EDUCATION EXPENSES AS A REDISTRIBUTIVE DEVICE. EVIDENCE FROM ITALY

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Abstract

Education expenses represent a leading redistributive policy. However, the design of the education system and the target of the corresponding transfers are matters of debate. The complexity of this issue depends on the fact that education provision allows at pursuing (at least) two different - and potentially conflicting - forms of redistribution: among individuals with different incomes and among individuals with different "natural" abilities. Moreover, education is not an homogeneous good as its costs and returns vary along different educational levels. Our empirical exercise aims at estimating the redistributive impact of education expenses in Italy in 2000 and 2004, by considering all the potential sources of variability in their consumption, namely income and ability. The proposed analysis allows at establishing whether, once controlled for households' personal taxation as well as for other relevant observable households characteristics, education provision in Italy redistributes resources among individuals with different abilities and incomes and, most importantly, in which direction. Accordingly, the chosen empirical strategy, quantile regression methodology, allows at drawing a complete picture of the effect of education transfers on different quantiles of the gross income distribution. By using quantile regression we aim at explaining the Lorenz curves dominance by covariates, that is by partialling out, quantiles by quantiles, a list of variables that are potential determinants of the household's income. More specifically, by controlling for the interactions between the families' unobservable needs and ability and the policy measure of interest, our analysis allows to provide the broadest view for evaluating the effects of education transfers in Italy and, therefore, to be able to constructively contribute to the policy debate on these issues.

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1. Introduction

Education is, together with health care, the main publicly provided good in countries with developed welfare states. Several motivations are at the basis of the public provision of educational service, ranging from the presence of positive externalities, to the view of education as a merit good, to market failures (De Fraja 2004). The main and more convincing justification is however represented by the possibility to achieve redistributive goals that could not be attained with other policies in presence of asymmetric information between taxpayers and the state (Besley and Coate, 1991; Blackorby and Donaldson, 1988). In this sense, education expenditures represent a mean for redistributing resources from rich to poor individuals when the former do not have incentive to display their true condition.

Households' investments in education however do not depend only on their income and, consequently, on their ability to pay. Incomes being equal, households' choices depend on their ability to benefit from education, namely on the expected earnings of their children (De Fraja 2002). The redistribution of education expenditures among individuals with different ability to benefit from them is an open problem. Unlike healthcare, where the redistribution from healthy to unhealthy people allow to achieve both an equity and an efficiency goal, the attainment of these two goals calls for different and often conflicting education policies, as argued by the two opposite views emerged in the literature. The first, called the "elitist" view argues that investments in education should be devoted mainly to high ability individuals, in order to maximize economic welfare and efficiency. The second, known as the "equality of opportunity" view states that natural inequality in terms of ability among individuals should be compensated by providing more education investments to less able children.

Italy represents an interesting case study for evaluating educational policies since it is largely recognized as a country characterized by inequality of outcomes measured by both gross income and disposable income (see Le franc et al 2008, Smeeding et al 2000, Bertola et al 2001). This high income inequality may call for redistributive policies. On a priori grounds, it is not clear how equality of opportunity and outcomes inequality are related. A country characterized by a low degree of inequality of opportunities can exhibit important differences in terms of outcomes if individuals exert heterogeneous effort levels. In contrast, a low level of income inequality can be detected in presence of heterogeneity in terms of circumstances. The existing literature suggests Italy as a country where inequality of opportunities plays an important role as well (see among the others Le Franc et al., 2008 and Checchi and Peragine, 2010).

The current paper aims at proposing an alternative empirical methodology to evaluate two different economic issues: the first relates to the redistributive power of the educational expenses; the second to the question whether these educational expenses intend to implement the equality opportunity view or whether the "elitist" view seems to prevail in Italy. These two issues are strictly correlated: social preferences towards redistributive policies may be affected by the extent to unequal ex-ante opportunities. Moreover, analyzing the extent of equality of opportunity remains a challenging problem fraught with difficulties. Perhaps the most obvious is that opportunities are not observables. We use quantile regressions methodology to address this problem. As stated above, according to the conception of equality to promote different policy choices can be made. The proposed exercise aims at measuring the effect of state educational transfers on households with different income (effort), ability and needs (i.e. circumstances). As far as educational transfers go, ceteris paribus, to less able individuals it is indeed possible to argue that state contribute at "levelling the playing field", namely at reducing the differences among individuals arising from their ex-ante inequality (Roemer, 1998). On the contrary, if more able individuals obtain more educational transfers, it is possible to claim that state intervention pursues an efficiency objective, thus raising ex-ante inequality among individuals. Moreover, by evaluating at the margin the impact of the educational expenses on different quantiles of the gross income distribution we are able to assess whether these transfers redistribute income from the rich to the poor promoting equality of outcomes. Finally, we are able to evaluate whether and to what extent the redistributive power and the equality of opportunity device of the educational expenses are related.

Education however cannot be considered an homogeneous good. First, a distinction has to be made between compulsory and post-compulsory education[1]. Concerning compulsory education, in principle neither income nor ability should be responsible of the amount of expenditures allocated to each family, the only potential difference among children' outcomes being due to different school dropout probabilities. Income and ability affect, on the other hand, households' investment decision in post-compulsory education (see for instance Haveman and Wolfe, 1995; Ermish and Francesconi, 2001). However previous empirical findings show that their effect is not homogeneous for different non compulsory educational levels, as costs and benefits widely differ between upper secondary school and university[2]. The empirical strategy adopted in this piece of work assess the redistributive power of Italian education policy as a whole, and afterward distinguishing between upper secondary and university public expenditures.

[1] In Italy during the years analysed in the present work the compulsory education level is represented by the low secondary school (scuola media inferiore).

[2] On the investment in secondary school see among others Bradley and Taylor (2004). On tertiary education see for instance Nguyen and Taylor (2004), Boarini and al. (2008).

The paper is organized as follows. Paragraph 2 presents previous relevant literature, and paragraph 3 describes the empirical strategy used to identify the distributional impact of education expenses. Paragraph 4 describes the data set and provides descriptive statistics. Paragraph 5 presents the results of the analysis. Finally paragraph 6 concludes.

2. Review of the Literature

Provided that individuals differ in terms of ability to benefit from education, the so called "elitist" view (Grossman and Kim, 2003; Cremer, De Donder and Pestieu, 2010) argues that overall welfare is maximized when public education redistribution is "regressive", namely when education expenditures are concentrated on high ability individuals. Regardless of the modeling framework, the assumption at the basis of this view is that the second cross derivative of the utility function with respect to ability and education expenditure is positives, namely that more able individuals benefit more than proportionately from an increase in education expenditures. The optimality of regressive education transfers arises both from partial equilibrium models focusing on education redistribution (Arrow, 1971), and, to a greater extent, from general equilibrium models where income taxation modifies the resources available to the population (De Fraja, 2002, Hare and Ulph, 1979, Ulph, 1977). In the latter models the public provision of education concentrated on individuals who can benefit more from it increases the overall available resources to be redistributed over the whole population throughout income taxation. From a normative point of view, the optimal education policy should widen the gap between the education achievements of high and low ability individuals existing in the pure market equilibrium. Accordingly, higher ability individuals should be subsidized by taxpayers and by household with less able children.

The issue of equality of opportunities can be analyzed either from a positive or a normative perspective. The former poses the problem of measuring the degree of opportunity inequality. The latter evaluates whether public policies can be conceived as devices favouring equality of opportunity. The existing literature has addressed the problem of measuring the degree of opportunity inequality using different, and often conflicting, approaches. On the one hand, the principle of compensation states that ex-ante differences in factors beyond individuals' responsibility (i.e. gender, race etc..) are inequitable and might be compensated. On the other hand, according to the principle of reward ex-post differences of achievements are the natural reward to individuals' actions and might not be compensated. In general the problem is to clarify whether overall inequality is due either to exogenous circumstances or to individuals' choices. Drawing on these two different concepts of equality of opportunity different policy advices can be suggested. Checchi and Peragine (2010) study opportunity inequality in Italy proposing a non parametric

approach in order to measure inequality of opportunities. They consider actual earnings as individual objective proxying the extent of individuals' effort and family background (i.e. the level of parents' education) as exogenous circumstances. The empirical application of their evaluation tools shows that about 20% of overall income inequality in Italy is due to opportunity inequality. This opportunity inequality is not homogeneous across Italian macro-regions but it is mainly concentrated in the Southern (the poorest) part of the country, especially when subgroups of the population are considered (across gender).

Lefranc et al (2008) provide empirical evidence on the relationship between the degree of income inequality and inequality opportunity for nine developed countries during the 1990s. They define equality of opportunity as a situation where the stochastic dominance criteria, assessed by a non-parametric approach (see Davidson and Duclos, 2000), cannot be applied to ranking the income distribution conditioned to parental education level and occupation (as proxy of social origin, i.e. the exogenous circumstances). They find that the degree of equality opportunity is quite heterogeneous across countries ranging from Sweden that promotes equality of both outcomes and opportunities to Italy and the US that exhibit a strong positive correlation between inequalities of outcome and opportunity (Bourgignon et al., 2003).

Evaluating the effects of educational expenses on households' income in terms of equality of opportunity is fraught with difficulties. Perhaps the most obvious is that opportunities (i.e. circumstances) are not observables. As a consequence, any concept of equality has to cope with incomplete information that may bias the empirical assessment of equality of opportunity. We use quantile regressions methodology to address this problem. The following paragraph describes the empirical setup in more details.

3. The Empirical Setup

We consider the following empirical model:

$$\frac{y_{g_i}}{\mu_{yg}} = \psi(C_i, F_i)\frac{tax_i}{\mu_{tax}} + \beta(A_i, F_i)\frac{edu_i}{\mu_{inkind}} + C_i + A_i + F_i + \gamma X_i \qquad [1]$$

$$\frac{edu_i}{\mu_{inkind}} = \gamma_{ik} X_i + \phi Z_i + \varepsilon A_i \qquad [2]$$

$$\frac{tax_i}{\mu_{tax}} = \gamma_{tax} X_i + \chi W_i + \lambda C_i \qquad [3]$$

where A_i and C_i denote unobserved household's characteristics affecting respectively the likelihood to accede to educational in-kind transfers[3] and personal tax liabilities[4], F_i is an idiosyncratic income shock[5] orthogonal with A_i and C_i. We define τ_C, τ_A, and τ_F the τ-quantiles of distribution of unobservables C_i, A_i and F_i respectively. X_i is a vector of household controls, y_{gi}, is the gross income, tax_i the tax liabilities, edu_i the educational in kind transfers of household i and μ_{yg} , μ_{tax} and $\mu_{in\text{-}kind}$ their average values over the relevant population. We include in the vector X family's size (the observable component of family needs), the number of income recipients and macro-area of residence of the family, gender, age, level of education and employment condition of the head of the family. The vectors W and Z include our instrumental variables for tax liabilities and educational in-kind transfers. Equation [2] associates, through the vector Z, the education in kind transfers of the household to the number of years of compulsory education for each child living in the household and to a proxy for the "supply" of higher education in the region of residence of the children who are potentially at college**.** The vector W in equation [3] correlates to tax liability to the system of either tax allowances or tax credits related to the source of the gross income, of both the head of the family and, if present, of the spouse. As discussed in Casalone and Sonedda [2009], quantile regression methodology is superior to OLS estimates when one suspects that the behaviour of observations is affected by exogenous covariates in different ways, according to where they rank in the response variable distribution. By using quantile regression we aim at explaining the dominance at the margin by covariates, quantiles by quantiles. That is, starting from equation [3] we evaluate the distributional and redistributive effects of noncash income by regressing for each quantile the ratio between the pre-tax and pre-transfer income for the quantile and its average value over the whole population on the corresponding ratios for both direct income taxes and non-cash income. the methodology allows us to consider the two dimensional ordering of households with respect to unobservable abilities and needs, leading us to interpret our results in terms of equality of opportunities according to which the less able and more needy households are deemed to be more deserving of a marginal transfer. That is, we evaluate whether the designed public policies are intended to implement both the equality of opportunity view and the redistributive goal.

The (exogenous) quantile regression estimates of parameter β, which captures the marginal effect of education in kind transfers on family income, is likely to be biased for two reasons: a) the household in kind transfers are correlated with unobserved ability, which affects family income: the

[3] Unobservable A_i can be thought as the sum of abilities that lead to receive in-kind transfers in terms of non compulsory education. Therefore, unobservables affecting the household's capability to receive these educational in kind transfers correspond to those unobservables that affect the household's educational choices.

[4] Concerning unobservable C_i, it is possible to assume that it represents the sum of individual abilities affecting the capacity to generate income and, consequently, to pay taxes on it.

[5] We interpret this idiosyncratic income shock in terms of unobservable family needs.

more talented children are, the more likely the family invests in education, the more the household takes advantage of education transfers from state; b) since our variables are the results of a microsimulation, they are measured with error. In this paper, we address these biases by using the number of years of compulsory education for each child living in the household and a proxy for the "supply" of higher education in the region of residence of the children who are potentially at college as instrumental variables for endogenous in kind education transfers6. We exploit two facts: first, the cross-section variation generated by the Italian policy reforms on compulsory school. The law 20/1999 (so called Legge Berlinguer) raised the compulsory schooling age in Italy from 14 years to 15 years old since the school year 1999/2000, namely for individuals born after 19857. Afterwards, the law 53/2003 (so called Riforma Moratti) restored the compulsory schooling age at 14 years for the cohorts born since 1989 onwards. Accordingly, for each household we have three different values of the compulsory years of schooling: zero if there are no children potentially at high school living in the household, eight for those children potentially at high school and not affected by the Berlinguer reform and nine for those children potentially at high school and affected by the reform. The cross-sectional variation due to the "supply" of higher education in the region of residence of the children who are potentially at college (HESUPPLY). The idea is that, especially for individuals coming from poor backgrounds, the presence of institutions providing higher education close to the household's residence could positively affect children's decision to enrol in college by relaxing household credit constraints8. Due to Berlinguer? Since a decentralization process in the supply of higher education occurred. Therefore, we have calculated for each child potentially at college in the years 2000 and 2004 the number of degree courses per square kilometres provided in their region of residence in their year of first enrolment. For those families who do not have children at all or that do not have children potentially at university in 2000 and 2004, we impute a zero value. With regards to tax liability, the choice of instruments is a more complex issue as one needs a variable which affects tax liability and, at the same time, is independent from gross income. Tax liability in Italy depends on several issues: basically on the overall individual's gross income, but also on its source and on taxpayer's household characteristics. As an identification strategy, we then exploit the differences in tax liabilities due to the system of tax allowances related to the source of the gross income, of both the head of the

[6] Since primary school is compulsory, we conceive as potentially endogenous only in-kind transfers related to secondary and tertiary education

[7] Since the age at which children normally start compulsory school is 6 years, the 1999 reform raised the number of years of compulsory schooling from 8 to 9.

[8] On the use of education supply indicators to explain educational choices see for instance Card (1999).

family and, if present, of the spouse9. The empirical specification of the household's income function includes also two dummies for the macro-area of residence of the family. These variables pick up the Italian macro-area disparities in economic outcomes and the potential positive correlation between the area's wealth and in kind educational transfers.

4. Descriptive statistics

The data used in this paper are two waves - 2000 and 2004 - of the Survey of Household Income and Wealth (SHIW). The SHIW is a nationally representative household survey conducted by the Bank of Italy on more than 8.000 Italian households, or about 22.000 individuals a year. The survey includes information on net pay and on household and job characteristics, which we use to compute both gross pay and individual income in-kind as in Sonedda and Turati (2005)[10]. Data are then collapsed into family income, ending up with a sample of 7802 and 8004 families in year 2000 and 2004 respectively, once positive incomes only are considered. All income figures are adjusted by considering differences in family needs. We use the ISEE equivalence scale to adjust cash income, and evaluate in-kind income in per capita terms[11]. The ISEE scale is simply defined as n^0.65, where n is the number of household components and 0.65 is a fixed coefficient that controls for the presence of scale economies in households' production.

Table 1a and 1b present some standard summary statistics of the variables included in the regressions. For the sake of comparability, 2000 data are at 2004 prices and expressed in euro. In 2000 the average gross income (y^g) was 14.081 euros, and it has been increasing by about five hundred euros during the following four years. The income increase occurred at the beginning of the 2000s did not change the income distribution, as showed by the Gini coefficient (0.41 in both years). Personal income taxation lessens, as expected, the Gini coefficient by about 12 and 9 percentage points respectively in 2000 and 2004. The post-tax average income (y^{pt}) was around 11.500 euros in both years, but in this case the Gini index shows a slight increase from 0.361 to 0.372, mainly due to an enlargement of the difference between the income of the lowest and highest deciles as suggested by the variation of the p90/p10 ratio. The pattern of the Gini indexes of the gross and post-tax incomes suggest a decrease in the tax system progressivity during the analysed period.

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[9] The Italian direct tax system is individual-based and takes into account the taxpayer's family situations through a complex set of tax and family allowances.

[10] Sonedda and Turati (2005) using the information contained in the SHIW attempt to identify the users of the health and educational services, or those on behalf of whom these expenditures were made, and to allocate to such users the value of the resources used in providing the service.

[11] ISEE is the standard means testing procedure applied in Italy to a variety of government benefits.

The monetary value of public education transfers to Italian households amount on average to about 2.300 euros in 2000. As the average transfer is calculated over the whole population, including households with no children at school, the average transfer received by households with children enrolled at school is obviously higher. In the following four years, according to our data, education transfers to households decreased by about 200 euros. This negative trend can be due either to a decrease in per-children transfers or to a change in households' composition. In both years the median education transfer is zero. This depends on the fact that expenditures have been attributed, by construction, only to families with children enrolled at school resulting in a great number of observations with a zero-transfer and a large inequality among recipients. Due to the unequal distribution of education transfers, the Gini indexes amount to 0.75 and 0.79 in 2000 and 2004 respectively, and the p90/p10 index cannot be calculated.

Splitting education expenditures by education level, we find that the highest average value is related to compulsory education, followed by secondary and tertiary education. Obviously, this result does not depend on the fact that the higher is the education level the lower are education expenditures, but on the fact that there are more children enrolled in compulsory than in post-compulsory education. Gini coefficients also show that education transfers in primary education, although highly concentrated, are less concentrated than the others.

Table 2a and Table 2b report some descriptive statistics concerning the quantiles of the distributions. Figures are reported only for quantiles analysed in the following regressions, that is 10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}.

First of all we observe that while in 2000 pre and post-taxation incomes of the two first quantiles are very close, in 2004 average post-tax income turns out to be lower than the corresponding pre-tax income, revealing a worsening in lowest incomes' economic conditions. With regards to other quantiles the differences between pre and post taxes incomes did not vary considerably in the analysed span. The lower dispersion in y^{pt} than in y^{g} previously evidenced by the Gini coefficient and the p90/p10 ratio emerges once more from these tables by looking at the ratio between each quantile and the median: on the one hand in 2000 the 10^{th} y^{g} quantile was about 30% of the median, and the corresponding quantile of y^{pt} about 35%; on the other hand, the 90^{th} quantile of y^{g} was around 223% of the median while the corresponding of y^{pt} at around 200%. These figures are confirmed also in 2004, with the exception of the 10^{th} quantile for which there are not differences among y^{g} and y^{pt} as previously noted.

Concerning education expenditures, as expected we find that they are very polarized as more than 50% of the analysed population, namely families without children at home, does not receive any transfer.

Finally, as a last descriptive exercise, we represent in figure 1 the distribution of the overall education transfers by y^g quantile in 2000 and 2004. To draw a complete picture of the distribution we consider twenty y^g quantiles ranging from the 5^{th} to the 100^{th}. Each histogram represent the share of transfer that goes to the n-th quantile of the gross income. Redistributive in-kind transfers would result in a left-skewed distribution with higher shares of transfers in correspondence of the lower gross incomes. The picture show that education transfers mainly go to households with gross incomes below the median. This probably depends on the fact that y^g in our data is lower among the younger, who receive the most education transfers.

5. Results

We run regressions on a number of specifications. First and foremost we estimate the relationship existing between in-kind transfers in education taken as exogenous and the gross income. Three specifications are presented, one investigating the overall education transfer (Table 3a) obtained by summing the cost of all education transfers received by the household, and the other two analysing upper secondary (Table 3b) and tertiary education transfers (Table 3c). Transfers related to compulsory schooling (primary and lower secondary school) are not specifically analysed as households with children in the correspondent schooling age are compelled to receive this in-kind benefit. In the same table we present the results of a further exercise where gross income is regressed on counterfactual in-kind transfers, obtained by attributing the education transfers to each family with children in the schooling age, independently from their actual educational condition. The idea at the basis of these estimates is to test the robustness of previous results, by eliminating the behavioural effect due to the fact that only a fraction of households decide to uptake the transfers in education by enrolling children at school after the compulsory education. The last columns in each table report then the results obtained by regressing the gross income on the difference between the exogenous and the counterfactual transfers in order to test if the two specifications significantly differ. All these estimates are carried on the whole sample, including also households with no children or with no children in the schooling age.

For each covariate, these point estimates may be interpreted as the impact of a one-unit change of the covariate on the dependent variable, at the relevant quantile, holding other covariates fixed. Results reported in the first two columns show that there is a statistically significant negative relationship between education transfers and gross income for any gross income quantile. According to estimates, along the whole gross income distribution, the higher is the in-kind transfer the lower is the household gross income. Quite interestingly then, in all specifications coefficients show an upward trend - in absolute terms - when moving from the lowest to the highest gross

income decile. The different impact of education transfers on different gross income quantiles is also confirmed for 2000 by the test on inter-quantile differences reported in Table 4. On the contrary, in 2004 the hypothesis of equality between the 10^{th} and the 50^{th} as well as the 50^{th} and the 90^{th} quantile cannot be rejected in the most cases. According to these estimates, then, the heterogeneous effect of education transfers on different gross incomes strongly decreased in the early 2000, suggesting a diminished redistributive power of this public expenditures on education services. Two further evidences deserve a greater attention. First, coefficients estimated on 2004 data are systematically lower for any education transfer than those on 2000; second, coefficients are directly (inversely) correlated with the size of the average transfer (the number of recipients) as they decrease when moving from the first to the second and third specification. Counterfactual and exogenous coefficients do not significantly differ in the first two specifications, while their difference turns out to be statistically significant in the third in 2000 for all quantiles except the 10th. This result depends on the fact that the rate of enrolment at university is lower than at other educational levels, thus overdrawing the effect of household behaviour.

In-kind transfers in education and taxation cannot, however, be considered as exogenous in presence of unobserved characteristics affecting access to education services and the income taxation. Table 5a reports the results of the first stage regression of overall education transfers on all exogenous variables and instruments, while table 5b focus on transfers related to upper secondary and tertiary education on all the exogenous variables and instruments. The F-statistic test on the significance of the instruments is then reported at the bottom of each table. In all cases estimates are carried on only on households with at least one child attending school or university. Most instruments are statistically significant, the only exception being HESUPPLY2 in 2004 estimates of the overall education transfer and COMPSCHOOL1 in 2000. As expected, all instruments positively affect the probability to take an education transfer. In particular, the "supply" of tertiary education in the regional of residence of the family - measured by the number of degree courses per km2 or per capita - greatly affects the probability to enroll at university, thus suggesting that Italian households' decision to invest in human capital strongly depend on the cost of education.

As regards the F-test, according to the rule of thumb provided by Stock and Staiger (1997) which suggests that the instruments are weak if the F-test for their inclusion in the auxiliary regression is lower than 10, estimates evidence that the chosen instruments are strong. Generally speaking the effect of the instruments is lower for the higher quantiles of the distributions of the unobserved characteristics affecting the two analysed fiscal policies.

Tables 6a, 6b and 6c illustrate the results of the estimates when both education transfers and income taxation are treated as endogenous. The first table reports the estimated coefficients of the overall

education transfers, the other two of the transfers in terms of upper secondary and tertiary education, respectively. As in the above reported exogenous regression, estimates are run on the sub-sample represented by households with at least one child in the schooling age, independently from their actual student condition. It has to be noticed that as far as the gross income and ability distributions of the sub-sample represented by families with children are not statistically different from those of the whole sample, our results can be easily generalized even to households with no children in the schooling age, namely to the whole sample.

In the bottom of each table is reported the quantile effects corresponding to the effect of in-kind income (over the sample mean) on the quantile of gross income distribution (over the sample mean) when in-kind income is treated as exogenous. The main advantage of the adopted control variate methodology with respect to simple exogenous estimates is that it allows to precisely establish how Italian in-kind transfers are distributed across households with different incomes and ability. In particular, by keeping constant the quantile of the τ_A distribution and looking at the estimated coefficients along the gross income distribution, it is possible to assess whether, ability being equal, transfers are equally distributed among families with different gross income or if there is a correlation between gross income and the amount of education received by the state. By this exercise we can establish whether the Italian education system redistributes resources from low to high income households or if the opposite occurs. Adopting a different perspective, by keeping constant the quantile of the τ_F distribution, and looking at the estimated coefficients along the distribution of households' ability, it is possible to assess whether, regardless of households' gross income, educational transfers are related to children's ability. This second exercise allows to investigate with a new perspective the equality of opportunity issue. Indeed, to the extent that transfers in education go, ceteris paribus, to less able individuals, state intervention contributes to narrow the gap existing among individuals with different abilities, thus reducing their ex-ante inequality. To the contrary, if education expenditures are mainly concentrated on high-ability individuals, regardless from their gross income, public spending in the form of education transfers contribute to broaden the differences existing among individuals and the existing ex ante inequality as well.

When we look at the estimated coefficients along the gross income distribution for any households' ability quantile τ_A we observe that their patterns are rather homogeneous within each year, whereas there are differences between 2000 and 2004. Concerning the overall education transfers in table 6a a reversed U-shaped trend emerges with a maximum in correspondence of τ_F=50 in 2000 and of τ_F=25 in 2004. Although for any gross income quantile the relation existing between overall education transfer and income is always negative, low-medium income families experience the

smallest sacrifice in terms of income reduction entailed by a transfer increase. The main difference emerging from the comparison of the two years is that higher income families in 2004 experience a greater income decrease to benefit from a unit education transfer increase. According to this result, the gap existing between low and high income families in terms of access to overall education, increased in absolute values over the analyzed time span. The analysis of elasticities is however necessary in order to establish whether this difference in terms of monetary absolute sacrifice emerges also in percentage terms.

The effect of overall education transfers however can be split in two different parts, according to the non compulsory schooling level. By doing this exercise we find that there exists heterogeneity in the coefficients' patterns. According to estimates reported in table 6b, the income decrease associated to a unitary increase in higher secondary school transfer is nearly monotonically increasing in absolute values along the households' gross income distribution: especially in 2004, the higher is the household gross income, the higher is the absolute income reduction arising from a unit transfer increase. The picture emerging from the analysis of tertiary education transfers is however rather different. As observed above in table 6a, coefficients show a reversed U-shaped trend, with a maximum in correspondence of τ_F=75 in 2000 and of τ_F=25 in 2004 and a minimum in correspondence of τ_F=10 and τ_F=90 in 2000 and 2004, respectively. Evidence suggests that in the period from 2000 to 2004 a main change occurred in the distribution of tertiary education transfers, as the greatest income fall associated to a one unit transfer increase shifted from the poorest to the richest Italian households. Since in 2001 a major university reform introduced the new 3+2 system, with the consequence of enlarging university enrollment also to social classes that previously were not minded to make such an education investment, according to our results the widening of university access in Italy has been paid by higher income classes.

By adopting the second perspective and looking at the estimated coefficients along the ability distribution for any households' gross income quantile τ_F, we find that coefficients' patterns are more heterogeneous, thus suggesting that the effect of ability is strictly related to households' economic resources. Concerning overall education transfers, in 2000 estimates do not evidence a clear path of the coefficients related to a one unit increase in this kind of state expenses. In 2004, however, it is possible to observe that for some gross income quantiles (τ_F=10, 75 and 90) the income decrease is negatively related to households' ability, namely that the higher is the household ability the lower is the gross income reduction due to a unitary increase of the in-kind transfer. Accordingly, it is possible to argue that in the period from 2000 to 2004 a slight movement towards a greater equality of opportunity through the education system has been recorded in Italy, especially for families in the two extreme tails of the gross income distribution. When we split the overall

education transfers in two parts we however find that the corresponding coefficients' pattern is not so clear. Concerning state expenditures for upper secondary school, the estimated income decrease is rather constant along the ability distribution for any τ_F quantile. Only in 2004 there exists a slight upward trend for higher gross income quantile (τ_F=75 and 90), thus suggesting the existence of a greater equality of opportunity in terms of secondary education, limited to high-income families. Estimates on tertiary education expenses evidence that, in general, no equality of opportunity emerges in the Italian tertiary education system. A part for very few exceptions, the absolute gross income loss due to a unitary increase in tertiary education state transfers does not show a clear trend along the ability distribution. Although the time span considered is not particularly broad, some major changes however occurred for the lowest gross income families. Whereas in 2000 the higher the ability among lowest income families (τ_F=10), the higher the absolute gross income loss due to a unitary increase in tertiary education state transfer, in 2004 the loss is rather homogeneous, regardless households' ability. This finding can be interpreted as an evidence of a further decrease of the very partial equality of opportunity which in 2000 was limited only to lowest income families.

6. Conclusions

This paper represents an attempt to empirically testing theoretical models on optimal education policy when households differ both in their "ability to pay" and in their "ability to benefit" from education (De Fraja 2002). As previously noted, taking account of the differences existing among individuals in terms of both dimensions is necessary in order to assess the complex issue represented by the redistribution mechanisms in education (De Fraja, 2004). Only a two-dimensions analysis allows indeed to establish whether education inputs are redistributed on the basis of households' income, ability or of a mix of both characteristics.

Assuming that households' ability to pay and ability to benefit from education are independent, four possible redistributive mechanisms can emerge from our analysis, as represented in the table below.

	From High ability to benefit to Low ability to benefit from education	From Low ability to benefit to High ability to benefit from education
From High ability to pay to Low ability to pay	A	C
From Low ability to pay to High ability to pay	B	D

Redistribution mechanisms A and C can be defined as "progressive" in that there is a redistribution of resources from high to low income households. B and D are "regressive" as the opposite occurs. On the other hand, mechanisms A and B are "ability equalizing", as there is a redistribution from

high to low ability to benefit from education households, whereas mechanisms C ad D increases the natural inequality existing across households in terms of ability to benefit from education.

Our findings show that along the whole gross income distribution, the higher is the in-kind transfer the lower is the household gross income. This negative relationship as the estimated income drop associated to an additional unitary education transfer increases in absolute value from the lowest to the highest gross income deciles. Moreover, the gap existing between low and high income families in terms of income decrease resulting from a transfer raise, increased in absolute values over the analyzed time span. By splitting in-kind transfers by education level findings suggest that in the period from 2000 to 2004 a main change occurred in the distribution of tertiary education transfers, as the greatest income fall associated to a one unit transfer increase shifted from the poorest to the richest Italian households. With regards to households' ability, from our results it is possible to argue that in the period analysed a slight movement towards a greater equality of opportunity through the education system has been recorded in Italy, especially for families in the two extreme tails of the gross income distribution. Finally, as expected, we record in both years a greater equality of opportunity within secondary education as compared with tertiary education.

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Table 1a – Summary statistics (2000)

	Mean	SEM	Median	p90/p10	Gini	Obs
Gross income (y^g)	14081.08	153.25	11649.30	7.63	0.410	8001
Post personal taxes income (y^{pt})	11455.40	98.93	10083.51	5.80	0.361	8001
Overall education transfers (ik_edu)	2297.87	42.06	0.00	-	0.749	8001
Compulsory education transfers (ik_edu1)	1318.08	31.88	0.00	-	0.845	8001
Upper secondary school education transfers (ik_edu2)	702.22	22.90	0.00	-	0.893	8001
Tertiary education transfers (ik_edu3)	277.58	12.02	0.00	-	0.931	8001

Table 1b – Summary statistics (2004)

	Mean	SEM	Median	p90/p10	Gini	Obs
Gross income (y^g)	14565.00	178.72	11815.80	7.85	0.410	8012
Post personal taxes income (y^{pt})	11513.15	113.02	10050.77	7.07	0.372	8012
Overall education transfers (ik_edu)	2044.92	40.11	0.00	-	0.789	8012
Compulsory education transfers (ik_edu1)	1140.65	29.35	0.00	-	0.872	8012
Upper secondary school education transfers (ik_edu2)	633.26	21.89	0.00	-	0.909	8012
Tertiary education transfers (ik_edu3)	271.00	11.59	0.00	-	0.938	8012

Table 2a – Distributional summary statistics (2000)

	Gross income (y^g)			Post personal taxes income (y^{pt})			Overall education transfers (ik_edu)		
Quantile group	Quantile	% of Median	Share, %	Quantile	% of Median	Share, %	Quantile	% of Median	Share, %
10	3406	29.24	0.75	3453	34.25	0.94	0	-	0
25	6805	58.42	2.25	6503	64.5	2.71	0	-	0
50	11649	100	3.94	10083	100	4.11	0	-	0
75	18056	155	6.18	14849	147.26	6.26	4654	-	8.4
90	25977	223	8.47	20017	198.51	8.32	8692	-	15.65

Table 2b – Distributional summary statistics (2004)

	Gross income (y^g)			Post personal taxes income (y^{pt})			Overall education transfers (ik_edu)		
Quantile group	Quantile	% of Median	Share %	Quantile	% of Median	Share, %	Quantile	% of Median	Share, %
10	3353	28.38	0.67	2848	28.35	0.49	0	-	0
25	7054	59.7	2.3	6378	63.46	2.63	0	-	0
50	11815	58.4	2.02	10050	100	4.22	0	-	0
75	18478	100	3.9	15017	149.42	6.31	3649	-	7.8
90	26311	222.68	8.56	20137	200.36	8.24	7967	-	15.35

Figure 1 Overall education transfers by gross income quantiles

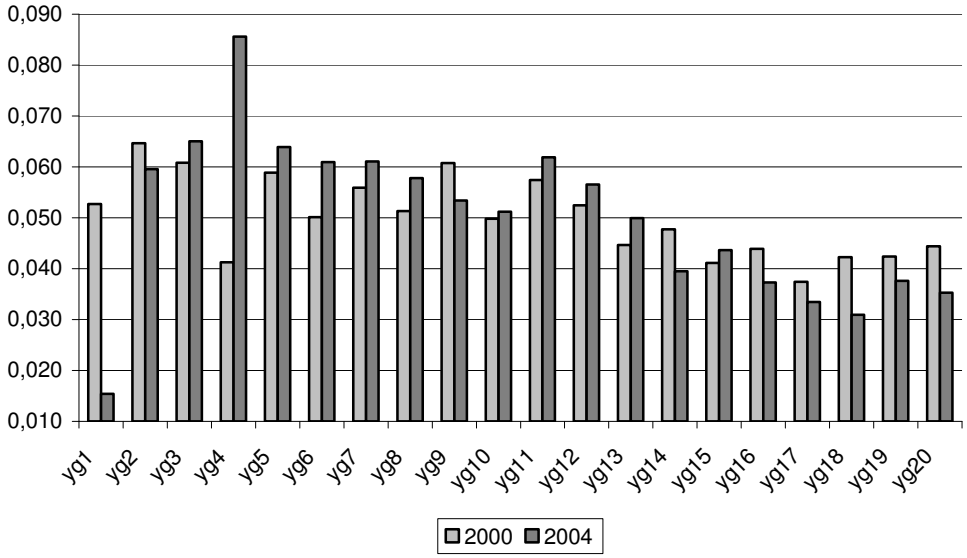

Table 3a Estimates of the redistributive effect of overall education transfers once controlled for direct taxation (overall sample)

	Esogenous	Counterfactual	Count diff
2000			
τ_F =10	-.0253***	-0.0305***	0.0018
	[.0031]	[0.0035]	[.0047]
τ_F =25	-.0283***	-0.0357***	0.0082***
	[.0015]	[0.0019]	[.0030]
τ_F =50	-.0300***	-0.0348***	0.0165***
	[.0011]	[0.0014]	[.0030]
τ_F =75	-.0343***	-0.0383***	0.0346***
	[.0009]	[0.0013]	[.0037]
τ_F =90	-.0334***	-0.0373***	0.0337***
	[.0014]	[0.0018]	[.0058]
2004			
τ_F =10	-.0177***	-.0239***	-.0055
	[.0016]	[.0021]	[.0038]
τ_F =25	-.0190***	-.0234***	-.0047*
	[.0013]	[.0015]	.0027]
τ_F =50	-.0183***	-.0238***	-.0012
	[.0011]	[.0014]	[.0027]
τ_F =75	-.0202***	-.0249***	.0015
	[.0016]	[.0017]	[.0045]
τ_F =90	-.0216***	-.0269***	-.0034
	[.0026]	[.0028]	[.0069]

τ_F denotes the quantile of the distribution of the unobservables affecting gross income. Each regression includes the following variables: a constant, dummies for the family's geographical area of residence, the number of income earners within the family, dummies for the dimension of the , dummies for the educational level of the principal earner of the family, industry and occupational dummies of the principal earner, gender dummy of the family's principal earner, age, age square. Three stars, two stars and one star for statistically significant coefficients at the 1%, 5% and 10% confidence level. Bootstrapped standard errors in brackets.

Table 3b Estimates of the redistributive effect of higher secondary education transfers once controlled for direct taxation (overall sample)

	Esogenous	Counterfactual	Count diff
2000			
τ_F =10	-.0083***	-.0092***	.0003
	[.0018]	[.0017]	[.0024]
τ_F =25	-.0072***	-.0080***	-.0003
	[.0009]	[.0009]	[0.0012]
τ_F =50	-.0075***	-.0087***	-.0003
	[.0004]	[.0005]	[.0010]
τ_F =75	-.0102***	-.0119***	.0013
	[.0006]	[.0006]	[.0014]
τ_F =90	-.0117***	-.0120***	-.0007
	[.0006]	[.0008]	[.0035]
2004			
τ_F =10	-.0047***	-0.0082***	-.0038**
	[0.0012]	[0.0012]	[.0016]
τ_F =25	-0.0057***	-0.0069***	-.0036**
	[0.0006]	[0.0006]	[.0011]
τ_F =50	-.0057***	-0.0069***	-.0018***
	[0.0005]	[0.0007]	[.0015]
τ_F =75	-0.0069***	-0.0083***	-.0001
	[.0008]	[0.0008]	[.0026]
τ_F =90	-0.0074***	-0.0087***	-.0026
	[0.0015]	[0.0018]	[.0036]

τ_F denotes the quantile of the distribution of the unobservables affecting gross income. Each regression includes the following variables: a constant, dummies for the family's geographical area of residence, the number of income earners within the family, dummies for the dimension of the , dummies for the educational level of the principal earner of the family, industry and occupational dummies of the principal earner, gender dummy of the family's principal earner, age, age square. Three stars, two stars and one star for statistically significant coefficients at the 1%, 5% and 10% confidence level. Bootstrapped standard errors in brackets.

Table 3c Estimates of the redistributive effect of tertiary education transfers once controlled for direct taxation (overall sample)

	Esogenous	Counterfactual	Count diff
2000			
τ_F=10	-.0029***	-.0094***	-.00003
	[.0010]	[.0022]	[.0010]
τ_F =25	-.0038***	-.0087***	.0014**
	[.0006]	[.0012]	[.0006]
τ_F =50	-.0050***	-.0086***	.0030***
	[.0004]	[.0008]	[.0005]
τ_F =75	-.0064***	-.0098***	.0041***
	[.0004]	[.0008]	[.0006]
τ_F =90	-.0068***	-.0105***	.0048***
	[.0006]	[.0009]	[.0048]
2004			
τ_F =10	-.0018**	-.0072***	-.0000
	[.0007]	[.0011]	[.0007]
τ_F =25	-.0026***	-.0072***	-.0012**
	[0005]	[.0008]	[.0006]
τ_F =50	-.0023***	-.0074***	-.0007
	[.0004]	[.0007]	[.0006]
τ_F =75	-.0030***	-.0074***	-.0009
	[.0008]	[.0010]	[.0011]
τ_F =90	-.0025***	-.0093***	-.0037
	[.00171]	[.0019]	[.0023]

τ_F denotes the quantile of the distribution of the unobservables affecting gross income. Each regression includes the following variables: a constant, dummies for the family's geographical area of residence, the number of income earners within the family, dummies for the dimension of the , dummies for the educational level of the principal earner of the family, industry and occupational dummies of the principal earner, gender dummy of the family's principal earner, age, age square. Three stars, two stars and one star for statistically significant coefficients at the 1%, 5% and 10% confidence level. Bootstrapped standard errors in brackets.

Table 4 Test on inter-quantile differences

	Esogenous	Counterfactual	Count diff
2000			
In-kind[10]= In-kind[50]	2.38	1.46	9.84
	0.1227	0.2264	0.0017
In-kind[50]= In-kind[90]	4.58	1.86	9.64
	0.0325	0.1730	0.0019
In-kind2[10]= In-kind2[50]	0.17	0.05	0.11
	0.6832	0.8155	0.7397
In-kind2[50]= In-kind2[90]	42.38	18.71	0.01
	0.0000	0.0000	0.9052
In-kind3[10]= In-kind3[50]	4.90	0.15	9.86
	0.0269	0.6943	0.0017
In-kind3[50]= In-kind3[90]	6.57	3.80	3.08
	0.0104	0.0511	0.0791
2004			
In-kind[10]= In-kind[50]	0.13	0.00	1.24
	0.7159	0.9572	0.2647
In-kind[50]= In-kind[90]	1.73	1.32	0.12
	0.1890	0.2511	0.7323
In-kind2[10]= In-kind2[50]	0.90	1.16	1.31
	0.3427	0.2819	0.2527
In-kind2[50]= In-kind2[90]	1.39	1.01	0.06
	0.2383	0.3139	0.8138
In-kind3[10]= In-kind3[50]	0.33	0.02	0.74
	0.5647	0.8941	0.3882
In-kind3[50]= In-kind3[90]	0.03	1.15	1.81
	0.8709	0.2830	0.1786

Table 5a First stage effects of instruments on overall education transfers (sample composed by households with at least one child attending any education level)

	τ_F =10	τ_F =25	τ_F =50	τ_F =75	τ_F =90
2000					
COMPSCHOOL_1	.02212***	.0315***	.0345***	.04323***	.0322***
	[.0043]	[.0015]	[.0060]	[.0046]	[.0070]
REFORM	.0928**	-.0006	.1769**	.0824**	.1124***
	[.0373]	[.0100]	[.0768]	[.0422]	[.1208]
Constant	.3776***	.5733***	1.1359***	2.0489***	1.7643***
	[.0755]	[.1090]	[.2591]	[.2817]	[.4253]
F test	269.91	248.06	39.92	58.09	15.88
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
2004					
COMPSCHOOL_1	.02899***	.0284***	.04881***	.0502***	.0563***
	[.0014]	[.0013]	[.0079]	[.0040]	[.0071]
HESUPPLY_2	-1.8875	3.970	16.043	25.431***	24.551***
	[6.362]	[5.083]	[5.909]	[6.9625]	[6.494]
Constant	.4617***	1.0023***	1.7605***	2.4766***	2.727***
	[.0697]	[.1102]	[.2681]	[.2740]	[.4487]
F test	203.64	230.08	26.09	83.43	40.27
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]

τ_F denotes the quantile of the distribution of the unobservables affecting gross income. Three stars, two stars and one star for statistically significant coefficients at the 1%, 5% and 10% confidence level. Bootstrapped standard errors in brackets. For the F- test on the significance of the instruments p-values in brackets.

Table 5b First stage effects of instruments on higher secondary school and tertiary education transfers (sample composed by households with at least one child attending higher secondary school or tertiary education)

	2000	2004
Educ 2		
COMPSCHOOL1	0.0288	.0431**
	[0.2539]	[.0210]
COMPSCHOOL2		.0415**
		[.0185]
REFORM	0.8727***	.4274**
	[0.2177]	[.1640]
Constant	0.6525	1.933
	[0.2177]	[2.527]
F test	50.71	11.42
	[0.0000]	[0.0097]
Educ3	2000	2004
HESUPPLY 1	109.658***	43.893***
	[9.147]	[9.92064]
HESUPPLY 2	50.052***	35.789***
	[17.399]	[12.756]
REFORM		0.8804***
		[0.1232]
Constant	-10.326***	-12.61***
	[1.431]	[2.756]
F test	173.05	248.91
	[0.0000]	[0.0000]

Table 6a Estimates of the redistributive effect of overall education transfers once controlled for direct taxation (only households with at least one child enrolled in any education level)

	τ_F =10	τ_F =25	τ_F =50	τ_F =75	τ_F =90
2000					
τ_A=10	-0.0921***	-0.0900***	-0.0489***	-0.0838***	-0.1117***
	[0.0068]	[0.0012]	[0.0012]	[0.0012]	[0.0013]
τ_A =25	-0.1066***	-0.0795***	-0.0493***	-0.0800***	-0.1007***
	[0.0084]	[0.0014]	[0.0002]	[0.0013]	[0.0018]
τ_A =50	-0.0840***	-0.0713***	-0.0498***	-0.1578***	-0.0855***
	[0.0035]	[0.0011]	[0.0000]	[0.0043]	[0.0006]
τ_A =75	-0.0859***	-0.0715***	-0.0477***	-0.0653***	-0.0842***
	[0.0025]	[0.0011]	[0.0005]	[0.0003]	[0.0014]
τ_A =90	-0.0726***	-0.0762***	-0.0507***	-0.0624***	-0.0919***
	[0.0017]	[0.0020]	[0.0000]	[0.0004]	[0.0003]
Mean Quantile Treatment Effect	-0.0882	-0.0777	-0.0493	-0.0898	-0.0948
2004					
τ_A =10	-0.1145***	-0.0668***	-0.0764***	-0.1798***	-0.222***
	[0.001]	[0.000]	[0.0038]	[0.0024]	[0.0035]
τ_A =25	-0.1182***	-0.0764***	-0.0852***	-0.1873***	-0.2483***
	[0.002]	[0.0018]	[0.0048]	[0.0024]	[0.0081]
τ_A =50	-0.0853***	-0.0643***	-0.0676***	-0.1254***	-0.1812***
	[0.0019]	[0.0011]	[0.0030]	[0.0018]	[0.0053]
τ_A =75	-0.0822***	-0.0645***	-0.0716***	-0.1201***	-0.1759***
	[0.0018]	[0.0002]	[0.0024]	[0.0022]	[0.0063]
τ_A =90	-0.0734***	-0.0624***	-0.0775***	-0.1149***	-0.1599***
	[0.0016]	[0.0003]	[0.001]	[0.0011]	[0.0042]
Mean Quantile Treatment Effect	-0.0947	-0.0668	-0.0756	-0.1455	-0.1975

τ_F denotes the quantile of the distribution of the unobservables affecting gross income; τ_A denotes the quantile of the distribution of unobservables characteristics that affect the family's educational choices (i.e. in-kind). Quantile effects corresponds to the effects of in-kind income (over the sample mean) on the quantile of gross income distribution (over the sample mean) when in-kind income is treated as exogenous. Each regression includes the following variables: a constant, dummies for the family's geographical area of residence, the number of income earners within the family, dummies for the dimension of the , dummies for the educational level of the principal earner of the family, industry and occupational dummies of the principal earner, gender dummy of the family's principal earner, age, age square. Three stars, two stars and one star for statistically significant coefficients at the 1%, 5% and 10% confidence level. Bootstrapped standard errors in brackets

Table 6B Estimates of the redistributive effect of higher secondary school transfers once controlled for direct taxation (only households with at least one child attending higher secondary school)

	τ_F =10	τ_F =25	τ_F =50	τ_F =75	τ_F =90
2000					
τ_A=10	-0.0069***	-0.0025**	-0.0230***	-0.0255***	-0.0201***
	[0.0013]	[0.0011]	[0.0002]	[0.0006]	[0.0000]
τ_A =25	-0.0023	-0.0053***	-0.0204***	-0.0230***	-0.0214***
	[0.0015]	[0.0010]	[0.0004]	[0.0003]	[0.0001]
τ_A =50	-0.0037***	-0.0048***	-0.0189***	-0.0221***	-0.0220***
	[0.0013]	[0.0012]	[0.0002]	[0.0000]	[0.0002]
τ_A =75	0.0024	-0.0054***	-0.0208***	-0.0181***	-0.0211***
	[0.0024]	[0.0006]	[0.0000]	[0.0000]	[0.0001]
τ_A =90	-0.0028	-0.0059***	-0.0153***	-0.0170***	-0.0267***
	[0.0021]	[0.0005]	[0.0003]	[0.0000]	[0.0003]
Mean Quantile Treatment Effect	-0.0026	-0.0048	-0.0197	-0.0211	-0.0223
2004					
τ_A =10	-0.0254***	-0.0387***	-0.0263***	-0.0506***	-0.0945***
	[0.0011]	[0.0004]	[0.0003]	[0.0006]	[0.0000]
τ_A =25	-0.0136***	-0.0308***	-0.0281***	-0.0499***	-0.0917***
	[0.0002]	[0.0001]	[0.0000]	[0.0000]	[0.0012]
τ_A =50	-0.0129***	-0.0263***	-0.0310***	-0.0450***	-0.0846***
	[0.0000]	[0.0003]	[0.0002]	[0.0009]	[0.0012]
τ_A =75	-0.0224***	-0.0307***	-0.0288***	-0.0418***	-0.0926***
	[0.0006]	[0.0001]	[0.0001]	[0.0005]	[0.0001]
τ_A =90	-0.0175***	-0.0303***	-0.0286***	-0.0397***	-0.0861***
	[0.0002]	[0.0002]	[0.0003]	[0.0005]	[0.0011]
Mean Quantile Treatment Effect	-0.0184	-0.0314	-0.0286	-0.0454	-0.0899

τ_F denotes the quantile of the distribution of the unobservables affecting gross income; τ_A denotes the quantile of the distribution of unobservables characteristics that affect the family's educational choices (i.e. in-kind). Quantile effects corresponds to the effects of in-kind income (over the sample mean) on the quantile of gross income distribution (over the sample mean) when in-kind income is treated as exogenous. Each regression includes the following variables: a constant, dummies for the family's geographical area of residence, the number of income earners within the family, dummies for the dimension of the , dummies for the educational level of the principal earner of the family, industry and occupational dummies of the principal earner, gender dummy of the family's principal earner, age, age square. Three stars, two stars and one star for statistically significant coefficients at the 1%, 5% and 10% confidence level. Bootstrapped standard errors in brackets

Table 6c Estimates of the redistributive effect of tertiary education transfers once controlled for direct taxation (only households with at least one child attending tertiary education)

	τ_F =10	τ_F =25	τ_F =50	τ_F =75	τ_F =90
2000					
τ_A=10	-0.0168***	-0.0146***	-0.0127***	-0.0129***	-0.0141***
	[0.0011]	[0.0000]	[0.0002]	[0.0001]	[0.0005]
τ_A =25	-0.0271***	-0.0174***	-0.0135***	-0.0113***	-0.0170***
	[0.0007]	[0.0003]	[0.0000]	[0.0002]	[0.0001]
τ_A =50	-0.0249***	-0.0182***	-0.0137***	-0.0112***	-0.0167***
	[0.0005]	[0.0002]	[0.0000]	[0.0001]	[0.0000]
τ_A =75	-0.0297***	-0.0182***	-0.0134***	-0.0121***	-0.0175***
	[0.0011]	[0.0002]	[0.0000]	[0.0004]	[0.0002]
τ_A =90	-0.0322***	-0.0156***	-0.0115***	-0.0108***	-0.0169***
	[0.002]	[0.0001]	[0.0003]	[0.0001]	[0.0002]
Mean Quantile Treatment Effect	-0.0261	-0.0168	-0.0648	-0.0116	-0.0164
2004					
τ_A =10	-0.017***	-0.0071***	-0.0082***	-0.0194***	-0.0446***
	[0.0005]	[0.0003]	[0.0004]	[0.0016]	[0.0046]
τ_A =25	-0.0220***	-0.0093***	-0.0080***	-0.0179***	-0.0396***
	[0.0000]	[0.0000]	[0.0004]	[0.0016]	[0.0042]
τ_A =50	-0.0184***	-0.0092***	-0.0084***	-0.0176***	-0.0415***
	[0.0000]	[0.0002]	[0.0003]	[0.0019]	[0.0048]
τ_A =75	-0.0143***	-0.0125***	-0.0097***	-0.0203***	-0.0437***
	[0.0007]	[0.0006]	[0.0001]	[0.0019]	[0.0049]
τ_A =90	-0.0203***	-0.0146***	-0.0126***	-0.0212***	-0.0361***
	[0.0001]	[0.0003]	[0.0003]	[0.0009]	[0.0411]
Mean Quantile Treatment Effect	-0.0184	-0.0105	-0.0093	-0.01928	-0.0324

τ_F denotes the quantile of the distribution of the unobservables affecting gross income; τ_A denotes the quantile of the distribution of unobservables characteristics that affect the family's educational choices (i.e. in-kind). Quantile effects corresponds to the effects of in-kind income (over the sample mean) on the quantile of gross income distribution (over the sample mean) when in-kind income is treated as exogenous. Each regression includes the following variables: a constant, dummies for the family's geographical area of residence, the number of income earners within the family, dummies for the dimension of the , dummies for the educational level of the principal earner of the family, industry and occupational dummies of the principal earner, gender dummy of the family's principal earner, age, age square. Three stars, two stars and one star for statistically significant coefficients at the 1%, 5% and 10% confidence level. Bootstrapped standard errors in brackets

Table 7 Test on inter-quantile differences

	τ_A=10	τ_A =25	τ_A =50	τ_A =75	τ_A =90
2000					
In-kind[10]= In-kind[50]	16.20	0.81	0.41	5.30	0.53
	0.0001	0.3682	0.5214	0.0215	0.4679
In-kind[50]= In-kind[90]	5.28	2730.71	14.22	5.69	44.93
	0.0217	0.0000	0.0002	0.0171	0.0000
In-kind2[10]= In-kind2[50]	0.00	0.00	0.00	0.29	0.62
	0.9694	0.9999	0.9808	0.5876	0.4309
In-kind2[50]= In-kind2[90]	0.10	0.29	0.09	0.02	1426.51
	0.7473	0.5880	0.7582	0.8913	0.0000
In-kind3[10]= In-kind3[50]	5.25	0.11	0.04	0.05	8.70
	0.0224	0.7439	0.8394	0.8231	0.0033
In-kind3[50]= In-kind3[90]	546.67	0.05	0.01	0.00	0.27
	0.0000	0.8286	0.9124	0.9702	0.6017
2004					
In-kind[10]= In-kind[50]	0.30	0.23	0.00	0.18	0.02
	0.5851	0.6320	0.9714	0.6720	0.8934
In-kind[50]= In-kind[90]	1.26	10.51	13.59	15.21	6.61
	0.2618	0.0012	0.0002	0.0001	0.0102
In-kind2[10]= In-kind2[50]	4.79	12.18	0.17	0.15	0.15
	0.0290	0.0005	0.6788	0.6981	0.6981
In-kind2[50]= In-kind2[90]	1.64	1.05	580.66	3.54	42.65
	0.2014	0.3055	0.0000	0.0599	0.0000
In-kind3[10]= In-kind3[50]	271.32	0.92	13.98	0.07	0.00
	0.0020	0.3373	0.0002	0.7915	0.9922
In-kind3[50]= In-kind3[90]	0.23	4.80	1.00	1.37	0.38
	0.6292	0.0290	0.3186	0.2426	0.5366

τ_A denotes the quantile of the distribution of unobservables characteristics that affect the family's educational choices (i.e. in-kind); τ_C denotes the quantile of the distribution of unobservables characteristics that affect the family's tax liability.