rich consume the high-quality private good. The current situation is that, in the absence of private markets, the economically stronger households in Greece capture disproportionately the quantity-rationed publicly provided good. And it could be argued that the deregulation of the market, i.e. the modification of Article 16 of the Constitution that prohibits the operation of private universities, could improve the overall progressivity of the system.

However, we are inclined to characterize this assertion as simplistic because it disregards political economy considerations.

Instead, it is more feasible to search for policies designed to extenuate the observed unwanted distributional effects of the current system. Here we can discern between two approaches. The first is to try to cure the inequities of the system before they emerge. This 'precautionary' approach is discussed in Tsakloglou and Antoninis (1999) who support the idea that the progressivity of tertiary education is likely to be the by-product of the improvement of the progressivity of post-compulsory secondary education. In that spirit, they propose policies such as the provision of economic incentives to students from poor households to stay in education after the completion of compulsory education.

Without questioning the merits of this *ex ante* approach, our study suggests an alternative approach aiming at healing the existing inequities of the system. In particular, we consider the imposition of a graduate tax. Since the children of well-off families are over-represented in tertiary education (and especially in high-cost institutions) and tertiary education graduates are likely to enjoy substantially higher life-time income than the rest of the population, this policy is likely to improve the long-term distributional impact of public education while simultaneously financing higher education. In the aftermath of the current economic crisis in Greece, the scope for considering such instruments in order to finance universities may be larger. However, we reckon that neither our approach is free of limitations, nor is the concept of the graduate tax flawless. The tax may contribute to human capital flight or to implicitly subsidize tax evading households. Yet such costs can be minimized via the appropriate design and the tax may be worth considering for its distributional and fiscal properties.

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Notes

1. The literature is heavily dominated by the relativist approach, according to which the yardstick of inequality is the relative 'distance' between households' incomes.
2. The restrictive admission policy of Greek higher education institutes also pushes a considerable number of students to study abroad. Most of them enrol in British universities.
3. This is not an uncontested choice. The exclusion of this component does not change qualitatively the results but rather reduces the size effect of the transfers, see Table A1 in the appendix.
4. Children aged 12 were included in the 5–12 age-group if they attended primary school and in the 12–18 age-group if they attended secondary school. Similarly, persons aged 18 were included in the 12–18 sample if attended secondary school. Lastly, graduates of higher education found in the 18–24 group were excluded from the sample.
5. Interestingly, according to Greek Constitution all citizens should receive equal 'amounts' of education.
6. The EUROMOD model is tax-benefit microsimulation model for the EU that calculates the effects of taxes and benefits on household incomes. More details can be found in the following link: https://www.iser.essex.ac.uk/euromod.

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Appendix

Figures regarding spending per student in tertiary education institutions, reported in Table 2 of the paper, include expenditures on R&D. However, it can be argued that such expenditures do not benefit directly higher education students, but mostly the academic stuff. The rest of the population may also benefit through positive externalities. Thus, in Table A1, we repeat the baseline calculations while excluding R&D expenditures. Our estimates on spending per student were adjusted using information about the share of R&D expenditures to total public expenditures for tertiary institutions, taken from OECD (2006). As the figures of the table indicate, the results slightly change; TEI education transfers are less progressive and AEI education transfers marginally less regressive. Finally, as far as total public education transfers are concerned, a comparison of the results with and without R&D expenditures shows that the aggregate effects hardly change after the exclusion of R&D expenditures from the definition of unit cost.

Table A1. Percentage changes in aggregate inequality due to public transfers (excl. R&D expenditures).

Index	Distribution of monetary income	TEI transfers	AEI transfers	TEI transfers (excl. students living alone)	AEI transfers (excl. students living alone)
Gini	0.3217	−0.3	−0.2	−0.2	0.1
Atkinson ($e = 0.5$)	0.0849	−0.5	−0.4	−0.3	0.2
Atkinson ($e = 1.5$)	0.2406	−0.4	−0.1	−0.3	0.4

Source: GHBS.