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# The progressivity of public education in Greece in the era of depression

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***Abstract***

This paper examines the progressivity of publicly provided education services in Greece during the tumultuous period of 2009-2013; that is before the crisis erupted and at its peak. We adopt two approaches in estimating the monetary value of public education transfers. The 'objective' progressivity of public education is measured through static incidence analysis under the assumption that the value of public transfers to the beneficiaries is equal to the average cost of producing the corresponding public services. The 'perceived' progressivity of public education is measured via demand analysis through which we derive a money metric of households' willingness to pay for public education. The juxtaposition of the two approaches yields empirical results which are valuable to policy makers.

***NOTE: This is a preliminary draft. Please quote after authors' permission.***

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## Contents

**ΠΕΡΙΛΗΨΗ**

Το άρθρο μελετάει την προοδευτικότητα της δημόσιας εκπαίδευσης στην Ελλάδα κατά την περίοδο 2009-2013, δηλαδή πριν το ξέσπασμα της οικονομικής κρίσης και – περίπου – στο ζενίθ της. Η μελέτη χρησιμοποιεί δύο μεθοδολογίες προκειμένου να εκτιμήσει τη χρηματική αξία της παροχής δωρέαν δημόσιας εκπαίδευσης στα νοικοκυριά. Η «αντικειμενική» προοδευτικότητα της δημόσιας εκπαίδευσης μετράται δια μέσου της στατικής ανάλυσης επιπτώσεων υπό την υπόθεση ότι η αξία των δημόσιων μεταβιβάσεων σε είδος είναι ίση με το κατα κεφαλήν κόστος παραγωγής των αντίστοιχων υπηρεσιών. Η «υποκειμενική» προοδευτικότητα της δημόσιας εκπαίδευσης μετράται με την εκτίμηση ενός συστήματος ζήτησης δια μέσου του οποίου εκτιμούμε ένα μέτρο της προθυμίας των νοικοκυριών να πληρώσουν για δημόσια εκπαίδευση. Η αντιπαραβολή των δύο μεθόδων είναι χρήσιμη στην εξαγωγή συμπερασμάτων για την άσκηση πολιτικής και δη της εκπαιδευτικής πολιτικής.

## 1. INTRODUCTION

The extent and severity of the economic crisis on Greece is known worldwide, yet the actual changes on basic macroeconomic figures never end to surprise; GDP per capita sunk by 21.2 percentage points during 2009-2013, unemployment rate catapulted from 9.6 in 2009 to 26.5 in 2014 and public debt peaked at 177.1 per cent of the GDP in 2014 (despite a very substantial restructuring in 2012). The implemented fiscal consolidation programmes were of an unprecedented magnitude (fiscal deficit declined from -15.6 per cent in 2009 to -3.5 per cent in 2014). These macroeconomic developments have been extensively discussed in the international political and academic fora for good reasons, yet issues pertaining to the income distribution remained in the shadow. This is an unfortunate negligence for reasons very well articulated in recent studies of influential world organisations, (IMF 2014, OECD 2015). Moving towards the direction of correcting this omission, the current paper examines an issue of distributional importance, namely the change in the progressivity of the public education system that occurred between 2009 and 2013.

It is not a coincidence that the link between publicly provided services and inequality is among the most celebrated themes in the field of empirical inequality studies. From a vast literature one can discern the older contributions of (Evandrou et al 1993; Smeeding et al 1993; Selden and Wasylenko 1995; Tsakloglou and Antoninis 1999; Garfinkel et al 2006; Aaberge and Langørgen, 2006; Callan et al 2008), the most recent of (Aaberge et al 2010; Spadaro et al 2013; Andreou et al, 2014) as well as the comprehensive meta-studies of (Marical et al, 2008; Verbist et al, 2012, 2013).

Still, the existing literature refers only to the pre-crisis period when the allocation of resources had not been yet distorted by the unanticipated shocks of the economic recession. But, nowadays, the urgent questions to answer refer to whether and to what extent the shrinkage of economic resources has affected the distributive capacity of in-kind welfare programmes. Apparently the Greek context is the most appropriate for such examination. In addition to that, the paper is interesting for methodological reasons, too. The vast majority of the bibliography – with very few exceptions (see for example; Andreou et al, 2014)-

measures the short term distributional effects of in-kind public goods using the so-called production cost approach, (Verbist et al, 2013)[1]. This approach presupposes that the per capita cost of producing public services reflects users' value. In our paper, alongside this traditional path of the literature, we also estimate a money metric for valuing consumers' willingness to pay for substituting public for private education following the methodological route of Andreou et al (2014). Thereafter this money metric is used in the framework of typical benefit incidence analysis for obtaining what we coin as the 'perceived distributional effects' of public education.

It should be stressed from the outset that we do not claim that the latter approach is superior to the production cost approach or it is without shortcomings. On the contrary, as we explain later, data availability issues limit considerably the scope for using consumer demand models in the context of income inequality studies. Nonetheless, by simultaneously implementing both approaches the analysis is embellished with valuable insights that would be otherwise lost.

The structure of the paper is simple; after providing an overview of the Greek educational system, section 3 describes the two methodologies and the data. Then, section 4 presents the results of the empirical analysis and conclusions follow.

## 2. AN OVERVIEW OF THE GREEK EDUCATIONAL SYSTEM

The Greek educational system is divided into three levels: primary, secondary and tertiary with an additional post-secondary level offering vocational training. Formal education is compulsory for all the children aged 6-15 and includes the primary and lower secondary levels, while attendance in pre-primary education (kindergartens and crèches) is optional except of the last year of kindergarten and serves as a preparatory stage for better integrating children in primary schools or simply for providing child care to families. In parallel, a number of

[1] Verbist et al (pg. 13, 2013) point out "*that this approach neglects differences within and across countries in the quality and efficiency in the provision of these services. Moreover, this approach does not necessarily reflect the user's value of the service, as the public service cannot (easily) be exchanged for other goods*". Indeed, as (Andreou et al, 2014) demonstrate in a specific country case the production cost approach may overestimate the distributional impact of publicly provided services.

post-compulsory non-classified vocational institutes provide work-oriented studies (ISCED[2] 4).

Primary education (ISCED 1) is provided by public and private primary schools and lasts six years. Children are admitted at the age of six and after six years of attendance pupils continue their studies in lower secondary schools (gymnasiums). Secondary education is divided into lower secondary (ISCED 2) and upper secondary (ISCED 3). The upper secondary level (lyceum) is not compulsory and is divided into the unified lyceum, the technical/vocational schools and other special schools (music schools, ecclesiastical schools, athletic schools, schools for children with special needs, etc.). The duration of studies is three years for both types while access is to public schools is free of charge.

Tertiary education (ISCED 5) is provided by the universities (henceforth AEI) and the technological education institutes (henceforth TEI). Students are admitted to TEIs or AEIs according to their performance at national level examinations. Eligible candidates should have successfully completed upper secondary education. Differences between AEIs and TEIs are both of substance and form. AEIs are orientated towards theoretical and scientific studies, while TEIs are geared towards applied research and vocational education. AEIs are also better funded than TEIs and offer degrees which are better received in the labour market, (Livanos and Pouliakas, 2011; Mitrakos et al, 2010a; Mitrakos et al, 2010b). Studies in both institutes are offered free of charge to all students without exceptions. Moreover, many AEIs and TEIs offer the possibility of master or doctorate studies (ISCED 6) at subsidized prices.

The educational system has expanded significantly during the last decades as manifested by the increasing rates of educational attainment. The percentage of the population aged 18-24 with at most lower secondary education (and not in further education or training) was 25.2% in 1992, decreased to 18.2% in 2000 and today stands at 9.0% (2014)[3], while the percentage of the population aged 30-34 who have successfully completed tertiary studies[4] was only 17.7% in 1992, reached 25.4% in 2000 and stood at 37.2% in 2014. These levels of educational attainment were achieved despite the fact that public education has

[2] ISCED stands for International Standard Classification of Education.
[3] According to the latest information from Eurostat Online Database, [Code: t2020_40]. Notably, this indicator serves as headline indicator for education in the context of Europe 2020.
[4] Ibid.

always been relatively underfunded; before 2009 public spending on education fluctuated below 4% of GDP[5], (as a point of reference: EU28 average was 5% in 2009).

The combination of an expanding education system and insufficient financing incurred a certain cost on other aspects of the system. Students' performance in PISA tests, in particular mathematics, is below international average according to the most recent 2012 PISA survey[6], (Greece's average score: 453 vis-à-vis OECD average: 494). On the other hand, pupils to teacher ratio, as well as average class size, stand at low levels; especially for public schools. In 2012 the average class size was 17.1 students in public primary schools and 19.7 students in private schools, while the respective OECD averages were 21.3 and 20.5, (OECD, 2014). At the lower secondary level, the corresponding figures were 21.8 (public schools) and 23.9 (private schools), when the OECD averages stood at 23.6 and 22.1 students per class for public and private schools, accordingly. Yet, to some extent, the good analogy between students and teachers/classes should not be necessarily interpreted as an indication of the quality of educational services, but also as an outcome of the idiosyncratic geography of Greece (i.e. schools located in small islands or remote mountain villages which operate with a very small number of students).

Finally, as regards educational personnel, it should be noted that teachers' salaries are relatively low compared to international standards, especially after (and due to) the severe austerity measures that were implemented in 2011-2014[7]. However, as another OECD study indicates despite that salaries are low, the salary cost per student is higher in Greece than in most OECD countries, possibly reflecting inefficiencies in the allocation of human resources, (OECD, 2011). On top of that, the school year in Greece is shorter than in many European countries and average workload (net teaching time) is relatively low,

[5] In 2013 this share rose to 4.5%, but of course this happened only because GDP declined at a higher pace than public spending. (Eurostat Online Database, [Code: gov_10a_exp]).
[6] The Programme for International Student Assessment (PISA) places mathematics as its main focus. The survey measures 15-year-olds' capacity to use mathematical concepts and reasoning in order to describe, explain and predict several phenomena.
[7] Specifically, the annual average public salary (including bonuses and allowances) of Greek teachers in 2012, ranged from 22,922 to 23,941 (in equivalent USD converted using PPPs) from pre-primary to upper secondary education levels, compared to the average OECD countries salaries which ranged from 38,253 to 47,165 for the corresponding year and educational levels, (OECD 2014).

(OECD, 2011). Furthermore, salaries are not linked to performance but rather to employment ranks which in turn depend on the educational qualifications and the time of service of the employee. Thus in the absence of an effective incentive structure there is little scope for a more efficient use of the system's human resources.

### 2.1 Public education, statism and egalitarianism

Education in Greece is under the supervision of the Ministry of Education, Research and Religious Affairs. The Ministry has the sole responsibility for the design and implementation of national education policy. The system is very bureaucratic marked by a high degree of centralisation with individual educational institutions having minimal command over staff selection, curriculum development and budget allocation, (OECD, 2011). Since educational decision-making follows a hard-line, top-down approach, (Saiti, 2003; Saiti and Menon, 2009), it is not so surprising that education policies reflect the priorities, interests and predilections of the political party in power. Adding to that, the instability of the Greek political system results to a lack of continuity in policies, including of course, educational affairs.

It is not surprising that in this context the role of formal private sector is limited. Table 1 shows the share of students enrolled in private institutions per educational level for each academic year spanning from 2005/6 to 2013/14. It can be seen that enrolment in private institutions stands at low levels and, furthermore, it has declined considerably the last years (with the exceptions of kindergartens); participation in private primary schools peaked at 7.3% in 2008/9 and decreased at 6.5% in 2013/14. Similarly enrolment rate in lower and upper secondary private schools bottomed at 4.5% and 4.4% in 2013/14.

**Table 1 Enrolment in private and public institutions, (2005-2014)**

| | Academic year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Level of education | 2005/6 | 2006/7 | 2007/8 | 2008/9 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 |
| **Kindergarten:** | | | | | | | | | |
| Public | 96.9 | 96.9 | 96.4 | 93.3 | 92.4 | 92.5 | 92.9 | 93.4 | 92.4 |
| Private | 3.1 | 3.1 | 3.6 | 6.7 | 7.6 | 7.5 | 7.1 | 6.6 | 7.6 |
| **Primary:** | | | | | | | | | |
| Public | 92.9 | 92.8 | 92.9 | 92.7 | 92.8 | 93.0 | 93.3 | 93.6 | 93.5 |
| Private | 7.1 | 7.2 | 7.1 | 7.3 | 7.2 | 7.0 | 6.7 | 6.4 | 6.5 |
| **Lower secondary:** | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Public | 94.7 | 94.7 | 94.5 | 94.4 | 94.4 | 94.8 | 94.8 | 95.2 | 95.5 |
| Private | 5.3 | 5.3 | 5.5 | 5.6 | 5.6 | 5.2 | 5.2 | 4.8 | 4.5 |
| **Upper secondary:** | | | | | | | | | |
| Public | 93.7 | 93.9 | 94.4 | 94.6 | 94.5 | 94.6 | 95.3 | 95.6 | 95.6 |
| Private | 6.3 | 6.1 | 5.6 | 5.4 | 5.5 | 5.4 | 4.7 | 4.4 | 4.4 |

Source: Ministry of Education, Research and Religious Affairs.

The situation in tertiary sector is more complex. The degrees offered by private higher education institutions are not officially recognized as equivalent to those of public institutions due to the provisions of Article 16 of the Constitution according to which: '*Education at university level shall be provided exclusively by institutions which are fully self-governed public law legal persons. These institutions shall operate under the supervision of the State and are entitled to financial assistance from it; they shall operate on the basis of statutorily enacted by-laws.*'[8] Yet, and despite the constitutional prohibition, a very diversified market of private colleges operate in Greece offering degrees that are not recognised by the government and as a consequence their graduates are not able to apply for graduate-level employment in the public sector, ask for military service deferment or obtain formal professional registration, (Zigouras and McBurnie, 2006).

The existence of a state monopoly that offers educational services at zero prices and at the same time hinders the development of a proper private market creates a distorted economic environment, where the demand for higher education far exceeds its supply. Following the postulates of economic theory; in the absence of pricing, the state is forced to control the issuance of the goods through some type of rationing mechanism. National examinations for gaining entry in the universities serve this purpose. But, as it is also well acknowledged in economic theory, rationing mechanisms introduce their own inequalities, since affluent households have both the incentive and the capacity to circumvent them.

Indeed, the modus operandi of the economic, political and intellectual elites is to enrol their children in top private schools, (Valassi, 2012) and later encourage them to continue their studies at privileged foreign universities, mostly in UK or USA. The route for tackling rationing is somewhat different for the middle class. These families usually spend large amounts of money on private tuition in order

[8] Official translation of the Hellenic Constitution, Article 16, Paragraph 5.

to increase their offspring' probability of performing well in the national examinations. This practice has led to a high level of private expenditures, financing not only formal private tuition but also a large informal sector of educational services, which according to some estimates absorbs more than 1 billion euros annually and corresponds to 0.5% of the GDP[9]. To the extent that income is positively correlated with the probability of enrolling in a university, the progressivity of the system is harassed. This point has been thoroughly analysed and widely discussed by several scholars (Patrinos 1995; Psacharopoulos and Tassoulas 2004; Psacharopoulos and Papakonstantinou 2005, Chrysakis et al, 2009). Tsakloglou and Antoninis (1999) and Antoninis and Tsakloglou (2001), using static incidence analysis, show that the observed progressivity of public education is due exclusively to the effect of primary and secondary education transfers, while tertiary education transfers exert an ambiguous impact on the income distribution. Moreover, Koutsampelas and Tsakloglou (2015) show the existence of a social gradient in the allocation of students between TEI (low public cost tertiary institutions) and AEI (high cost institutions). Thus, family income is a good predictor not only of having access to a higher education institute but also of studying in a good institute. In short, the relevant studies show that Greek educational statism has underperformed in regards to its initial egalitarian aspirations.

Yet, the post-2010 economic slump brought about profound changes in the educational landscape. In economic terms, the middle class has suffered the most, being squeezed between increasing tax obligations and soaring unemployment. As the crisis moved into uncharted waters, families' ability to afford out-of-pocket payments for supplementing public schooling with private tuition weakens. For the same reason, enrolment in private schools has been steadily decreasing after 2010 (see Table 1). This results to a dwindling and polarised private sector, wherein most elite schools endure crisis and the not so privileged private schools (which were typically attracting children from the middle and/or the upper-middle class) are struggling to survive. Similarly, studying abroad becomes gradually an unaffordable choice; making public universities more attractive to an increasing number of families. Meanwhile, public spending on education has been slashed; leaving open the questions of

[9] Quoted from (Zambeta and Kolofousi, 2014).

whether and to what extent these cutbacks impaired the efficiency and equity of the system. In this rather chaotic setting, with a plethora of opposing forces acting and counteracting, estimating the progressivity of public education becomes an intriguing task.

## 3. DATASET AND METHODS

### 3.1 The dataset

The empirical analysis is based on two micro-datasets; the 2009 and 2013 Greek Household Budget Surveys (HBS). The choice of the datasets was made on the following basis; 2009 is the year just before the eruption of the crisis and 2013 reflects the situation of Greek households when the crisis peaked. The 2013 dataset was also the most updated source information when conducting our analysis. The HBS is carried out annually by the National Statistical Service of Greece and covers all the private households[10] of the country with a sampling fraction of 1/1,000 (the sample includes 3,524 households in 2009 and 3,468 households in 2013).

The HBS collects detailed information on households' income, consumption, socio-economic characteristics and living conditions. The dataset consists of a representative random sample based on a two-stage stratified sampling with pre-specified areas consisting of one or more building blocks serving as the Primary Sampling Units (PSU) and the household (and its members) being the final sampling unit. The household expenses are encoded using the COICOP-HBS classification [11]. The classification is structured into the following 12 main categories: food and non-alcoholic beverages, alcoholic beverages and tobacco, clothing and footwear, housing, water, electricity, gas, and other fuels of main and secondary residence, health, transport, communications, recreation and culture, education, hotels, cafes and restaurants and miscellaneous goods and services. But consumption items was re-organised and re-categorised for the purposes of consumer demand analysis approach. All calculations in the analysis

[10] Population groups such as homeless, institutionalised persons and people conscripted in Greek military are excluded.
[11] The COICOP (Classification of Individual Consumption by Purpose) is adopted by EU Members States and proposed by Eurostat.

were conducted using the sampling weights provided with the survey with the exception of the SUR (Seemingly Unrelated Regression) model for which the use of sampling weights was deemed unnecessary (and even unwanted).

The dataset provides very detailed information on every income item received by the sampled households[12]. These income items (which are provided net of social insurance contributions and taxes) were summed up for each household following a simple definition of household income. Thereafter, in order to render meaningful the comparisons between heterogeneous households (i.e. households that differ in size and age structure), the Eurostat equivalence scales were applied[13].

The distributional effect of public education is measured in terms of percentage changes in widely used inequality indicators (in particular, the Gini and the Atkinson index ) that occur when adding the value of education transfers on households' income. Thus, in this context, public services are treated as cash transfers in order to measure their progressivity. The value of education transfers has been calculated using two alternative methodologies; namely, the production cost approach and the demand analysis approach, (both methods will be presented in detail in the following sections). Finally, as regards the choice of the dataset, it should be noted that Household Budget Surveys are a far superior choice than EU-SILC data on conducting this type of analysis, for EU-SILC does not contain information on consumption expenditures and the type of school (private/public) pupils attend.

### 3.2 Methodology

#### 3.2.1 The production cost approach

The fundamental assumption of the production cost approach is that the value of in- kind transfers to their beneficiaries is equal to the cost of producing the corresponding good or service, (Smeeding et al, 1993). Accordingly, the value

[12] In the 2013 dataset, a number of extreme and implausible values were observed in income data. To deal with this problem we truncated the highest 0.5% of income components. This treatment was considered necessary since several inequality indicators (e.g. Atkinson index for high values of the inequality aversion parameter) are extremely sensitive to outliers.

[13] The equivalence scales used by Eurostat assign weights of 1.0 to the household head, 0.5 to each of the remaining adults and 0.3 to each child aged below 14.

attached to each beneficiary is equal to the total cost divided by the total number of beneficiaries. The rationale of this allocation rule is that one euro spent by the government is equal to one euro worth to the recipient of the corresponding good or service. Positive externalities are typically disregarded due to the insurmountable difficulties of measuring and allocating them to individuals. Applications of this method in the context of public education are found in (Smeeding et al, 1993; Tsakloglou and Antoninis, 1999; Garfinkel et al, 2006; Callan et al, 2008; Paulus et al, 2010; Aaberge et al, 2010; Andreou et al, 2014).

Table 2 consists of three parts. In the first we report total spending by educational level. This information is drawn from the Classification of the Functions of Government (COFOG) data which is available online by Eurostat. All amounts are in million EUR and cover the period 2009-2013. However, the COFOG database does not break down public spending on tertiary education by type of institution (AEI/TEI). According to OECD (2007), Greece spends four and half times more on type-A institutes (AEI) than on tertiary type-B institutes (TEI)[14]. Using this rule of thumb as an approximation (that is assuming that the composition of public spending on tertiary education remains stable through time), we obtained some very plausible approximations of spending on TEI and AEI for the reference period.

The second part of Table 2 reports the total number of pupils/students by educational level. In order to align financial and academic years, the total number of students/pupils in each year is calculated as the average of the two closest academic years (thus, the total number of students in 2009 is the average of 2008/9 and 2009/2010 academic years). An interesting feature of the data is that the number of pupils in primary and secondary education decline slightly between 2009 and 2013. This is most likely the effect of net migratory flows; Greek and non-Greek families with children who migrate out of Greece for employment reasons vis-à-vis non-EU migrants with children who come to Greece. As regards tertiary education, it should be noted that the reported figures include only current students who have not exceeded the normal duration of studies; those who have, are not included in the calculations. The rationale for disregarding the latter is that these students typically do not attend lectures and

[14] Table B2.2 Expenditure on educational institutions as a percentage of GDP, by level of education (2004).

classes; thus, they neither benefit from public education services nor cause negative externalities to those who benefit from these services.

Finally, in the last part of Table 2, we combine the above information in order to derive per capita spending by educational level. Spending per pupil in secondary education is almost 40% higher than in primary education (2009). There is also a substantial difference between the two branches of tertiary education, with yearly spending per AEI student being more than double than spending per TEI student, which is even lower than spending per primary school student. After 2009, austerity took its tool on the education system; spending per pupil was reduced by 18% and 27% in primary and secondary education respectively, while the impact of fiscal consolidation was even harsher in tertiary education resulting to 28% and 33% reductions in spending per student for TEI and AEI students, respectively.

**Table 2 Spending on education per student/pupil by educational level (2009-2013)**

| | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| **Total Spending (in million EUR)** | | | | | |
| Primary education[a] | 3,027 | 2,789 | 2,878 | 2,667 | 2,502 |
| Secondary education | 3,653 | 3,348 | 3,280 | 2,940 | 2,610 |
| Tertiary education | 2,128 | 1,937 | 1,894 | 1,856 | 1,632 |
| TEI | 383.0 | 348.7 | 340.9 | 334.1 | 293.8 |
| AEI | 1,745 | 1,588.3 | 1,553.1 | 1,521.9 | 1,338.2 |
| **Total number of pupils/students** | | | | | |
| Primary and primary education | 741,604 | 746,054 | 749,804 | 749,786 | 747,442 |
| Secondary education | 640,659 | 642,206 | 643,104 | 642,451 | 632,285 |
| TEI | 101,334 | 103,278 | 110,096 | 109,411 | 108,236 |
| AEI | 182,587 | 194,001 | 199,981 | 207,749 | 210,087 |
| **Per capita spending (EUR)** | | | | | |
| Primary education | 4,081.7 | 3,738.3 | 3,838.3 | 3,557.0 | 3,347.4 |
| Secondary education | 5,701.9 | 5,213.3 | 5,100.3 | 4,576.2 | 4127.9 |
| TEI | 3,780.0 | 3,375.9 | 3,096.6 | 3,053.5 | 2,714.1 |

| | | | | | |
|---|---|---|---|---|---|
| AEI | 9,556.9 | 8,187.3 | 7,766.1 | 7,325.8 | 6,369.9 |

Source: Eurostat Online Database, Product code: gov_10a_exp, Ministry of Education, Research and Religious Affairs and own calculations. Notes: [a] It includes pre-primary education (kindergartens).

Only the first and the last column of Table 2 (referring to years 2009 and 2013) enter explicitly in the analysis. The per capita amounts reported in these columns are defined as the monetary value of the corresponding education transfers received by families with children enrolled in public institutions. The middle columns serve a wider informational role; mostly for exhibiting the evolution of these magnitudes during the period of crisis.

Finally, some words of caution regarding this methodology are due. The soundness of allocating public spending to households is grounded on the premise that the provision of public services does not deviate significantly from norms of operational and allocative efficiency. This means that the government produces relatively efficiently the public good and at the level and quality which are desired by the consumers. In terms of the well known Samuelson (1954) optimality condition: the sum of individuals' marginal rate of substitution and the marginal rate of transformation between the public good and the private good are equal. Of course it is not realistic to expect that such theoretical construction does hold in practice; however, it can be assumed that deviations between the theoretical and the actual are not substantial. On the other hand, deviating considerably from optimality would mean that for each euro spent by the government, much less than one euro reaches its intended beneficiaries. In settings within which the public sector is expected to be grossly inefficient, ignoring this fact will risk deriving results that overestimate the 'actual' redistributive effect of public transfers (Andreou et al, 2014).

### 3.3.3 The consumer demand approach

Empirical demand systems consist of sets of equations that describe households' allocation of total expenditures to goods and services, taking prices as given. They are typically used in applied economics for estimating price/income elasticities, assessing the effects of demographic characteristics on demand as well as estimating equivalence scales. In our study, a demand system serves for recovering households' willingness to pay for public education services.

In the institutional framework within which the analysis is conducted, primary and secondary education is provided free of charge to all by public schools. However, households not satisfied with the quantity/quality of public education may either substitute it with private schooling or supplement public schooling with private tuition purchased from the market. In any case, households with children in public schools derive a certain benefit whose value can be estimated via the informational content of a demand system. In doing so, we assume that private schools operate in a competitive market. This is a plausible assumption for primary and secondary education but completely untenable in regards to Greek tertiary sector (due to the institutional particularities which are described in section 2.1). Consequently our analysis is confined to families with children enrolled in primary and secondary schools.

The analysis is based on a two-stage budgeting framework for modelling household consumption decisions, (Blundell et al, 1993). At the first stage, total expenditure is allocated between non-durables and durables. At the second stage, the budget of non-durables is allocated among commodities of this group, given households' characteristics and the (predetermined) consumption level of durables [15]. Therefore, the choice between state and private education is assumed to be predetermined at the first stage and the cost incurred by those choosing private schooling is reflected (and estimated) at the second stage from parameters capturing observed shifts in consumer behaviour. The empirical validity of this framework is tested via the separability test.

The analysis utilizes an integrable demand system which stems from a Quadratic Logarithmic (QL) cost function[16]:

$$C(p, z_h, U_h) = a(p, z_h) + \frac{\beta(p, z_h) U_h}{1 - \lambda(p, z_h) U_h} \qquad (1)$$

where $p = [p_1, p_2, \dots, p_n]$ is a vector of commodity prices, $z_h = [z_{1h}, z_{2h}, \dots \dots . z_{kh}]$ is a vector including households' demographic characteristics, $U_h$ the utility level of the $h^{\text{th}}$ household and $a(p, z_h)$, $\beta(p, z_h)$ and $\lambda(p, z_h)$ are linearly independent

[15] This methodological treatment of durables is justified on the grounds that these goods and services usually represent less flexible demands.

[16] QL is the most general functional form that allows recovery of the cost and welfare effects of changes in consumer behaviour. Furthermore, (Banks et al, 1997) demonstrate the superiority of integrable quadratic logarithmic expenditure systems in welfare analysis.

and homogeneous functions. The relative cost of a household with children in private education ($z_h^*$) to reach the same utility level (at prices $p$) as an otherwise identical household with children in public education ($z_h^0$) is:

$$I = C(p, z_h^*, U) - C(p, z_h^0, U) \quad (2)$$

Given the QL form of consumer preferences of (1), (2) can be written as:

$$\mathrm{I} = a(p, z_h^*) - a(p, z_0^*) + \left[\frac{\beta(p,z_h^*)}{1-\lambda(p,z_h^*)\mathrm{U}} - \frac{\beta(p,z_h^0)}{1-\lambda(p,z_h^0)\mathrm{U}}\right] U \quad (3)$$

This expression can be interpreted as the compensation a household would accept in order to give up its entitlement to free public schooling and enrol its child in a private school while remaining at the same utility level. To obtain the value of I we must estimate the parameters characterising the cost function. This is possible through empirically estimating the Marshallian budget share[17] of the i$^{th}$ commodity group of the h$^{th}$ household which is derived from (1):

$$\omega_{ih} = a_i(p, z_h) + \beta_i(p, z_h)[lnX_h - a(p, z_h)] + \lambda_i(p, z_h)[lnX_h - a(p, z_h)]^2 \quad (4)$$

, where $a_i(p, z_h)$ , $\beta_i(p, z_h)$ and $\lambda_i(p, z_h)$ are the price derivatives of the corresponding functions of (1) and $X_h$ the level of aggregate consumer expenditure which also includes education expenditures. In the absence of price variation, and assuming *Independence of Base* (IB)[18] and linear effects for the household characteristics, (4) can be written as:

$$\omega_{ih} = a_i + \sum_k \delta_{ik} z_{kh} + \beta_i[lnX_h - \varepsilon_0 - \varepsilon_1 z_{1h} - \varepsilon_2 z_{2h}] + \lambda_i[lnX_h - \varepsilon_0 - \varepsilon_1 z_{1h} - \varepsilon_2 z_{2h}]^2 \quad (5)$$

where the parameters: $a_i$ are constants; $\delta_{ik}$ show the effect of household characteristics; $\beta_i$ and $\lambda_i$ show the effect of (equivalised logarithmic) expenditure and expenditure squared, respectively; $\varepsilon_0$ is subsistence expenditure (fixed to the logarithm of average expenditure of the poorest 1% of households); $\varepsilon_1$ is the cost per child attending public school; $\varepsilon_2$ shows how $\varepsilon_1$ is modified by private

[17] The Marshallian demands are derived using standard microeconomic manipulations (e.g. inverting the cost function and applying Roy's identity).

[18] According to IB restriction any monotonic transformation of utility must be independent of the household characteristics. In general, for a given household characteristic $z^h$ IB holds when the cost function $C(z^h, p, U^h)$ can be written in the multiplicatively separable form $C_1(p, z^h) * C_2(p, U^h)$, implying that $\partial lnC(.)/\partial U^h$ does not depend on the household characteristic in question, (Lewbel, 1989).

school choice; and $z_{1h}, z_{2h}$ are the number of children in public and private school, respectively. The demand system described in (4) is estimated using nonlinear SUR under the integrability restrictions, which in the absence of price variation becomes: $\sum_i \delta_i(z_h) = 1 \; and \; \sum_i \beta_i(z_h) = \sum_i \lambda_i(z_h) = 0$ for adding-up.

Moving back to indicator (3), we set $U = 0$, $z_{1h} = 1$ and $z_{2h} = 1$, and (3) simplifies to:

$$I = \varepsilon_0 + \varepsilon_2 z_{2h} - (\varepsilon_0 + \varepsilon_1 z_{1h}) = \varepsilon_2 - \varepsilon_1 \quad (6)$$

The final step involves the estimation of parameters $\varepsilon_2$ and $\varepsilon_1$.

## Empirical results

The demand system described by equation (4) consists of three equations - food, services and other goods. A more detailed commodity disaggregation was avoided because it would have reduced the degrees of freedom without offering any information advantage. The sample consists of two-adult (non-retired) households either without children or with children up to 16 years old attending either private or public pre-primary, primary or secondary education[19]. These restrictions resulted to samples of 912 and 824 observations in 2009 and 2013 respectively; with 60.6% (2009) and 59.6% (2013) of those observations corresponding to households with children. About 7% (2009) and 5.5% (2013) of the latter households have children enrolled only in private schools and 2.9% (2009) and 1.2% (2013) have children enrolled in private and public schools. Table 3 reports the parameters of interest, $\varepsilon_1$ and $\varepsilon_2$ and the relevant diagnostic tests. The results suggest that, on average, a child in state education accounts for about 20% of total household expenditure; and this cost becomes 28% and 33% for households opting for private schooling in 2009 and 2013 respectively. These figures can be translated to an average annual household willingness to pay of €2,182 in 2009 and €2,517 in 2013 per school-age child for substituting state for private education. The corresponding figures of public spending per pupil are €4,832 and €3,705 for 2009 and 2013 respectively[20].

[19] This restriction was imposed in order to reduce the extent of preference heterogeneity among households of different demographic characteristics.

[20] These figures were obtained as the weighted average between primary and secondary per capita public spending.

The results of testing separability (i.e. the validity of two stage budgeting) and non-IB are also reported in Table 3. Separability, (tested as the joint significance of the top stage commodity expenditures -housing, durables, education etc.- in the lower stage budget shares) is rejected, yet this does not affect the size and significance of the parameters determining the value of public provision. The IB hypothesis is empirically tested as the independence of the (utility) parameters, $\beta's$ and $\lambda's$ of household characteristics entering the calculation in money metrics of welfare. In this paper the money metric of particular concern is the value of public education as perceived by households. Thus IB requires $\beta's$ and $\lambda's$ not to depend on whether a child attends public or private school. As shown in Table 3 this hypothesis is also rejected as it is very common in the empirical literature, (Pashardes, 1995). That does not compromise the results rather suggests that their validity weakens for high income households. That said the estimated money metric should be understood as an average with all the advantages and shortcomings averages convey.

**Estimates of the consumer benefit from opting for public schooling**

| | 2009 Coefficient | t-ratio | 2013 Coefficient | t-ratio |
|---|---|---|---|---|
| Cost per child for public schooling ($\varepsilon_1$) | 0.20 | 7.51 | 0.21 | 7.51 |
| Cost per child for private schooling ($\varepsilon_2$) | 0.28 | 3.85 | 0.33 | 3.51 |
| Separability test | LR= 23.85 (<0.000) | | LR=31.50 (<0.000) | |
| IB test[1] | LR= 29.49 (0.003) | | LR= 64.95 (<0.000) | |
| Willingness to pay (in €) | €2,182 | | €2,517 | |

*Notes:* [1]The model is estimated by setting $\beta_{ih} = \beta_{i0} + \beta_{i1} z_{1h}^{*} + \beta_{i2} z_{2h}^{*}$ and $\lambda_{ih} = \lambda_{i0} + \lambda_{i1} z_{1h}^{*} + \lambda_{i2} z_{2h}^{*}$ and then testing $\beta_{i1} = \beta_{i2} = \lambda_{i1} = \lambda_{i2} = 0$ where $z_{1h}^{*}$ and $z_{2h}^{*}$ denote the number of children and the number of children in private education in the household, respectively.

Source: Authors' calculation using 2009 & 2013 HBS.

## 4. ESTIMATING THE PROGRESSIVITY OF PUBLIC EDUCATION

The progressivity of public transfers depends on two factors; first, the ranking of beneficiaries in the income distribution and, second, the size of the transfers relative to beneficiaries' income. Starting with Table 4 and Table 5, we examine the first factor, namely the allocation of the direct beneficiaries of public

education (i.e. pupils/students) across five income quintiles ordered from the poorest to the richest. The evidence shows that pupils studying in primary and secondary public schools are mostly concentrated in the lower half of the income distribution. This is rather a regularity as households with children have typically high dependency ratios. The dependency ratio, which is the ratio of nonworking age individuals to working age individual, is negatively correlated with equivalised income. This pattern is evident in both years, but it has intensified in 2013, especially as regards families with children in secondary public schools.

The data reveal also protruding differences between AEI and TEI students, with TEI students mostly found in low quintiles, while AEI students are more uniformly allocated across the income distribution. Nevertheless, as previous studies in the subject have indicated (e.g. Koutsampelas and Tsakloglou, 2015), reported income might be a less accurate proxy of the actual economic capacity of students who live alone, i.e. away from their parental home. For this reason, we have repeated the calculations (in the columns labelled TEI* and AEI*) after excluding students who live alone (and thus restricting the sample only to students who live with their parents). The change in the results is very impressive and reveals the existence of a socioeconomic gradient in higher education. The probability of studying in a university is positively correlated with income and exactly the opposite holds for technological institutes which appear to attract students from lower socioeconomic background. Finally, the last columns of Table 4 and Table 5 allocate all beneficiaries of public education (irrespectively of the educational level they participate in) and shows not only that they are over-presented in the lower half of the income distribution but that this pattern became more intense in 2013 (the proportion of pupils/students in the poorest quintile increased to 26.1% from 27.9% and in the second quintile to 23.5% from 21.8%)[21].

**Table 3 Distribution of pupils/students (2009)**

| | primary | secondary | TEI | TEI* | AEI | AEI* | All |
|---|---|---|---|---|---|---|---|
| 1st (poorest) | 29.1 | 23.8 | 36.7 | 24.7 | 19.1 | 8.5 | 26.1 |
| 2nd | 20.2 | 22.1 | 28.4 | 30.8 | 21.7 | 14.5 | 21.8 |
| 3rd | 20.2 | 17.9 | 13.5 | 15.2 | 19.5 | 20.2 | 19.0 |
| 4th | 16.0 | 19.6 | 11.4 | 16.7 | 20.2 | 27.3 | 17.5 |

[21] This conclusion survives the sensitivity test of restricting the sample to students who live with their parents.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5th (richest) | 14.4 | 16.5 | 10.0 | 12.7 | 19.5 | 29.5 | 15.6 |
| all | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: 2009 & 2013 HBS, Authors' calculations.

**Table 4 Distribution of pupils/students (2013)**

| | primary | secondary | TEI | TEI* | AEI | AEI* | All |
|---|---|---|---|---|---|---|---|
| 1st (poorest) | 23.2 | 31.4 | 45.7 | 30.0 | 30.4 | 13.1 | 28.0 |
| 2nd | 24.9 | 24.0 | 25.7 | 30.5 | 12.6 | 12.1 | 23.5 |
| 3rd | 21.3 | 14.0 | 13.6 | 18.8 | 18.8 | 24.0 | 18.3 |
| 4th | 18.2 | 17.4 | 7.8 | 10.8 | 15.9 | 20.5 | 17.0 |
| 5th (richest) | 12.4 | 13.1 | 7.2 | 9.9 | 22.4 | 30.3 | 13.2 |
| all | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: 2009 & 2013 HBS, Authors' calculations.

Table 6 and Table 7 report the relative size of transfers per quintile. The relative size of a public transfer is calculated by dividing the sum of the relevant public transfers accrued to a quintile to the sum of disposable income accrued to all households of the quintile, multiplied by 100. In-kind education transfers, as the evidence clearly indicates, are more important for the low income households; in particular education transfers amount to 30% of the income of the poorest quintile (2009). Furthermore, the relative importance of transfers is negatively correlated with income. The latter is a finding echoing the bibliography and, certainly, is not surprising. What is more impressive, however, is the extent to which the relative size of transfers increased in 2013 for the low income households, despite the fact that the absolute size of transfers decreased due to the austerity programme. Public spending on primary schools and secondary schools per pupil decreased by about 17% and 27%, nonetheless the average relative size of the corresponding in-kind transfers increased from 3% and 3.4% in 2009 to 4.0% and 3.9% in 2013. The increase in the relative size of transfers is even more pronounced for the low income households. In 2013, adding the value of education transfers to poor's income amounts to a 50% increase in their income on average. This aggregate effect is driven by secondary education transfers, followed by primary education, while tertiary sector transfers have a milder impact on quintiles' income (especially as regards the richer one).

The comparison between the two approaches shows that the production cost approach tends to overestimate the impact of transfers on households' income, which of course is a direct consequence of the fact that households' willingness

to pay for the public good is lower than the cost of producing it. In 2009, primary education transfers amounted to 1.3% of disposable income (4.8% for the poorest quintile). In 2013, the share of primary education transfers increased to 2.4% (9.8% for the poorest quintile). Similar are the changes in regards to secondary education transfers whose relative size increased to 1.6% from 2.8%.

**Table 5 (Relative) size of transfers per quintile (2009)**

| | Production cost approach | | | | |
|---|---|---|---|---|---|
| | Primary | Secondary | TEI | AEI | All |
| 1st | 11.3 | 10.6 | 2.1 | 5.3 | 29.3 |
| 2nd | 4.8 | 6.0 | 1.0 | 3.7 | 15.5 |
| 3rd | 3.6 | 3.7 | 0.4 | 2.5 | 10.2 |
| 4th | 2.2 | 3.1 | 0.2 | 2.0 | 7.5 |
| 5th | 1.0 | 1.4 | 0.1 | 1.0 | 3.5 |
| all | 3.0 | 3.4 | 0.4 | 2.1 | 9.0 |
| | Demand based approach | | | | |
| 1st | 4.8 | 4.9 | n/a | n/a | 9.7 |
| 2nd | 2.0 | 2.7 | n/a | n/a | 4.8 |
| 3rd | 1.6 | 1.7 | n/a | n/a | 3.3 |
| 4th | 0.9 | 1.4 | n/a | n/a | 2.4 |
| 5th | 0.4 | 0.6 | n/a | n/a | 1.1 |
| all | 1.3 | 1.6 | n/a | n/a | 2.9 |

Source: 2009, 2013 HBS. Authors' calculations.

**Table 6 (Relative) size of transfers per quintile (2013)**

| | Production cost approach | | | | |
|---|---|---|---|---|---|
| | Primary | Secondary | TEI | AEI | All |
| 1st | 16.3 | 21.3 | 3.1 | 8.2 | 48.9 |
| 2nd | 8.1 | 7.7 | 0.8 | 1.6 | 18.2 |
| 3rd | 5.2 | 3.3 | 0.3 | 1.5 | 10.2 |
| 4th | 3.0 | 2.8 | 0.1 | 1.2 | 7.1 |
| 5th | 1.2 | 1.2 | 0.1 | 0.9 | 3.4 |
| all | 4.0 | 3.9 | 0.4 | 1.5 | 9.8 |
| | Demand based approach | | | | |
| 1st | 9.8 | 15.6 | n/a | n/a | 25.4 |
| 2nd | 4.9 | 5.6 | n/a | n/a | 10.5 |
| 3rd | 3.1 | 2.4 | n/a | n/a | 5.5 |
| 4th | 1.8 | 2.1 | n/a | n/a | 3.8 |
| 5th | 0.7 | 0.9 | n/a | n/a | 1.6 |
| all | 2.4 | 2.8 | n/a | n/a | 5.2 |

Source: 2009, 2013 HBS. Authors' calculations.

The progressivity of public education is quantified through the use of indices of inequality. Thus, Table 8 and Table 9, by reporting the percentage change in relative inequality between the pre-benefit distribution and the post-benefit distribution, essentially combine all the information encapsulated in the previous Tables in a single indicator.

Starting from the 2009 income distribution, when all education transfers are added in the concept of income the Gini index declines by 7.8%. The decline in Atkinson index varies from 10.2% to 14.8% depending on the value of the inequality aversion parameter. Almost the entire inequality reducing effect is driven by the redistributive impact of primary and secondary education transfers, whereas transfers to TEI and AEI students have a marginal and not statistically significant impact, meaning that higher education transfers exert an ambiguous effect on inequality. Yet it is safe to assert that these transfers are distributed almost as unequally as the initial pre-benefit distribution which already exhibits high levels of inequality, especially in 2013. In the lower part of Table 8, we also measure the progressivity of public education when the value of the transfers has been measured via the demand based approach. In that case, the size of the (perceived) progressivity of primary and secondary education appears lower compared to the calculations based on the production cost approach. Notwithstanding that this result echoes the findings of Table 3, it is an interesting result per se because it raises the question of whether there is a gap between the perceptions of policymakers about the impact of their policies and the perceptions of those who are actually affected by these policies. Indeed, governments might design interventions which appear in principle as very progressive; but the extent of progressivity might be viewpoint-dependent.

**Table 7 Distributional Effects of Public Education (2009)**

| | Primary | Secondary | TEI | AEI | All |
|---|---|---|---|---|---|
| Production cost approach | | | | | |
| Gini | -3.8 | -3.1 | -0.6 | -0.2 | -7.8 |
| ATK05 | -6.7 | -5.8 | -1.1 | -0.9 | -14.1 |
| ATK1 | -6.4 | -5.4 | -1.1 | -0.6 | -13.3 |
| ATK2 | -4.8 | -4.4 | -0.9 | -0.7 | -10.2 |
| Demand based approach | | | | | |
| Gini | -1.9 | -1.8 | n/a | n/a | -3.7 |
| ATK05 | -3.5 | -3.4 | n/a | n/a | -6.8 |
| ATK1 | -3.5 | -3.4 | n/a | n/a | -6.8 |
| ATK2 | -3.1 | -3.3 | n/a | n/a | -6.2 |

Source: 2009, 2013 HBS. Authors' calculations.

**Table 8 Distributional Effects of Public Education (2013)**

| Production cost approach | | | | | |
|---|---|---|---|---|---|
| | Primary | Secondary | TEI | AEI | All |
| Gini | -4.7 | -5.1 | -0.7 | -0.8 | -10.7 |
| ATK05 | -9.0 | -10.5 | -1.9 | -2.1 | -21.7 |
| ATK1 | -8.7 | -10.7 | -2.5 | -2.5 | -22.8 |
| ATK2 | -6.4 | -8.5 | -3.6 | -2.6 | -21.7 |
| Demand based approach | | | | | |
| | Primary | Secondary | TEI | AEI | All |
| Gini | -3.3 | -4.1 | n/a | n/a | -7.1 |
| ATK05 | -6.6 | -8.6 | n/a | n/a | -14.2 |
| ATK1 | -6.7 | -9.1 | n/a | n/a | -14.5 |
| ATK2 | -5.9 | -7.9 | n/a | n/a | -11.8 |

Source: 2009, 2013 HBS. Authors' calculations.

Then, in Table 9, the calculations are iterated for the 2013 income distribution. The most eye-catching result is the extent that education transfers have become more progressive. The total redistributive effect increased from -7.8% in 2009 to -10.7% in 2013 (according to Gini index) and almost doubled for some variants of the Atkinson index; from -10.2% to -21.7% for Atkinson (e=2). Equally impressive are the changes in the separate effects of each education level. Primary education transfers resulted to a decrease in inequality ranging from -3.8% to -6.8% in 2009; while the corresponding range in the 2013 distribution is -4.7% to -9.1%. Similarly, the redistributive effect of secondary education reached -10.5% in 2013, almost double compared to 2009. TEI and AEI transfers appear also to reduce inequality (according to some indices) in the 2013 distribution, whereas in 2009 they exerted a rather ambiguous effect.[22] The demand-based approach yielded larger improvements in the (perceived) progressivity of the public education. Indicatively, the redistributive effect of secondary education was -1.8% in 2009 (Gini index) and increased at -4.1% in 2013. This is because households' willingness to pay for public education appears to have increased in 2013 despite that public spending per pupil declined.

[22] It makes sense to exclude students living alone from the calculations on the basis that their reported income is not an accurate indicator of their actual economic background. However, such exercise reduces considerably the sample to the extent that the statistical significance of the results is impaired.

These results may initially appear as rather unanticipated for two reasons; first, during 2009-2013 the percentage of children being enrolled in private schools decreased[23], indicating that a number of households substituted private with public schooling. On that basis alone, one could have anticipated a deterioration in the progressivity of public education transfers since many relatively well-off households substituted the private good with the public good[24]. Secondly, austerity measures weakened the public system, reducing ostensibly the per pupil/student public spending and consequently the redistributive capacity of the system. Nevertheless, these factors were countervailed by the large income rerankings that took place during the reference period and the fact that the decline in public spending was much stronger than the decline in incomes, especially for the poor. Although the economic well-being of all population groups dwindled, the impact of the crisis was harsher for families with children and milder (in relative terms) for households whose incomes do not stem directly from the markets (e.g. pensioners, public sector employees).

Therefore, the movement of a number of families with children to lower income quintiles improves the potential inequality reducing effect of public spending on education as it widens the range of low income beneficiaries. Our expectations are that this phenomenon will intensify the upcoming years before it is decidedly revoked by the income dynamics of economic growth in the future.

## CONCLUSIONS

The scope of our paper is to assess how the progressivity of the Greek public education system changed in a turbulent period in the context of which both public spending and household disposable income plunged. In doing so, the value of in-kind transfers was estimated through two methods; the production-cost approach which is the dominant option in the relevant bibliography and the

[23] According to administrative data of the Ministry of Education, Research and Religious, the number of children enrolled in primary private schools declined from 46,639 pupils in 2008/9 to 41,040 pupils in 2013/14. The number of pupils in lower secondary private schools declined from 18,947 to 13,983 during the same period. Similarly, participation in upper secondary private schools was also reduced. The only exception is private kindergartens, where participation in fact increased, at least until 2013/14.

[24] This is the opposite of the mechanism suggested by (Besley and Coate, 1991) according to which the progressivity of public goods can be improved if well-off households are incentivized to substitute the public good with the private goods. In the Besley and Coate model this is possible through imposing a ‘quality ceiling’ on the public good.

demand-based approach which has been used in our analysis for estimating the perceived progressivity of the public good. The demand-based approach was not applied in the field of tertiary studies due to the absence of a functioning private market for tertiary education in Greece, but its application in regards to primary and secondary state schooling showed that there is a discernible gap between the per capita production cost of the public good and its value as perceived by the consumers. Yet, we find that this gap was reduced between 2009 and 2013, most likely because of the increasing demand for public schooling. The results stemming from the application of the demand-based approach also imply that, in some cases, households' perceptions of the progressivity of public policies might fall short of the initial aspirations of those who designed the corresponding policies.

Policy-wise, the most important finding of the study is the substantial increase in the progressivity of public education that took place from 2009 to 2013. In plain words, every euro spend in education had (and most probably still has or is going to have) a larger inequality-reducing effect as crisis deepened[25]. This is because a number of households with children moved to lower income quintiles whilst the relative position of other groups (especially pensioners) was improved. The effect of population groups' reranking was further reinforced by the fact that the households' income fell faster than public spending, thus increasing the relative importance of public transfers.

Therefore the results show that there is scope for redistribution through the education system. But policymakers can go one step further by killing two birds with one stone. Public education in Greece is underfunded compared to international standards, which makes a clear case for investing in education for efficiency purposes. It is uncommon in policymaking to come across policies that simultaneously promote efficiency and equity targets. In this sense, it would be a major blunder of the coming governments to fail seizing the opportunity. That said, our conclusions should not be interpreted as a vague suggestion of "throwing money in the problem". Obviously, the Greek public education system suffers from several structural weaknesses which range from radically reforming the anachronistic legal framework that regulates tertiary studies to encouraging

[25] Unfortunately the recession in Greece continued after 2013, but we feel that this development most likely reinforces our arguments.

the fruition of more autonomous and decentralised educational institutions. In the end, reforming the organisational structure of the system is the necessary prerequisite for ensuring that each euro spent in education would be instantly translated into efficiency and equity gains.

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## APPENDIX

Table A1. Statistical Inference for indices of inequalities (2009, production cost approach)

| | Year 2009 | | | confidence interval | |
|---|---|---|---|---|---|
| Gini | distribution of: | point estimate | std. error | lower bound | upper bound |
| | baseline (1) | 0.3350 | 0.0080 | 0.3194 | 0.3506 |
| | plus primary (2) | 0.3223 | 0.0078 | 0.3069 | 0.3376 |
| | plus second (3) | 0.3245 | 0.0078 | 0.3093 | 0.3398 |
| | plus TEI (4) | 0.3330 | 0.0079 | 0.3175 | 0.3486 |
| | plus AEI (5) | 0.3342 | 0.0078 | 0.3190 | 0.3494 |
| | plus all (6) | 0.3089 | 0.0078 | 0.2937 | 0.3242 |
| | difference (2)-(1) | -0.0127 | 0.0012 | -0.0150 | -0.0105 |
| | difference (3)-(1) | -0.0105 | 0.0011 | -0.0127 | -0.0083 |
| | difference (4)-(1) | -0.0020 | 0.0003 | -0.0026 | -0.0013 |
| | difference (5)-(1) | -0.0008 | 0.0008 | -0.0023 | 0.0007 |
| | difference (6)-(1) | -0.0261 | 0.0017 | -0.0294 | -0.0228 |
| Atk0.5 | baseline (1) | 0.0939 | 0.0048 | 0.0845 | 0.1033 |
| | plus primary (2) | 0.0876 | 0.0046 | 0.0786 | 0.0966 |
| | plus second (3) | 0.0885 | 0.0046 | 0.0795 | 0.0974 |
| | plus TEI (4) | 0.0929 | 0.0048 | 0.0835 | 0.1023 |
| | plus AEI (5) | 0.0930 | 0.0047 | 0.0839 | 0.1022 |
| | plus all (6) | 0.0807 | 0.0042 | 0.0724 | 0.0890 |
| | difference (2)-(1) | -0.0063 | 0.0012 | -0.0087 | -0.0038 |
| | difference (3)-(1) | -0.0054 | 0.0012 | -0.0079 | -0.0030 |
| | difference (4)-(1) | -0.0010 | 0.0003 | -0.0017 | -0.0003 |
| | difference (5)-(1) | -0.0008 | 0.0009 | -0.0026 | 0.0009 |
| | difference (6)-(1) | -0.0132 | 0.0021 | -0.0173 | -0.0091 |
| Atk1 | baseline (1) | 0.1729 | 0.0074 | 0.1583 | 0.1875 |
| | plus primary (2) | 0.1618 | 0.1618 | -0.1553 | 0.4790 |
| | plus second (3) | 0.1635 | 0.1635 | -0.1570 | 0.4840 |
| | plus TEI (4) | 0.1711 | 0.0074 | 0.1566 | 0.1856 |
| | plus AEI (5) | 0.1718 | 0.0072 | 0.1577 | 0.1859 |
| | plus all (6) | 0.1499 | 0.0066 | 0.1369 | 0.1630 |

| | | | | | |
|---|---|---|---|---|---|
| | difference (2)-(1) | -0.0111 | 0.0018 | -0.0147 | -0.0075 |
| | difference (3)-(1) | -0.0094 | 0.0020 | -0.0133 | -0.0055 |
| | difference (4)-(1) | -0.0018 | 0.0005 | -0.0028 | -0.0009 |
| | difference (5)-(1) | -0.0011 | 0.0018 | -0.0046 | 0.0024 |
| | difference (6)-(1) | -0.0230 | 0.0032 | -0.0293 | -0.0166 |
| Atk2 | baseline (1) | 0.3187 | 0.0137 | 0.2919 | 0.3455 |
| | plus primary (2) | 0.3033 | 0.0141 | 0.2756 | 0.3310 |
| | plus second (3) | 0.3047 | 0.0137 | 0.2779 | 0.3315 |
| | plus TEI (4) | 0.3159 | 0.0138 | 0.2889 | 0.3429 |
| | plus AEI (5) | 0.3163 | 0.0072 | 0.3022 | 0.3305 |
| | plus all (6) | 0.2862 | 0.0143 | 0.2582 | 0.3142 |
| | difference (2)-(1) | -0.0154 | 0.0000 | -0.0154 | -0.0154 |
| | difference (3)-(1) | -0.0140 | 0.0000 | -0.0140 | -0.0140 |
| | difference (4)-(1) | -0.0028 | 0.0000 | -0.0028 | -0.0028 |
| | difference (5)-(1) | -0.0024 | 0.0018 | -0.0059 | 0.0011 |
| | difference (6)-(1) | -0.0325 | 0.0000 | -0.0325 | -0.0325 |

Source: HBS, 2009. Notes: Standard errors are estimated using standard estimation procedures via the DASP module developed for Stata, (Araar and Duclos, 2007).

Table A2. Statistical Inference for indices of inequalities (2013, production cost approach)

| | Year 2013 | | | confidence interval | |
|---|---|---|---|---|---|
| Gini | distribution of | point estimate | std. error | lower bound | upper bound |
| | baseline (1) | 0.3416 | 0.0056 | 0.3306 | 0.3527 |
| | plus primary (2) | 0.3256 | 0.0056 | 0.3147 | 0.3366 |
| | plus second (3) | 0.3241 | 0.0053 | 0.3138 | 0.3344 |
| | plus TEI (4) | 0.3394 | 0.0056 | 0.3284 | 0.3504 |
| | plus AEI (5) | 0.3389 | 0.0056 | 0.3279 | 0.3500 |
| | plus all (6) | 0.3051 | 0.0052 | 0.2949 | 0.3154 |
| | difference (2)-(1) | -0.0160 | 0.0016 | -0.0192 | -0.0128 |
| | difference (3)-(1) | -0.0175 | 0.0018 | -0.0211 | -0.0140 |
| | difference (4)-(1) | -0.0022 | 0.0004 | -0.0030 | -0.0014 |
| | difference (5)-(1) | -0.0027 | 0.0008 | -0.0043 | -0.0010 |
| | difference (6)-(1) | -0.0365 | 0.0025 | -0.0414 | -0.0316 |
| Atk0.5 | baseline (1) | 0.0986 | 0.0033 | 0.0921 | 0.1052 |
| | plus primary (2) | 0.0898 | 0.0032 | 0.0835 | 0.0960 |
| | plus second (3) | 0.0883 | 0.0029 | 0.0827 | 0.0940 |
| | plus TEI (4) | 0.0968 | 0.0033 | 0.0903 | 0.1032 |
| | plus AEI (5) | 0.0965 | 0.0033 | 0.0900 | 0.1031 |
| | plus all (6) | 0.0772 | 0.0027 | 0.0719 | 0.0825 |
| | difference (2)-(1) | -0.0089 | 0.0021 | -0.0130 | -0.0048 |
| | difference (3)-(1) | -0.0103 | 0.0027 | -0.0156 | -0.0051 |
| | difference (4)-(1) | -0.0019 | 0.0008 | -0.0035 | -0.0003 |

| | | | | | |
|---|---|---|---|---|---|
| | difference (5)-(1) | -0.0021 | 0.0012 | -0.0044 | 0.0002 |
| | difference (6)-(1) | -0.0214 | 0.0035 | -0.0282 | -0.0146 |
| Atk1 | baseline (1) | 0.2069 | 0.0073 | 0.1926 | 0.2211 |
| | plus primary (2) | 0.1888 | 0.0070 | 0.1750 | 0.2026 |
| | plus second (3) | 0.1848 | 0.0064 | 0.1723 | 0.1973 |
| | plus TEI (4) | 0.2017 | 0.0072 | 0.1876 | 0.2158 |
| | plus AEI (5) | 0.2017 | 0.0073 | 0.1874 | 0.2161 |
| | plus all (6) | 0.1598 | 0.0060 | 0.1480 | 0.1715 |
| | difference (2)-(1) | -0.0181 | 0.0033 | -0.0245 | -0.0117 |
| | difference (3)-(1) | -0.0221 | 0.0027 | -0.0273 | -0.0169 |
| | difference (4)-(1) | -0.0051 | 0.0005 | -0.0062 | -0.0041 |
| | difference (5)-(1) | -0.0051 | 0.0016 | -0.0083 | -0.0019 |
| | difference (6)-(1) | -0.0471 | 0.0044 | -0.0557 | -0.0384 |
| Atk2 | baseline (1) | 0.4763 | 0.0158 | 0.4454 | 0.5073 |
| | plus primary (2) | 0.4459 | 0.0166 | 0.4133 | 0.4785 |
| | plus second (3) | 0.4361 | 0.0159 | 0.4049 | 0.4673 |
| | plus TEI (4) | 0.4593 | 0.0161 | 0.4277 | 0.4909 |
| | plus AEI (5) | 0.4639 | 0.0165 | 0.4317 | 0.4962 |
| | plus all (6) | 0.3731 | 0.0172 | 0.3394 | 0.4069 |
| | difference (2)-(1) | -0.0305 | 0.0000 | -0.0305 | -0.0305 |
| | difference (3)-(1) | -0.0403 | 0.0000 | -0.0403 | -0.0403 |
| | difference (4)-(1) | -0.0170 | 0.0000 | -0.0170 | -0.0170 |
| | difference (5)-(1) | -0.0124 | 0.0000 | -0.0124 | -0.0124 |
| | difference (6)-(1) | -0.1032 | 0.0000 | -0.1032 | -0.1032 |

Source: HBS 2013. Notes: Standard errors are estimated using standard estimation procedures via the DASP module developed for Stata (Araar and Duclos, 2007).

Table A3. Statistical Inference for indices of inequalities (2009, demand based approach)

| | Year 2009 | | | confidence interval | |
|---|---|---|---|---|---|
| Gini | distribution of | point estimate | std. error | lower bound | upper bound |
| | baseline (1) | 0.3350 | 0.0080 | 0.3194 | 0.3506 |
| | plus primary (2) | 0.3285 | 0.0079 | 0.3130 | 0.3440 |
| | plus second. (3) | 0.3290 | 0.0079 | 0.3135 | 0.3444 |
| | plus all (6) | 0.3227 | 0.0078 | 0.3073 | 0.3380 |
| | difference (2)-(1) | -0.0065 | 0.0005 | -0.0075 | -0.0054 |
| | difference (3)-(1) | -0.0060 | 0.0006 | -0.0072 | -0.0049 |
| | difference (4)-(1) | -0.0123 | 0.0008 | -0.0139 | -0.0108 |
| Atk0.5 | baseline (1) | 0.0939 | 0.0048 | 0.0845 | 0.1033 |
| | plus primary (2) | 0.0906 | 0.0047 | 0.0814 | 0.0998 |
| | plus second. (3) | 0.0907 | 0.0047 | 0.0815 | 0.0999 |
| | plus all (6) | 0.0875 | 0.0046 | 0.0785 | 0.0966 |
| | difference (2)-(1) | -0.0033 | 0.0006 | -0.0045 | -0.0021 |

| | | | | | |
|---|---|---|---|---|---|
| | difference (3)-(1) | -0.0032 | 0.0007 | -0.0045 | -0.0019 |
| | difference (4)-(1) | -0.0063 | 0.0009 | -0.0082 | -0.0045 |
| Atk1 | baseline (1) | 0.1729 | 0.0074 | 0.1583 | 0.1875 |
| | plus primary (2) | 0.1668 | 0.0073 | 0.1525 | 0.1811 |
| | plus second (3) | 0.1670 | 0.0073 | 0.1528 | 0.1813 |
| | plus all (6) | 0.1612 | 0.0071 | 0.1472 | 0.1752 |
| | difference (2)-(1) | -0.0061 | 0.0008 | -0.0077 | -0.0046 |
| | difference (3)-(1) | -0.0059 | 0.0009 | -0.0077 | -0.0041 |
| | difference (4)-(1) | -0.0117 | 0.0013 | -0.0142 | -0.0092 |
| Atk2 | baseline (1) | 0.3187 | 0.0137 | 0.2919 | 0.3455 |
| | plus primary (2) | 0.3089 | 0.0139 | 0.2817 | 0.3362 |
| | plus second (3) | 0.3082 | 0.0135 | 0.2817 | 0.3348 |
| | plus all (6) | 0.2989 | 0.0137 | 0.2720 | 0.3258 |
| | difference (2)-(1) | -0.0098 | 0.0000 | -0.0098 | -0.0098 |
| | difference (3)-(1) | -0.0105 | 0.0000 | -0.0105 | -0.0105 |
| | difference (4)-(1) | -0.0198 | 0.0000 | -0.0198 | -0.0198 |

Source: HBS 2009. Notes: Standard errors are estimated using standard estimation procedures via the DASP module developed for Stata (Araar and Duclos, 2007).

Table A4. Statistical Inference for indices of inequalities (2013, demand based approach)

| | Year 2013 | | | confidence interval | |
|---|---|---|---|---|---|
| Gini | distribution of | point estimate | std. error | lower bound | upper bound |
| | baseline (1) | 0.3416 | 0.0056 | 0.3306 | 0.3527 |
| | plus primary (2) | 0.3304 | 0.0056 | 0.3195 | 0.3414 |
| | plus second (3) | 0.3277 | 0.0053 | 0.3173 | 0.3381 |
| | plus all (6) | 0.3174 | 0.0053 | 0.3070 | 0.3278 |
| | difference (2)-(1) | -0.0112 | 0.0011 | -0.0133 | -0.0091 |
| | difference (3)-(1) | -0.0139 | 0.0014 | -0.0166 | -0.0112 |
| | difference (4)-(1) | -0.0242 | 0.0018 | -0.0277 | -0.0207 |
| Atk0.5 | baseline (1) | 0.0986 | 0.0033 | 0.0921 | 0.1052 |
| | plus primary (2) | 0.0921 | 0.0032 | 0.0859 | 0.0984 |
| | plus second (3) | 0.0901 | 0.0029 | 0.0843 | 0.0959 |
| | plus all (6) | 0.0846 | 0.0028 | 0.0790 | 0.0902 |
| | difference (2)-(1) | -0.0065 | 0.0015 | -0.0094 | -0.0036 |
| | difference (3)-(1) | -0.0085 | 0.0022 | -0.0128 | -0.0043 |
| | difference (4)-(1) | -0.0140 | 0.0026 | -0.0191 | -0.0089 |
| Atk1 | baseline (1) | 0.2069 | 0.0073 | 0.1926 | 0.2211 |
| | plus primary (2) | 0.1929 | 0.0070 | 0.1791 | 0.2067 |
| | plus second (3) | 0.1880 | 0.0064 | 0.1754 | 0.2006 |
| | plus all (6) | 0.1768 | 0.0063 | 0.1645 | 0.1891 |
| | difference (2)-(1) | -0.0139 | 0.0020 | -0.0178 | -0.0101 |

| | | | | | |
|---|---|---|---|---|---|
| | difference (3)-(1) | -0.0188 | 0.0020 | -0.0227 | -0.0150 |
| | difference (4)-(1) | -0.0301 | 0.0029 | -0.0357 | -0.0244 |
| Atk2 | baseline (1) | 0.4763 | 0.0158 | 0.4454 | 0.5073 |
| | plus primary (2) | 0.4485 | 0.0162 | 0.4167 | 0.4802 |
| | plus second (3) | 0.4386 | 0.0156 | 0.4080 | 0.4693 |
| | plus all (6) | 0.3731 | 0.0162 | 0.3414 | 0.4049 |
| | difference (2)-(1) | -0.0279 | 0.0000 | -0.0279 | -0.0279 |
| | difference (3)-(1) | -0.0377 | 0.0000 | -0.0377 | -0.0377 |
| | difference (4)-(1) | -0.1032 | 0.0000 | -0.1032 | -0.1032 |

Source: HBS 2013. Notes: Standard errors are estimated using standard estimation procedures via the DASP module developed for Stata (Araar and Duclos, 2007).

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