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Short-run distributional effects of public education in Greece

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Abstract

The present paper examines the short-run distributional impact of public education in Greece using the micro-data of the 2004/5 Household Budget Survey. The aggregate distributional impact of public education is found to be progressive although the incidence varies according to the level of education under examination. In-kind transfers of public education services in the fields of primary and secondary education lead to a considerable decline in relative inequality, whereas transfers in the field of tertiary education appear to have a small distributional impact whose size and sign depend on the treatment of tertiary education students living away from the parental home. When absolute inequality indices are used instead of the relative ones, primary education transfers retain their progressivity, while secondary education transfers appear almost neutral and tertiary education transfers become quite regressive. The main policy implications of the findings are outlined in the concluding section.

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1. Introduction and short literature review

The standard approach of most empirical distributional studies is to rely exclusively on distributions of disposable income or, more rarely, consumption expenditure. However, a household's command over resources is determined not only by its spending power over commodities it can buy, but also on resources available to the household members through the in-kind provisions of the welfare state. Thus, from a theoretical point of view, a measure that includes in-kind public transfers is superior to the conventional measure of cash disposable income as a measure of a household's standard of living [Atkinson and Bourguignon (2000), Atkinson et al (2002), Canberra Group (2001)]. In most countries, developed and developing alike, one of the most important public transfers in-kind to the members of the population takes place through the education system. One of the main aims of such transfers is the mitigation of socio-economic inequalities. Therefore, a number of national and cross-national empirical study the distributional effects of public education transfers either alone or in combination with other public transfer in-kind, [Meerman (1979), Jimenez (1986), James and Benjamin (1987), Lampman (1988), Evandrou et al (1993), Smeeding et al (1993), Selden and Wasylenko (1995), Steckmest (1996), McLennan (1996), Huguenenq (1998), Harris (1999), Sefton (2002), Lakin (2004), Garfinkel, Rainwater and Smeeding (2006), Callan et al (2008), Marical et al (2008)]. These studies employ a variety of techniques and their results suggest that public education transfers reduce aggregate inequality, but the effect varies considerably according to the level of education and the country under examination.

In Greece education services are provided free of charge by the state at all levels (primary, secondary and tertiary), while the role of private education is limited. The idea that education subsidies have a progressively redistributive impact is strongly embedded in the public discourse. The only relevant issue that has been widely discussed in the literature is that of unequal access to tertiary education [Psacharopoulos and Papas (1987), Psacharopoulos (1988), Papas and Psacharopoulos (1991), Chryssakis (1991), Patrinos (1992, 1995), Polydoridis (1995), Gouvias (1998), Chryssakis and Soulis (2001), Psacharopoulos and Tassoulas (2004), Psacharopoulos and Papakonstantinou (2005). Even though most of these studies are descriptive in nature (for example, no study uses probability analysis in order to investigate in detail the factors that affect the success or failure of candidates in the

general examinations), their conclusions are very similar: children of parents with better educational qualifications and occupational background are far more likely to succeed in tertiary education examinations than students from lower socio-economic strata. This phenomenon is far stronger in Universities than in Technological Education Institutes. Further, a number of studies have shown that in Greece, as in many other countries, education is closely associated with inequality and that, ceteris paribus, the higher the educational level of the household head the higher the standard of living enjoyed by the household, Tsakloglou (1992), and, in addition, there is evidence of inter-generational transmission of educational inequalities, Papatheodorou and Piachaud (1998). Despite all these evidence, few attempts have attempted to measure the distributional effects of public education in Greece. Tsakloglou and Antoninis (1999) and Antoninis and Tsakloglou (2000, 2001) use static incidence analysis for the late 1980s and the early 1990s and show that the aggregate effect of public education subsidies is strongly progressive, but the progressivity is due exclusively to the effect of primary and secondary education transfers. These studies also show that the aggregate progressivity of public education subsidies declined between the late 1980s and the mid-1990s.

Since the mid-1990s two very important developments took place. First, tertiary education expanded rapidly; according to the OECD (2006) between 1995 and 2003 the number of tertiary education students in Greece almost doubled. Second, the effects of demographic decline become evident and the number of students in primary education declined considerably, even though in the 1990s there was a large increase of the migrant population in the country (many of them with their families). Under these new developments, it is interesting to examine whether the results of earlier studies are still valid.

The paper uses the information of the 2004/5 Household Budget Survey (HBS). It is organized as follows. The next section provides a short description of the structure of the Greek education system. Section 3 is concerned with methodological issues, while section 4 presents the empirical results. Finally, section 5 concludes the paper and discusses its possible policy implications.

2. A brief overview of the Greek education system

According to the Greek constitution, education is provided free of charge at all levels. A limited number of private schools operate at the first two levels, whereby enrolment rates fluctuate around 6% for primary and secondary schools. At the tertiary level, in particular, degrees offered from private institutions, which are treated as commercial enterprises rather than educational institutions, are not officially recognized as equivalent to those of public institutions.

Pre-primary education is not compulsory, while primary and lower secondary are. These levels are not diversified. The great majority of lower secondary education graduates continue to upper secondary education, which is diversified. Students can choose between General and Technical Vocational Upper Secondary Education. Graduates of the General Upper secondary Education are eligible to take part in the general examinations to enter the Higher Education Institutions, which operate under a numerus clausus status. Higher Education Institutions are divided into Universities (AEI) and Technological Education Institutes (TEI). Graduates of Technical Vocational Upper Secondary Education may also enter the Technological Education Institutions, either by participating in the general examinations or on the basis of their school certificate record. Until the early 1990s, about one third of the candidates succeeded in entering Technological Education Institutions. After the rapid expansion of tertiary education in the late 1990s and the early 2000s, this proportion has risen considerably, but varies considerably between faculties. Before entering the labour market, upper secondary education graduates can also participate in post-secondary non-tertiary education (IEK), which has a hybrid educational-vocational character. Both private and public institutions operate at this level.

Private demand for higher education is strong. As a result of the households' keen interest in the general examinations a very large number of private, costly crammer schools assisting the candidates have sprouted, operating in parallel with the official education system but, in fact, substituting it in many respects. Moreover, the operation of numerus clausus in Greek higher education institutions and, until recently, the underdevelopment of post-graduate studies leads a large number of students to foreign universities. OECD estimates suggest that over 50,000 Greek students study abroad, most of them in British Universities, and Greece's number of

tertiary education students studying abroad is the sixth in the OECD (behind South Korea, Germany, Japan, France and Turkey), but by far the first when it comes to tertiary students studying abroad per capita.

Table 1 provides an overview of the Greek education system in 2004/5 in terms of numbers of students (in both public and private schools), total expenditure (distinguished between current and investment expenditure) stated in current 2004 prices and average yearly cost per student attending a public school for each of the three levels of the education system. Taking into account that investment spending fluctuates a lot over time, the estimates for investment expenditures reported in the table are the averages (in real terms) of investments during the period 1998-2004. The analysis of the distributional impact of public education spending is based on the information included in this table. It should be noted that in the case of tertiary education the number of students refers to the number of regular students; i.e. students enrolled for the number of years required for obtaining a degree (in practice, few students graduate exactly on the number of years required for obtaining a degree). Spending per student in secondary education is almost 50% higher than the corresponding figure in primary education. It is interesting to note the substantial difference in spending per student in the two branches of tertiary education. While yearly spending per student in Universities is more than twice the average of primary and secondary education, spending per student per year in Technological Education Institutions is even lower than spending per primary education student.

Table 1: Number of students and structure of public expenditure in the Greek education system (2004-2005)

								Annual average cost per student	
		Number of students	*%*	*Current Expenditure*	*Capital Expenditure*[a]	*Ratio of Current to Capital Expenditures*	*Total Expenditure*	*Current*	*Total*
Primary	Public	740.167	94,0	1.634.948.193	160.121.571	10,2	1.795.069.764	2.209	2.425
	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	3.177	3.555
	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	2.468	4.551
	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	4.083	6.339
TEI		177.229[c]	44,0	309.708.442	52.807.226	5,9	362.515.667	1.748	2.045
	All	402.494	100,0						

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

3. Data and general methodology

The data used in the paper are the micro-data of the 2004/5 Greek Household Budget Survey, which was carried out by the National Statistical Service of Greece. The survey covers all the private (non-institutional) households of the country and its sampling fraction is 2/1000 (around 6,500 households or 18,000 individuals). The baseline distribution is the distribution of disposable income. All monetary values were expressed in constant mid-2004 values in order to remove the impact of inflation. The distributions used are distributions of equivalised household disposable income per capita and they are derived using the "modified OECD equivalence scales" (Hagenaars et al, 1995) that assign weights of 1.00 to the household head, 0.50 to each of the remaining adults in the household and 0.30 to each child (person aged below 14) in the household. Since the estimates in the HBS are expressed in monthly figures, the cost estimates of Table 1 are adjusted accordingly.

The estimates derived in the next section rely on static incidence analysis under the assumption that public education transfers do not create externalities. No dynamic effects are considered in the present analysis. In other words, it is assumed that the beneficiaries of the public transfers are exclusively the recipients of the public education services (and the members of their households) and that these services do not create any benefits or losses to the non-recipients (i.e. the taxes that finance the transfers are already there). 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. We also assume that the benefit is shared by all household members (not only the direct beneficiary); in other words, we implicitly assume that in the absence of the public transfer the burden of financing the provision of education services would be born by the household. Similar assumptions are standard practice in the analysis of the distributional impact of publicly provided services.

4. Empirical results

4.1. Distribution of beneficiaries

The position of the direct beneficiaries of public education subsidies in the income distribution is reported in Table 2 (population is grouped in quintiles according to their equivalised disposable income). For both primary and, especially, secondary education the beneficiaries are concentrated in the lower half of the income distribution. This is likely to be the consequence of two factors. The first has to do with demographics. Households with children are less likely to have reached the top of their earnings capacity and/or have a lower share of earners and, hence, are more likely to be concentrated in the lower quintiles. The second has to do with private education. All private education students in the sample of the HBS belong to the top quintiles of the income distribution. Likewise, the distribution of post-secondary non-tertiary education students is more skewed towards the bottom of the income distribution, but due to their small numbers, the pattern is erratic. Regarding tertiary education students, a clear difference between AEI and TEI students is evident. TEI students are more likely to be concentrated towards the lower quintiles of the distribution, while AEI students are more evenly spread across the income distribution. The last column reports the distribution of all beneficiaries, irrespective of their educational level and re-iterates the point made earlier; beneficiaries are mildly over-represented in the lower half of the income distribution or, in other words, they are relatively evenly spread across the entire distribution, apart from the top quintile. Almost all primary and secondary education students live with their parents. However, this is not the case with tertiary education students. Unlike the case of students living with their parents, in the case of tertiary education students living away from their parental homes there is the broader question of whether the equivalised household income per capita is a good approximation of their standard of living. As the evidence of Table 3 shows, about one third of tertiary education students live away from their parental homes.[1] There are no reasons to believe that students living away from their parents are a very distinct group of persons with low living standards, etc.

[1] The proportion of tertiary education students who study in places other than that where their families live is likely to be substantially higher, but a considerable proportion of these students were interviewed in the houses of their families during vacation periods, while a few others live in collective households (student halls) and were excluded from the HBS sample.

TABLE 2: 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
all	100,0	100,0	100,0	100,0	100,0	100,0

However, as the evidence of the table shows, while the overwhelming majority (65%) of TEI students living with their parents can be found in the middle quintiles, almost 90% of the TEI students living away from their parents are found in the bottom half of the income distribution and none in the top quintile. The difference between the two groups is even more striking in the case of AEI students. Almost two thirds of those living with their parents can be found in the top two quintiles, while over 80% of those living away from their parental homes are located in the bottom half of the income distribution. Typically, in most empirical studies, students living away from their parents who do not live in collective households are treated as independent units. However, as the evidence of Table 3 suggests, in our case this treatment may lead to misleading results regarding the distributional effects of public education subsidies to tertiary education students. For this reason and as a sensitivity exercise, we also report results excluding such students from the HBS sample.

TABLE 3: Disaggregated distributions of tertiary education students

	TEI students			*AEI students*		
Quintile	*Living with their families*	*Living alone*	*All*	*Living with their families*	*Living alone*	*All*
1	16,9	31,0	21,5	7,3	32,1	16,4
2	21,2	43,5	28,5	12,9	31,5	19,7
3	28,3	18,0	25,0	18,0	21,5	19,3
4	21,8	7,5	17,1	29,4	12,3	23,1
5	11,8	0,0	7,9	32,4	2,5	21,5
All	100,0	100,0	100,0	100,0	100,0	100,0

The results of Tables 2 and 3 provide only partial evidence on the redistributive role of public education subsidies, since they may be driven primarily by demographics. Table 4 attempts to isolate this factor. More specifically, this Table reports the relative ratio of actual beneficiaries to potential beneficiaries per quintile for each educational level. For the construction of this indicator, first the number of the quintile's children who benefit from public education transfers in a particular level is divided by the total number of children in the corresponding age bracket (5-11 for primary; 12-17 for secondary and 18-24 for the rest). In the next stage, the resulting ratio of each quintile and educational level is divided by the corresponding national ratio. As a result, figures above (below) one imply that the children of the corresponding quintile are overrepresented (underrepresented) among the beneficiaries of public education transfers.

The ratio of actual to potential beneficiaries in the case of primary education is almost everywhere apart from the top two quintiles close or above 1 – clearly due to the concentration of private education students in the top quintiles of the income distribution. A similar pattern is also observed in the case of secondary education, the only difference being that a ratio substantially less than one is only observed in the top quintile. Since only 4% of those aged 18-24 participates in post-secondary non-tertiary education, the pattern for the group is rather erratic, although there is evidence that the beneficiaries are relatively disproportionately concentrated in the bottom quintiles. In the case of TEI students, ratios above one are observed in the middle of the income distribution, while ratios higher than one for AEI students are only observed in the top two quintiles.

TABLE 4: Relative ratio of actual to potential beneficiaries

Quantiles	*Primary education*	*Secondary education*	*IEK*	*TEI*	*AEI*	*All Public education institutions*
1	1,02	1,02	1,08	0,97	0,74	0,85
2	1,08	1,09	0,78	1,23	0,85	0,97
3	1,08	1,00	1,15	1,16	0,90	1,01
4	0,98	1,02	1,18	0,86	1,16	1,06
5	0,84	0,82	0,74	0,61	1,64	1,21
all	1,00	1,00	1,00	1,00	1,00	1,00

4.2 The size of the public benefit

In this section, we examine the absolute and differential magnitude of the public education transfers per quintile. Table 5 depicts estimates of the mean monthly transfer per capita for each quintile for every level of education (that is the ratio of the sum of the public transfers to the quintile population). In the cases of primary and secondary education, public transfers to the average member of the three bottom quintiles are higher than those received by the average member of the two top quintiles and, especially, the top. In the case of post secondary non tertiary education the transfers per capita are very modest and almost evenly spread across quintiles with the exception of the top one. Low average transfers per capita are also observed in the case of TEI transfers and they are higher for the tow lowest quintiles, while AEI transfers per capita are evenly spread across quintiles, with the exception of the bottom quintile where the value of the transfer is marginally lower. The last column reports the corresponding figure taking all public education transfers together. Unsurprisingly, taking into account the above evidence, average transfers per capita per quintile are not dramatically different in the case of the four lower quintiles and decline for the top one

TABLE 5: Mean transfers per quintile

Quantiles	*Primary education*	*Secondary education*	*IEK*	*TEI*	*AEI*	*All Public education institutions*
1	14,8	22,6	1,1	2,2	8,7	44,9
2	16,3	21,2	0,8	2,9	10,5	46,4
3	17,3	19,7	1,1	2,5	10,2	45,8
4	14,7	19,0	1,1	1,7	12,3	42,9
5	12,5	12,2	0,4	0,8	11,4	32,1
All	15,1	19,0	0,9	2,0	10,6	42,4

Table 6 reports the proportional increases in the incomes of the various population quintiles due to the inclusion of public education transfers. In contrast with the previous Table, Table 6 measures the relative importance of benefits with respect the mean incomes of population quintiles (total education transfers/total equivalized

disposable income per quintile). On average, households received an in-kind transfer of education services equal to 8,8% of their disposable income. When, we move to the analysis of the quintile distribution, interesting distributional patterns emerge.

Across all educational levels, the increase in the disposable income diminishes as we move up to higher income quintiles. The change is most rapid in the cases of primary and secondary education (from 8,2% to 1,3% for primary education transfers and from 11,3% to 1,1% for secondary education transfers). Average increases due to post-secondary non-tertiary education transfers are very low, mainly because of the small number of IEK students. Tertiary education transfers, as a whole, cause an important increase in households' disposable income (on average 1,9%). This is due to the impact of AEI transfers, while the impact of TEI transfer on disposable income is more moderate. The observed declining pattern of proportional increases per quintile is a sign of progressivity, however more distributional analysis is needed to reach more robust conclusions about the distributional effect of public education.

TABLE 6: Proportional increases in disposable income

Quantiles	*Primary education*	*Secondary education*	*IEK*	*TEI*	*AEI*	*All Public education institutions*
1	8,2	11,3	0,5	0,9	3,2	24,0
2	5,3	6,2	0,2	0,7	2,4	14,9
3	4,2	4,3	0,2	0,5	1,8	11,0
4	2,6	3,1	0,2	0,3	1,8	8,0
5	1,3	1,1	0,0	0,1	1,0	3,5
All	3,1	3,5	0,2	0,3	1,6	8,8

4.3 The distributional effects of public education in Greece

This section provides a qualitative picture of the changes in inequality induces by the addition of public education transfers in the definition of income. Graph 1 plots the difference between the Lorenz curves for the five distributions of augmented income (disposable income plus primary education public transfers, disposable income plus secondary education public transfers, disposable income plus IEK public transfers, disposable income plus TEI public transfers and disposable income plus AEI

education transfers) and the Lorenz curve for disposable income. As a matter of fact, if the difference between the two Lorenz curves is always positive, then the relevant transfers is unambiguously inequality reducing. Indeed, almost all the augmented distributions Lorenz dominate the monetary distribution. The only exception is AEI transfers. In that case, the respective function crosses the horizontal axis at p≈0.74.

The redistributive effects of primary, secondary, IEK, TEI public education transfers are, unambiguously, inequality reducing. Or, in other words, whatever the social welfare function behind the inequality index, these transfers decrease aggregate inequality. This is not the case with AEI education transfers. In this case the distributional outcome depends on the social welfare function chosen. These transfers reduce inequality at the upper part of the distribution (p>0,74) but do exactly the opposite for the bottom of the distribution (p<0,74).

GRAPH 1: Difference between Lorenz curves

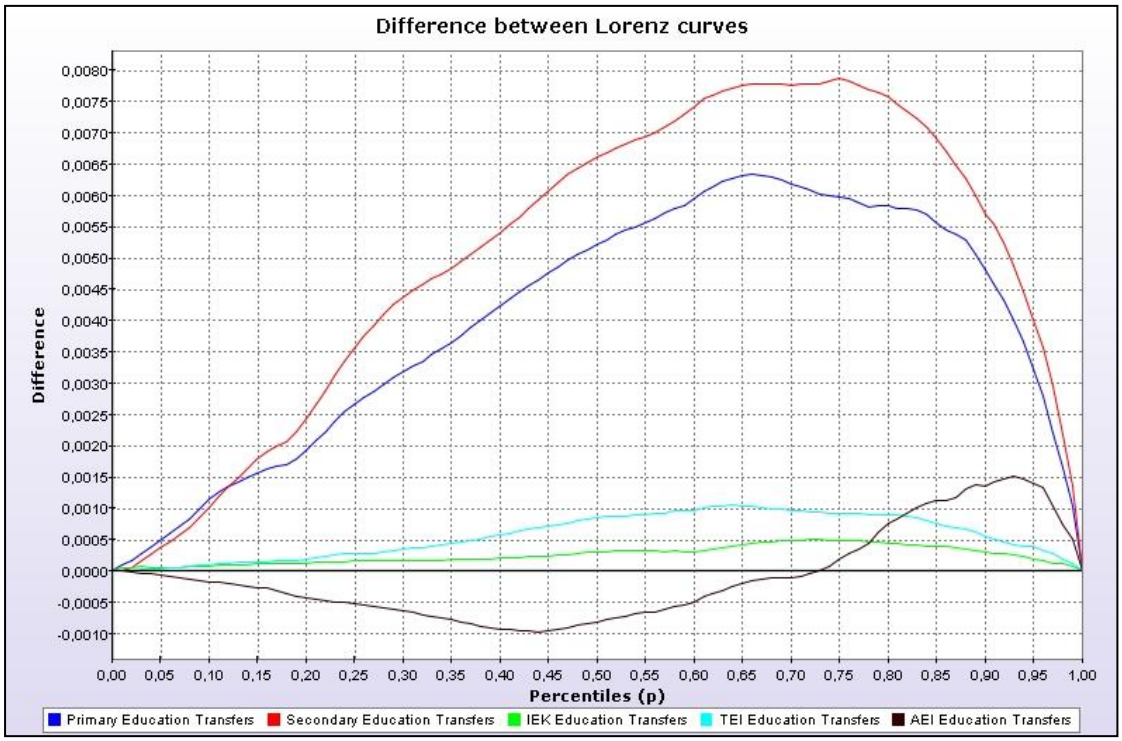

Table 7 examines the distributional impact of public education transfers per level of education on aggregate inequality; that is, it reports the proportional change in a number of inequality indices when we move from the distribution of disposable income to the distribution of disposable income augmented by the public transfers at

the corresponding educational level. When moving from the distribution of disposable income to the augmented distribution of resources, the Gini index declines by 6,5%, while the Atkinson index (e=0,5) declines by 12,1% and by 10,8% if inequality aversion parameter is set to 1,5. Almost the entire effect is driven by the progressive redistributive impact of primary and secondary education transfers. TEI and post-secondary non-tertiary transfers reduce inequality, but only marginally. The sign of the effect of AEI transfers depends on the index used. When the value of the inequality aversion parameter of the Atkinson index rises beyond a certain level (higher than 0,5 but lower than 1,5) inequality increases as a result of these transfers. The latter implies the intersection of the Lorenz curve for the distribution of disposable income and the Lorenz curve for augmented by AEI transfers income. The changes in inequality reported in Table 7 are statistically significant except of the changes induced by the AEI education transfers, which are not significant at the a=5% level.

TABLE 7: Proportional changes in aggregate inequality after the inclusion of in-kind public transfers in the concept of resources

		Proportional changes in inequality due to the inclusion of:					
Index	*Distribution of monetary income (baseline distribution)*	*Primary education transfers*	*Secondary education transfers*	*IEK transfers*	*TEI education transfers*	*AEI education transfers*	*All education transfers*
Gini	0,3217	-2,7	-3,4	-0,2	-0,4	0,0	-6,4
Atkinson (e=0.5)	0,0849	-5,2	-6,4	-0,4	-0,6	-0,1	-12,1
Atkinson (e=1.5)	0,2406	-5,0	-5,3	-0,6	-0,5	0,3	-10,8

4.4. Sensitivity analysis

As noted earlier, equivalised disposable income per capita may not be a good indicator of the living standards of tertiary education students living away from their parents. Therefore, in Table 8 we repeat the calculations of the main analysis after removing them from the sample. Taking into account that tertiary education students living away from their parents have low incomes and receive large public transfers, it is not surprising to find that their removal from the sample results in less

progressive distributional effects of public transfers. However, since these students are not that many, the reported aggregate effects of the public transfers do not change dramatically. The Gini index declines by 6,1% instead of 6,4% and the two Atkinson indices by 11,5% and 10,3%, instead of 12,1% and 10,8%. However, when examining the effects to AEI and TEI students alone, the differences in the two sets of estimates are quite different. This time all indices record an increase in inequality as a consequence of AEI transfers (from 0,3% to 0,7% depending on the choice of the inequality index), while the progressive effect of TEI transfers is smaller (inequality declines from -0,2% to -0,4% depending on the choice of the index).

TABLE 8: Proportional changes in inequality after the inclusion of in-kind public tertiary education transfers in the concept of resources (excl. students that live alone)

		Proportional changes in inequality due to the inclusion of:					
	Distribution of monetary income (baseline distribution)	*TEI education transfers*	*AEI education transfers*	*All education transfers*	*TEI education Transfers (excl. students that live alone)*	*AEI education transfers excl. students that live alone)*	*All education transfers excl. students that live alone)*
Gini	0,3217	-0,4	0,0	-6,4	-0,2	0,3	-6,1
Atkinson (e=0.5)	0,0849	-0,6	-0,1	-12,1	-0,4	0,4	-11,5
Atkinson (e=1.5)	0,2406	-0,5	0,3	-10,8	-0,3	0,7	-10,3

Even though the results reported in previous sections are interesting, we should note that the sample used for the examination of the distributional impact of public education includes several households that are very unlikely to benefit directly from public education (elderly households, childless couples, etc.). For this reason, we repeat the analysis using two alternative approaches. The first approach isolates the cohorts that are most likely to have members participating in the education system according to the age of the household head. More specifically, in this case the sample consists of all the households with heads aged 25-60. This sample includes the overwhelming majority of households with members in primary and secondary education as well as about two thirds of those with members in tertiary education. The results are reported in Table 9. Qualitatively they do not differ substantially

from the baseline results but quantitatively they are stronger. The Gini index declines by 10,2% and the two Atkinson indices by over 18%, when we add public education transfers in the definition of income. The difference between these results and the corresponding results of baseline analysis are almost exclusively due to the transfers in the fields of primary and secondary education, while the redistributive effects if post-secondary non-tertiary and tertiary (AEI and TEI) education transfers are similar[2]. The second approach repeats the analysis on the sample of households with members aged 6-24. Thus, almost all the beneficiaries of public education transfers are included in the sample, while the overwhelming majority of the non-beneficiaries is left out of the picture. The results are reported in the third panel of Table 9. In quantitative terms the estimates are even stronger than those of the previous case ("only households with head aged 25-60"). The Gini index declines by 13,1% and the Atkinson around 24% (Atkinson) due to public education transfers. The progressive effect is again driven by primary and secondary education transfers, but the distributive effects of tertiary education transfers (as well as that of IEK) are also progressive and stronger than in the baseline scenario.

TABLE 9: Proportional changes in inequality due to the inclusion of in-kind public education transfers in the concept of resources.

		Proportional changes in inequality due to the inclusion of:					
	Distribution of monetary income (baseline distribution)	*Primary education transfers*	*Secondary education transfers*	*IEK education transfers*	*TEI education transfers*	*AEI education transfers*	*All education transfers*
All households (17348)							
Gini	0,3217	-2,7	-3,4	-0,2	-0,4	0,0	-6,4
Atkinson (e=0.5)	0,0849	-5,2	-6,4	-0,4	-0,6	-0,1	-12,1
Atkinson (e=1.5)	0,2406	-5,0	-5,3	-0,6	-0,5	0,3	-10,8
Only households with head aged 25-60 (11.415 obs.)							
Gini	0,3165	-4,3	-5,5	-0,2	-0,3	0,1	-10,2
Atkinson (e=0.5)	0,0830	-8,4	-10,0	-0,5	-0,6	-0,1	-18,8

[2] As in the baseline scenario, changes in inequality due to AEI transfers are not statistically significant.

Atkinson (e=1.5)	0,2381	-8,6	-8,9	-0,9	-0,4	0,3	-18,3
Only households with members aged 4-24 (8.840 obs.)							
Gini	0,3093	-5,0	-6,6	-0,3	-0,6	-0,5	-13,1
Atkinson (e=0.5)	0,0795	-9,8	-12,1	-0,7	-1,1	-1,0	-24,4
Atkinson (e=1.5)	0,2269	-10,1	-10,6	-1,1	-0,8	-0,8	-24,5

4.5 Overall progressivity

Usually, progressivity indices are used in the tax literature. Yet, employing them in our framework of analysis may yield interesting results concerning the overall progressivity of public education transfers. For the purposes of the analysis, the family of distributionally sensitive Gini indices is utilized, Donaldson and Weymark (1980), and the inequality aversion parameter, v, is set at 2 (the usual Gini index), 3 and 4. The results are reported in Table 10. Kakwani (1977) indices are only examining the location of the recipients in the original income distribution. According to this criterion, the most progressive transfers appear to be those to post-secondary non-tertiary education students, unless the inequality aversion parameter is set at relatively high levels (v=4), while the most progressive component of public education appears to be the transfers to secondary education system. Irrespective of the value of the inequality aversion parameter, the lowest progressivity is recorded in the case of AEI transfers. The index of Reynolds-Smolensky (1997) takes into account the location of the recipient in the original distribution as well as the size of the transfer (but not the resulting re-ranking of population members after the transfers). The Reynolds-Smolensky index demonstrates that the progressivity of public education transfers emanates from the transfers to primary and secondary education students while the rest of the transfers have a positive but marginally progressive impact. When the index is corrected for the effects of re-ranking [Atkinson (1980), Plotnick (1981)], the overall progressivity of the transfers declines, while that of transfers to AEI students is almost eliminated.

TABLE 10: Indices of Progressivity

	Kakwani			*Reynolds-Smolensky*			*Reranking*			*Reynolds-Smolensky corrected*		
	v=1,5	*v=2,0*	*v=4,0*	*v=1,5*	*v=2,0*	*v=4,0*	*v=1,5*	*v=2,0*	*v=4,0*	*v=1,5*	*v=2,0*	*v=4,0*
Primary	0,2467	0,3630	0,5340	0,0074	0,0109	0,0161	0,0013	0,0024	0,0051	0,0061	0,0085	0,0110
Secondary	0,2840	0,4255	0,6552	0,0097	0,0145	0,0224	0,0019	0,0035	0,0081	0,0078	0,0111	0,0143
IEK	0,2994	0,4436	0,6675	0,0005	0,0007	0,0011	0,0005	0,0007	0,0011	0,0000	0,0000	0,0000
TEI	0,2937	0,4362	0,5959	0,0009	0,0014	0,0019	0,0001	0,0003	0,0007	0,0008	0,0011	0,0013
AEI	0,1550	0,2199	0,3248	0,0025	0,0036	0,0053	0,0021	0,0037	0,0066	0,0004	-0,0001	-0,0013
ALL	0,2472	0,3655	0,5483	0,0199	0,0295	0,0442	0,0048	0,0087	0,0187	0,0151	0,0207	0,0255

4.6 Changes in absolute inequality

The standard approach in studies of the distributional effects of public transfers is to employ a relativist framework of inequality measurement. In the same spirit the above analysis follows this path, since it is based on the mean independence axiom. This axiom is used in the framework of inequality analysis in order to avoid getting different estimates of particular inequality indices when the income distribution is measured in different metric units (dollars, euros, pounds, etc.). However, in the framework of the present analysis it can have a perverse effect, since in order to keep the level of inequality constant, the beneficiaries should receive transfers proportional to their (equivalised) disposable income. This is a rather unusual treatment that contravenes the very rationale behind of public transfers. At least according to the Greek constitution, each beneficiary should be entitled to an equal amount of public transfers. Under these circumstances, it may be preferable to base our analysis on absolute rather than relative inequality indices [Kolm (1976), Blackorby C. and Donaldson D. (1980)].

Nevertheless, even this treatment may be far from perfect. Public education transfers are not meant to benefit the entire population, but particular age groups only. Therefore, in Table 11 instead of assuming that the benefits of public education are shared by all household members, it is assumed that these benefits are captured exclusively by the students themselves. The index used is the Gini index, although the same analysis can be performed using any index of inequality. The absolute index is the product of the relative index by the mean of the distribution The distributions used are distributions of persons in particular age brackets and

comparisons of the levels of both relative and absolute inequality before and after the transfers are made. These population groups are defined in such a way as to include the potential beneficiaries of each level of the education system (5-11, 12-17 and 18-24 for primary, secondary and tertiary education, respectively). More specifically, it is assumed that the pre-transfer welfare level of each member of these groups is determined by his/her level of equivalised disposable income while the post-transfer welfare level is determined by his/her equivalised disposable income plus the value of the public transfer in the corresponding education level, if he or she is participating.

the lower panel of the table provides estimates of the changes in absolute inequality as a result of public education transfers. In case the in-kind transfer was given to all potential beneficiaries, the distributive impact would be neutral due to the property of translation invariance of the absolute indices. However drop-outs and private school students keep the aggregate distributional effect away from neutrality. Primary education transfers appear to reduce absolute inequality (by 1,2%-2,0%). This is probably due to the effect of private education, as there are very few dropouts in this age bracket and the majority of private education students who do not benefit from public education subsidies are located close to the top of the distribution of persons aged 5-11. On the contrary, public transfers to secondary education students cause a mild rise in absolute inequality among those aged 12-17 (except when the value of the inequality aversion parameter is set at 0,5) despite the fact that the great majority of private education students who do not benefit from public education subsidies are located close to the top of the distribution of persons aged 12-17, the inequality-increasing effect is due to the fact that the non-participation rates are substantially higher among the poorer rather than the richer member of this specific group. Transfers to tertiary education students clearly increase absolute inequality among population members aged 18-24; a result mainly driven by the effect of transfers to AEI students. The latter increase absolute inequality by 14,7%-16,4%.

TABLE 11: Distributions of targeted population

	5-11		*12-17*		*18-24*			
	A	*B*	*A1*	*B1*	*A2*	*B2*	*C*	*D*
Mean	912,5	1092,0	843,3	1099,0	843,1	1018,9	865,3	952,6
Gini 1,5	0,2117	0,1733	0,2060	0,1573	0,2009	0,1875	0,1960	0,2040
Gini 2,0	0,3156	0,2590	0,3105	0,2393	0,3016	0,2854	0,2949	0,3094
Gini 4,0	0,4936	0,4076	0,4909	0,3877	0,4770	0,4593	0,4700	0,4915
AbsGini 1,5	193,1	189,2	173,7	172,8	169,4	191,1	169,6	194,3
AbsGini 2,0	288,0	282,8	261,9	262,9	254,3	290,8	255,2	294,7
AbsGini 4,0	450,4	445,1	414,0	426,1	402,2	467,9	406,7	468,2
Proportional Changes								
Gini 1,5		-18,1%		-23,6%		-6,7%	-2,4%	1,5%
Gini 2,0		-18,0%		-22,9%		-5,4%	-2,2%	2,6%
Gini 4,0		-17,4%		-21,0%		-3,7%	-1,5%	3,0%
AbsGini 1,5		-2,0%		-0,5%		12,8%	0,1%	14,7%
AbsGini 2,0		-1,8%		0,4%		14,3%	0,4%	15,9%
AbsGini 4,0		-1,2%		2,9%		16,4%	1,1%	16,4%

A: Distribution of equivalised disposable income (persons aged 5-11), B: Distribution of equivalised disposable income plus education transfers (5-11), A1: Distribution of equivalised disposable income (persons aged 12-17), B1: Distribution of equivalised disposable income plus education transfers (12-17), A2: Distribution of equivalised disposable income (persons aged 18-24), B2: Distribution of equivalised disposable income plus education transfers (18-24), C: Distribution of equivalised disposable income plus TEI education transfers (only aged 18-24), D: Distribution of equivalised disposable income plus AEI education transfers (18-24)

5. Conclusions and policy implications

Our findings show that in-kind public education transfers in Greece lead to a significant decline in aggregate inequality. This equalizing effect is mainly the result of public transfers to primary and secondary education students, while transfers to post-secondary non-tertiary (IEK) and TEI students were found to affect aggregate inequality very little (nevertheless, progressively). The effect of transfers to University (AEI) students depended on the treatment of students living away from their parents. Our main analysis showed that the distributional effect of those transfers is ambiguous, however under the plausible assumption of excluding students that live away from parental homes, we found their effect to be mildly regressive. Another interesting result of the study was the adoption of an absolutist perspective to inequality. Whereas the majority of distributional studies rely on a relative concept of inequality, we believe that an absolute inequality framework may make sense in the context of publicly provided services such as public education

services. For the purposes of the analysis, we confined the estimation to the distributions of potential beneficiaries and we found that only primary education transfers decrease absolute inequality (as measured by the absolute parametric Gini). Secondary education transfers increase absolute inequality, whereas tertiary education transfers appear to be regressive.

Yet, the results may be even more interesting, had we access to information about the disaggregated costs of tertiary education institutions. Costs per student vary widely across tertiary education institutions and faculties and there is evidence that students that belong to high income segments of the population are over-represented in the faculties with the highest cost per student, such as medicine and engineering, [Chrysakis (1991), Chryssakis and Soulis (2001)]. Hence it is likely that the use of more disaggregated data regarding education could have produced even stronger inequality increasing results with respect to AEI transfers.

In the light of this evidence, a number of policies designed to mitigate such unwanted distributional effects are desirable. An improvement of the distributional performance of the public tertiary education in Greece is likely to be the by-product of the improvement of the progressivity of public post-compulsory secondary education. Students from poor households who reach the entrance examinations are less likely to succeed than students from rich households, therefore students from richer households are over-represented in tertiary education. Hence, policies aimed to address these inequities - such as the provision of grants and other incentives to students from poor households in order to stay in education after the completion of compulsory education could improve at the same time the distributional impact of both upper secondary and tertiary public education.

Another alternative that has been suggested in the public discourse regards the financing of tertiary education via the imposition of a graduate tax [Barr (2004), Barr and Crawford (2005)]. Since the children of better-off families are over-represented in tertiary education and moreover, from a dynamic point of view, tertiary education graduates are likely to enjoy substantially higher life-time incomes than the rest of the population, such a policy is likely to improve the long-term distributional impact of public education. A graduate tax scheme is not without limitations. It may act as a deterrent to potential students or to implicitly subsidize tax evading households. Yet, costs may be minimized via the appropriate design, while a graduate tax may be

worth considering for its distributional and fiscal properties. We have considered the distributional and fiscal consequences of a graduate tax in Greece using the EUROMOD Microsimulation model. The results of the Microsimulation can be found in the Appendix. According to our estimates this policy reform is not only inequality-reducing, but also can cover a significant part of the cost of the tertiary institutions.

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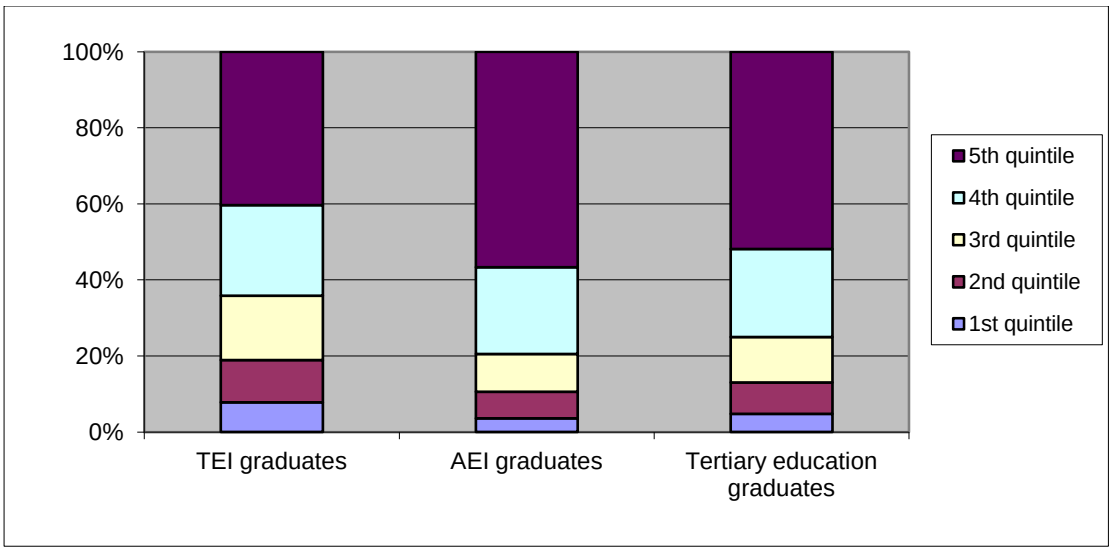
Appendix: The case for a graduate tax

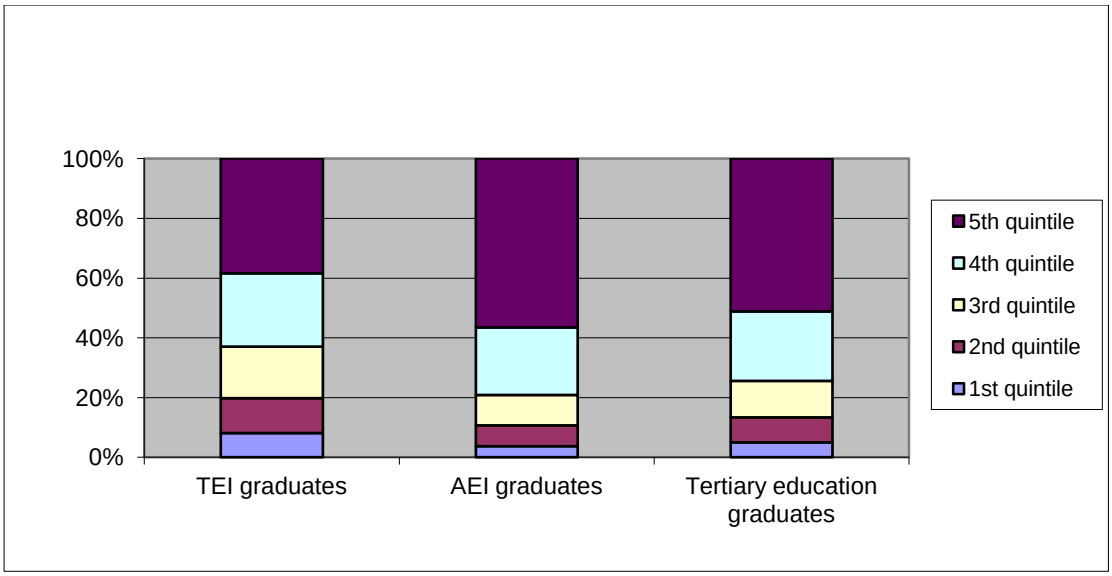
The basic idea of graduate taxation was first proposed by Friedman and Kuznets (1945) who suggested that if individuals issued equity shares of their human capital, then they could finance their professional education. Some years later, Friedman (1962) extended his idea to higher education in general. He wrote that *"the device adopted to meet the corresponding problem for other risky investments is equity investment plus limited liability on the part of shareholders. The counter-part for education would be to "buy" a share in an individual's future earning prospects and advance him the funds needed to finance his training"*. The mechanism is very simple: a student would accept money in order to pay his cost of study and pay it back later via his income taxes. The scheme resembles a loan, however a major difference is that he is not supposed to pay back the capital plus the interest, but a percentage of his future income.

Many studies have shown that there is a financial return to higher education or in other words that graduates' earnings are systematically higher than non-graduates'. Indeed, several empirical findings prove that graduates enjoy a significant wage premium that can be attributed to their qualifications [for example see Psacharopoulos & Patrinos (2004)]. Consequently, they belong to the most well-off segments of the population. This result is also confirmed by our data. Graphs AP.1 and AP.2 show the distribution of tertiary graduates (entire population, aged bellow 65, respectively) per quintile. As the graphs indicate tertiary education graduates are heavily concentrated at the upper part of the distribution. This pattern is especially striking for AEI graduates, over half of the university graduates are located at the top quintile. In contrast, graduates are very under-presented at the bottom part of the distribution. Under a graduate tax scheme, graduates pay a special tax in order to cover part of the cost of the tertiary qualifications, they received. The tax takes the form of a supplementary tax rate, which is imposed to graduates' income only. The repayment rearrangements are such that the students don't pay anything while they are studying, but only after their graduation, when they also enjoy the financial benefits of their tertiary qualifications. Moreover the repayments are made via the 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 graduates, treating the scheme as if it had been in work for several years already.

GRAPH AP.1: Distribution of tertiary education graduates per quintile



GRAPH AP.2: Distribution of tertiary education graduates aged under 65 per quintile



The policy simulations were implemented using the EUROMOD model. We model the graduate tax as an increase in the existing income tax rates according to different policy scenarios. Across simulations we differentiate the level of the tax rate increase, as well as whether the same rate increase will be applied to AEI and TEI graduates or not. The graduate tax scheme implemented in this section is open-ended. This means that the graduate tax is payable by all graduates whose taxable income is above the tax threshold. In the next section, we test the sensitivity of the results by confining the paying population only to those aged bellow 65. Policy simulations 1a,

1b, 1c do not distinguish between TEI and AEI graduates; the same tax rate increase is imposed to all. On the other hand, simulations 2a, 2b, 2c apply lower graduates tax rates on TEI graduates on the basis that their cost of tuition is significantly lower[3] and finally simulations 3a, 3b, 3c is a more "extreme" variant of the simulations 2a, 2b, 2c. These simulations exclude TEI graduates from the paying population. The supplementary rates were added to the existing tax rates of each income bracket of the tax schedule. For example, whereas the marginal income tax rates in 2004 were 15%, 30% and 40%, they rise to 16%, 31% and 41% for simulation 1a and similar for other simulations. Our baseline scenario assumes that the graduate tax is imposed on all incomes.

Having applied the supplementary tax rates on the current stock of graduates, we now turn to evaluate the distributional impact of the tax. Before we move to distributional effects, Table AP.1 provides estimates of the fiscal effects that would be induced by the graduate tax scheme. Additional tax revenues are reported as a percentage of disposable income, income tax revenues and public expenditure in tertiary education.

TABLE AP.1 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%	0,50%	0,12%	1,60%	5,60%	-0,17	-0,32	-0,2
2b	2%	1%	0,23%	3,10%	11,10%	-0,34	-0,64	-0,4
2c	3%	1,50%	0,35%	4,70%	16,70%	-0,51	-0,96	-0,59
3a	1%	0%	0,11%	1,40%	5,00%	-0,16	-0,3	-0,18
3b	2%	0%	0,21%	2,80%	10,10%	-0,31	-0,6	-0,36
3c	3%	0%	0,32%	4,20%	15,10%	-0,47	-0,89	-0,54

[3] See Table 1; "The cost structure of Greek education system".

As one might expect, graduate tax revenue is a small part of disposable income, but not so of total income tax revenues. Across all simulations it 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 relatively affluent taxpayers. Nevertheless, the main aim of the graduate tax is to cover part of the public tertiary education expenditures. The last column of the Table shows that it can cover a modest part of public tertiary education expenditures. The share of public tertiary expenditure covered varies form 5% to 18,3% across the various simulations.

Estimates of simulation 1c (that impose the highest graduate tax rate) demonstrate that graduate taxes could cover up to 18,3% of public tertiary education expenditures. However as it was also stated in the previous section, changes in policy parameters that are not marginal (as it is the case of simulation 1c) should be interpreted with caution, for they neglect behavioural responses. Yet, these effects depend on the elasticity of labor supply and remain a question of empirical investigation.

The comparison of simulations 1a, 1b, 1c with 2a, 2b and 2c and especially 3a, 3b 3c reveals the dependence of graduate tax revenues on AEI graduates. When we impose a lower graduate tax rate or we even exclude TEI graduates from the paying population, then the reduction in revenues is relatively small. For example, if we impose a 1% graduate tax only to AEI graduates, then the graduate tax revenues as a proportion of public expenditure in tertiary education decrease only from 6,1% to 5,0%. This is due not only to the fact that AEI graduates are more than TEI graduates, but also because they are located higher in the income distribution than the TEI graduates. Yet, as we noted earlier 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 the graduate revenues will increase as the number of graduates that enter in the scheme is higher than the number of graduates that exit.

The Table, also, reports the quantitative estimates of the short–run distributional effects of the graduate tax. Across all simulations aggregate inequality decreases mildly. The higher the graduate tax we impose, the larger the measured

redistributive effect (for example, when we impose a 3% graduate tax on all graduates the Gini index declines by about -0,55% and the two Atkinson by -1,02% and -0,64%, respectively). When we differentiate the tax rates for AEI and TEI graduates the redistributive effect becomes milder. However, it should be noted that the effect of excluding TEI graduates (or taxing them at a smaller rate) on inequality is very small. Also, the largest declines are recorded when the index used is the Atkinson (e=0.5), which is relatively more sensitive to changes close to the top of the distribution.