

Education and Redistribution

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L'istruzione è un modo molto costoso di attuare di politiche redistributive. Ciò è dovuto al fatto che coloro che traggono più vantaggio dall'investimento in istruzione sono coloro già favoriti da madre natura/la dea fortuna. Efficienza richiederebbe che le risorse educative siano distribuite secondo la capacità di ricevere beneficio, implicando che i più fortunati debbano ricevere di più: ciò chiaramente non è equo. Alcune caratteristiche contro-intuitive della fornitura di istruzione possono essere comprese in termini di questo conflitto fra equità ed efficienza: preferenze elettorali per le sovvenzioni dell'università, le conseguenze distributive degli esami di ammissione, l'interazione fra i prezzi delle case e la qualità delle scuole.

Education is a very expensive way of carrying out redistributive policies. This is because those who have been more favoured by nature/luck are also those who benefit most from the investment in education: if educational resources are distributed according to the ability to benefit, as efficiency would require, the better off should receive more, which is clearly inequitable. Some counterintuitive features of the provision of education can be understood in terms of this conflict between equity and efficiency: electoral preferences for the provision of university subsidies, the distributive consequences of admission tests, and the interaction between house prices and the quality of schools. [JEL Code: H400, I200, D300, O150]

*[<dfraja@le.ac.uk>](mailto:dfraja@le.ac.uk) A shorter version of this paper was delivered as my inaugural lecture at the University of Leicester on 11 January 2005. Both the paper and the lecture are dedicated to my children, Margherita, Elena, and Thomas, from whom I am learning much more than anyone has ever learnt from me. I would like to thank Gustavo Piga for many helpful comments on an earlier draft.

1. - Introduction

The theme running through this paper is that the relationship between education and distribution is much more complex than one would think at first sight, and that there are therefore many conflicting points of view that the analyst and the policy maker should be aware of, to avoid that the policy implementation of a desirable principle may result in undesirable and counterintuitive consequences.

1.1 *Features of Education*

Let us begin by focusing on certain important features of education as an economic good. Education is *(i)* a private *(ii)* investment good, *(iii)* provided publicly to a considerable extent, *(iv)* financed by the public purse to a considerable extent, *(v)* legally mandated to a substantial level, and *(vi)* not chosen by the main user.

Let's examine each in turn.

Education has all the characteristics of a private good, and none of those of a public good. Using the checklist proposed by Atkinson and Stiglitz (1980), this is easy to verify. There is rivalry in consumption: if a maths teacher is explaining what an eigenvector is to a third year undergraduate class, she is not going through the proof of Fermat's last theorem with you. Education is cheaply excludable (roll calls at the beginning of every lesson are commonplace). Marginal cost is definitely not 0: having an extra pupil in a course implies a substantial increase in the total cost of running that course, even though the opposite is claimed at many meetings to co-ordinate Socrates exchanges.

With regard to *(ii)*, education has no doubt an element of consumption good; this is proved by the increasing number of "mature students" who happily spend their retirement writing essays on Dostoyevsky instead of (or as well as) tending their roses and looking after grandchildren. However, quantitatively it is overwhelmingly an investment good; moreover, the interesting and pol-

icy relevant research questions emerge when education is regarded as primarily an investment good, since the consumption aspects are straightforward to analyse.

Consider (iii) (iv) and (v) now. The three are related, but are not necessarily implied by one another, and it is, I believe, useful, to keep them conceptually separate. In practically every country in the world, education is compulsory: parents are not allowed to stop their children from receiving education; even where children are allowed not to go to school, for example because their parents school them at home, legislation requires their education to satisfy numerous requisites with regard to quality and quantity. This is a rather unique case of compulsory provision of personal performance, which can be assimilated only to the provision of compulsory military service. A superficial similarity could be drawn with compulsory pension provision. But this is only superficial: quite apart from the fact that rules imposing on individual the provision of adequate pensions for example by saving into special funds are, as far as I am aware, only at the discussion stage, and are not law in any main country, they are more similar to the payment of taxes – which of course is of course also compulsory, but is not a personal performance. As the example of pension provision (or of compulsory car insurance), per se, this is not a requirement for public provision and financing, and indeed the early days of universal primary education schooling could be compulsory and not free (in Britain the *Education Acts* of 1870 and 1876 made primary education compulsory, but not free, as school boards were allowed to charge a weekly fee not exceeding 9 pence. Elementary education became effectively free with the passing of the 1891 *Education Act*). Nowadays, however, given the substantial cost of education, it would be difficult to enforce attendance if parents had to pay a substantial portion of the cost.¹ So, it is

¹ There are of course hidden costs which may be substantial: my personal experience in Italy in the school year 2003-2004, with three children in the state education system, illustrated the substantial cost difference in cost of attendance to compulsory schools in Italy and in the UK, even for primary school, where books are provided for free: the aggregate cost of writing paper, pens pencils pen cases, rucksacks, music and PE (physical education) lessons, was not indifferent, when all these things are free in the UK state system.

the case that most of the cost of the education is borne by the government. Table 1 illustrates this: it reports, for selected countries, the proportion of the cost of the total education expenditure which is borne by public funds (the Table is for the year 2000, and does not include the public subsidy to private education expenditure).

Note that financing and provision of education are conceptually separate. Roads are typically publicly financed and built by private contractors. In many countries, a substantial, and rising, proportion of medical care is also financed by the public purse but supplied by private providers, private hospitals and self-employed family doctors. Conversely, prior to privatisation, much of the supply of gas electricity water and telephone services were supplied by agencies in the public sector and financed, largely, by revenues obtained privately in the market.² So a preliminary question intimately linked to the to the role of education as a re-distributive instrument is the following: Why is it the case that education is largely financed and provided by the state?

Finally, feature *(vi)*.

Most goods are paid for by whoever consumes them. But the investment nature of education, together with the fact that it is best acquired during a person's youth, implies that essentially all of the acquisition of education is not paid for by the person who receives it. In practice two categories of agents pay for a person's education: her parents and the state.

Education begins, when it is formally provided by professional individuals not part of the immediate household, at age three or sooner, with the so-called pre-school education. Even if we take primary education as a starting point, most children in the world have begun it (or should have begun it) by their seventh birthday. This is no age at which individuals can take decisions; indeed, most people have "ended" their education by the time they are in a position legally to take decision regarding property ownership, or to participate in the electoral process. This implies that deci-

² At a theoretical level, this raises the question of what should be supplied and financed by the government.

TABLE 1

EXPENDITURE ON EDUCATIONAL INSTITUTIONS
AS A PERCENTAGE OF GDP (1995, 2000)
EXPENDITURE ON EDUCATIONAL INSTITUTIONS FROM PUBLIC
AND PRIVATE SOURCES FOR ALL LEVELS OF EDUCATION,
BY SOURCE OF FUNDS AND YEAR (source OECD)

	Public ¹	Private ²	Total	Public ¹	Private ²	Total
	<i>2000</i>			<i>1995</i>		
OECD countries						
Australia	4.6	1.4	6.0	4.6	1.0	5.6
Austria ³	5.4	0.3	5.7	5.9	0.3	6.3
Belgium	5.1	0.4	5.5	m	m	m
Canada	5.2	1.2	6.4	6.2	0.8	7.0
Czech Republic	4.2	0.5	4.6	4.9	0.5	5.4
Denmark ³	6.4	0.3	6.7	6.1	0.2	6.3
Finland	5.5	0.1	5.6	6.3	x	6.3
France	5.7	0.4	6.1	5.9	0.4	6.3
Germany	4.3	1.0	5.3	4.5	1.0	5.5
Greece ³	3.7	0.2	4.0	2.9	n	3.0
Hungary	4.4	0.6	5.0	4.9	0.6	5.5
Iceland ³	5.7	0.6	6.3	4.5	0.6	5.1
Ireland	4.1	0.4	4.6	4.7	0.5	5.3
Italy	4.5	0.4	4.9	4.8	m	m
Japan	3.5	1.2	4.6	3.5	1.1	4.7
Korea	4.3	2.8	7.1	m	m	m
Luxembourg	m	m	m	m	m	m
Mexico	4.7	0.8	5.5	4.6	1.0	5.6
Netherlands	4.3	0.4	4.7	4.6	m	4.8
New Zealand	5.8	m	5.8	4.8	m	4.8
Norway	5.8	0.1	5.9	7.0	0.2	7.1
Poland ³	5.2	m	5.2	5.5	m	5.5
Portugal ³	5.6	0.1	5.7	5.3	n	5.3
Slovakia ³	4.0	0.2	4.2	4.6	0.4	5.1
Spain	4.3	0.6	4.9	4.6	1.0	5.5

Source: OECD. www.oecd.org/edu/eag2003

¹ Including public subsidies to households attributable for educational institutions. Including direct expenditure on educational institutions from international sources.

² Net of public subsidies attributable for educational institutions.

³ Public subsidies to households not included in public expenditure, but in private expenditure.

⁴ Year of reference 1999.

⁵ Direct expenditure on educational institutions from international sources exceeds 1.5 per cent of all public expenditure.

TABLE 1 (cont.)

EXPENDITURE ON EDUCATIONAL INSTITUTIONS
AS A PERCENTAGE OF GDP (1995, 2000)
EXPENDITURE ON EDUCATIONAL INSTITUTIONS FROM PUBLIC
AND PRIVATE SOURCES FOR ALL LEVELS OF EDUCATION,
BY SOURCE OF FUNDS AND YEAR (source OECD)

	Public ¹	Private ²	Total	Public ¹	Private ²	Total
	<i>2000</i>			<i>1995</i>		
Sweden	6.3	0.2	6.5	6.3	0.1	6.4
Switzerland	5.3	0.4	5.7	5.4	m	m
Turkey ³	3.4	n	3.4	2.3	n	2.3
United Kingdom	4.5	0.7	5.3	4.6	0.9	5.5
United States	4.8	2.2	7.0	m	m	m
Country mean	4.8	0.6	5.5	—	—	—
OECD total	4.6	1.3	5.9	—	—	—
Country mean for countries with 1990, 1995 et 2000 data (24 countries)	5.0	0.5	5.6	5.1	0.5	5.7
Non-OECD countries						
Argentina ³	4.5	1.4	5.9	m	m	m
Brazil ^{3, 4}	4.2	m	m	m	m	m
Chile	4.2	3.3	7.4	m	m	m
India ⁴	4.1	0.2	4.2	m	m	m
Indonesia ^{3, 5}	1.5	0.8	2.3	m	m	m
Israel	6.6	1.6	8.2	6.9	1.5	8.5
Jamaica	6.4	3.3	9.7	m	m	m
Malaysia ³	5.9	n	5.9	m	m	m
Paraguay	5.0	2.2	7.2	m	m	m
Philippines ⁴	3.9	2.5	6.4	m	m	m
Russian Federation ³	3.0	m	m	m	m	m
Thailand ³	4.9	0.2	5.1	m	m	m
Tunisia ³	7.7	m	m	m	m	m
Uruguay ^{3, 5}	2.8	0.1	3.0	m	m	m
Zimbabwe ³	7.6	m	m	m	m	m

Source: OECD. www.oecd.org/edu/eag2003

¹ Including public subsidies to households attributable for educational institutions. Including direct expenditure on educational institutions from international sources.

² Net of public subsidies attributable for educational institutions.

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sions concerning education are not taken by the consumers of education.

Parents are possible candidates for decision making, and indeed, they do take many relevant decisions; however, the sheer magnitude of the cost involved implies that it is essentially impossible for most parents to pay for their children education out of their current income. In the OECD, the annual cost of education is \$5,763 on average, ranging from \$4137 for pre-primary education to \$9571 for higher education, representing from 17% to 42% of the annual GDP per capita (OECD, 2003). As the Table shows, much of the education provided in the world is paid by the state or other public institutions. The sums involved are enormous, and, as a percentage of the GDP do not vary substantially with the nation's GDP.

1.2 *Why Public Intervention?*

So public intervention is big. State concern is not new either, but dates back a long time. Universities in England have received a *Royal Charter* from the early days; what they could and could not teach was also determined by the king; in 1548 King Edward VI completed Henry VIII's destruction of the Church-based welfare system by nationalising the assets of the remaining colleges and chantries with the aptly named *Confiscation Act*, but took care to exempt four educational institutions, Eton and Winchester, and the universities of Oxford and Cambridge. The paper by Goldin and Katz (2003) is a highly readable account of the early days of education in the United States, where it is shown, among other things, that there was public involvement (at local and state level before than at federal level) from very earlier on.

But why is there state concern in education? This is a germane question, since, as argued above, education is a private good. Justifications for public intervention can be classified into four broad groups (Barr, 1998): (i) externalities; (ii) a merit goods argument; (iii) market failures and (iv) redistributive motives. As Barr (1988) argues, the first three are unlikely to constitute a

compelling argument for public provision of education. Externalities, the standard argument goes, are likely to exist in this market, but they are likely to be small and limited to primary education (Stiglitz, 1974). Society undoubtedly benefits if highly generic training, such as the ability to read and write is widespread, because, in the absence of slavery, private provision of such generic training cannot be appropriated by the trainer. This is the QWERTY argument (David, 1985) that goes as follows. In the absence of some intervention in the provision of basic training, free riding would occur: employers would try to poach trained employees from each other, and workers who have paid for their own training would foresee the risk of being expropriated by employers. This justifies a subsidy, so that the investors do not fear being expropriated. In the case of primary and secondary education, given that those who need to invest in primary education are typically very young, it may well be the case that the administratively simplest way of providing this subsidy is in the form of wholesale public provision.³ But why should university education, which is typically quite expensive and the returns of which accrue almost exclusively to the individual, be subsidised by the taxpayer to a very large extent? Recent empirical work does find evidence of some external effects even at tertiary education (Moretti, 2004*a* and 2004*b*): this justifies a limited subsidy. However, the overwhelming agreement in the literature is that most returns from secondary and tertiary education can be appropriated by the individual that receive education (Acemoglu and Angrist, 2000).

So the externality case is weak. The merit goods argument is based on the idea that individuals do not know/understand their own preferences: education is good for them, and so they should consume it even if they would rather spend their income on holidays in Ibiza. To induce the “individually” optimal level of con-

³ Although the literature on incomplete contracts (see TIROLE J., 1999 for a critical survey) does suggest that there are ways of avoiding this expropriation (e.g. AGHION F. *et al.*, 1994, CHE Y.K. - HAUSCH D.B., 1999), they may involve complex negotiation mechanisms, and public provision might be the cheapest option of avoiding free riding here.

sumption the state provides education below cost. This, however, is an argument that economist would rather not make, because it has strong implication of paternalism (Barr, 1998) and economists prefer to let individuals choose their consumption bundles by themselves. Even if the paternalistic argument were accepted, it would justify making the acquisition of education compulsory, not necessarily call for wholesale public provision.⁴

As we argued above, there are strong market failures in education. Because the expenditure in education must be undertaken by individuals who have no financial resources, investment would need to be financed by loans, but individuals cannot give collateral, slavery being illegal. This is true, and not disputed, but is of course an argument for public intervention in the loan market, not wholesale provision of education. Indeed there are many examples of this intervention (Barr, 1997; 1993).

So the first three potential justifications for the public provision of education are not very strong. There are however very good reasons to provide education as a means of effecting redistribution. These can be divided into two groups, one based on asymmetric information, the other on political acceptability. Theoretical analysis suggests that in the presence of asymmetric information redistribution may be best carried out with the provision of private goods rather than with standard instrument of taxation and subsidy (Besley and Coate, 1991; Blackorby and Donaldson, 1988). The standard “symmetric information” argument is that, in the absence of paternalistic consideration, the utility of the individuals at the “receiving end” of redistribution increases (weakly) more for the same utility loss of the taxpayers if they receive cash (subsidies) rather than specific goods: intuitively, this

⁴ A separate argument is that educated citizens are better citizen: as noted by MILLIGAN K.E. *et al.* (2004), this is an externality argument which is accepted even by writers usually reluctant to recognise externalities which may justify government intervention: according to FRIEDMAN M. (1962), «a stable and democratic society, is impossible without a minimum degree of literacy and knowledge [...] the gains are sufficiently important to justify some government subsidy». SMITH A. (1776), himself also acknowledged that education of the “common people” makes them less likely to fall prey of rubble rousing fanatics and be used as instrument of social disorder. MILLIGAN K.E. *et al.* (2004), find a correlation between political participation and education in the US, but less so in the UK.

is because, in the absence of paternalism, they are the best judges of what increases their utility, and if they do not spend the cash by buying the good that would be provided with distribution in kind, this means that this makes them better off. More succinctly, the budget set is strictly larger when the redistributive transfer is cash. This is no longer true if there is some form of asymmetric information. In an extreme form, suppose the government cannot identify those who it wants to redistribute towards (in the sense that rich people can pretend to be poor): then cash redistribution is simply impossible. Instead taxing everybody (equally) and then offering everybody a good or service that only the poor wish to consume, will ensure that redistribution does take place. Low quality education is such a good: the rich prefer private education and the poor government provided education; an identical reasoning can be made with regard to low quality health care.

Political acceptability suggests that education is a suitable private good to give away at a price below marginal cost. Other goods consumed proportionally more by the poor, such as convenience food, beer, cigarettes, holidays to Ibiza, are less likely to find the voters' support as a means to effect redistribution. Housing of course also satisfies both these characteristics of naturally separating those with high willingness to pay from those with low willingness to pay — as the offer of not more than adequate housing is likely to be taken up by the poor more than by the rich — and of being politically acceptable to the electorate — because decent housing is viewed as a human right. And indeed social housing remains an important instrument with which the lower income households in society can be helped. Note that this argument is a separate one from the merit goods/paternalistic argument. It is compatible with a government whose utility function has individuals' utilities (not consumption bundles) as argument, but assumes externalities in consumption: the utility of the better-off depends on the consumption bundle of the worse-off.

So, to put it succinctly, education is provided by the state because it is a simple and acceptable method of redistributing from the rich to the poor.

2. - Education and Redistribution: A General Formulation

Things, as ever, are not so black and white. Using education as a redistributive tool, has however, two very serious drawbacks. First, it is very expensive, in a sense to be made precise below, and second, it is manipulable by policy makers and pressure groups.

Put bluntly, manipulability implies that, because it is difficult to see the link between expenditure on education and its redistributive effects, redistribution does not necessarily go the way one would like it. In a seminal contribution, Hansen and Weisbrod (1969*a* and 1969*b*), show that the Californian state system of higher education constituted a transfer from the poor to the rich: though the income tax system was progressive, the latter attended university in much larger number than the former, and, as a group, they benefited from the free universities more than they contributed through their tax payments.⁵

2.1 *Kenneth Arrow's General Set-Up*

The theoretical reason for these possibly ambiguous⁶ redistributive effects was identified by Arrow (1971), in model which is formally very simple and conceptually very profound. He showed that the efficient provision of goods for which, loosely speaking, the marginal benefit increases with a rough measure of "innate capacity to benefit" is regressive: efficient provision requires that resources be allocated where they are most productive, that is, that more be given to those who are already been favoured by luck/mother nature/god. This is because, given two individuals with the same education, the one who benefit more from an extra unit of expenditure is the brighter of the two. This

⁵ Their evidence is disputed by PECHMAN J.A. (1972), and a debate has been generated both at theoretical and at empirical level, see BARBARO S. (2004).

⁶ The common opposition of the Conservative party and the Socialist Workers party and more generally the left of the Labour party in the UK to the recently introduced government reform of the financing of the higher education sector is a stark manifestation of this ambiguity.

is in line with our intuition and it tallies with our practice to give scholarship to the most able people (who, presumably, would do well for themselves anyway). Formally, Arrow considers a population of individuals, differentiated by a parameter θ , normalised in such a way that other things equal a higher θ is preferable (so θ is innate ability, or general health status). The government can provide these individuals with a quantity of a given good or service, say s , which measures for example the net expenditure on an individual on the goods or services considered: note that, since this is a private good, the expenditure level s can differ across individuals. A policy is the relation between the individual's θ and the expenditure s he/she receives. A policy is input regressive if $s'(\theta) > 0$: more is spent on individuals who have a higher type. If the government is utilitarian, in the sense that its objective function is the maximisation of total utility in society (note that this does not preclude a distaste for inequality, because if individuals have concave utility functions, then redistributing £1 from the rich to the poor increases total utility), and if the second cross derivative of the utility function with respect to type and expenditure is positive, then the policy that maximises the government's utility is input regressive. Conversely, of course, when the second cross derivative is negative, "low luck" individuals are those that benefit most from expenditure, and the optimal policy is progressive.

So a lot hinges on this second derivative: it measure the way the marginal benefit changes with "ability". As argued above, intuition would suggest that it is indeed positive for education, whereas it would be negative for health: someone healthy would not benefit as much, in terms of increased health from an increase in expenditure from £10,000 to £10,100, as someone in poor health. However intuition is not necessarily the best guide, and it is therefore largely an empirical matter to determine the sign of this cross derivative. Unfortunately, most empirical studies impose linearity, thus making it impossible to determine whether there are differences in marginal benefit at different ability level (Dearden Ferri and Meghir, 2002 and Dearden *et al.*, 2002).

2.2 *A More Specific Model*

My work on the optimal education policy (De Fraja, 2002; 2005) is an application of this principle. I started from a very simple basic question, which, however, had not been asked before: Suppose the government is free to design a complete tax-and-education system, from, as it were, scratch, subject only to the constraint due to its inability to observe people's privately known individual characteristics. What education policy would the government implement?

To answer this question, I construct a general equilibrium, overlapping generation model where individuals differ in "ability"⁷ (measured by a parameter θ) and in their parental income. In the steady state, the government chooses the income taxation schedule and the education policy. The latter comprises a level of education (denoted by e), which can be a function of innate ability, and a tuition fee schedule (fees can be paid up-front or when the student reaches the labour market and starts to earn). If there is no asymmetric information, or if there is no distortionary cost of taxation, then the optimal policy equalises utility for the various income levels. However, in the presence of asymmetric information, the optimal educational policy is regressive: it uses income from middle class and poor household where the individual has average ability to subsidise the education received by the most able individuals, especially those from wealthier households. Graph 1 illustrates the point starkly: it assumes that the government implements the optimal education policy (that is the policy that maximises total utility in society), and it depicts the net financial contribution to the education sector paid/received by households with different income levels. This is the difference be-

⁷ The measure of an individual's potential to benefit from education is potentially controversial. In the present set-up, it captures «everything that contributes to the child's income potential, is in the child at the time he takes his education decision, and cannot be purchased on the market» (RUBINSTEIN V. - TSIDDON D., 1999, p. 19). Ability, therefore, may be influenced but what is normally meant by «intelligence», but is not certainly restricted to this: it includes the capacity to interact with others, the range of family and personal connections which may help an individual to have a well-paying and satisfying job, and so on.

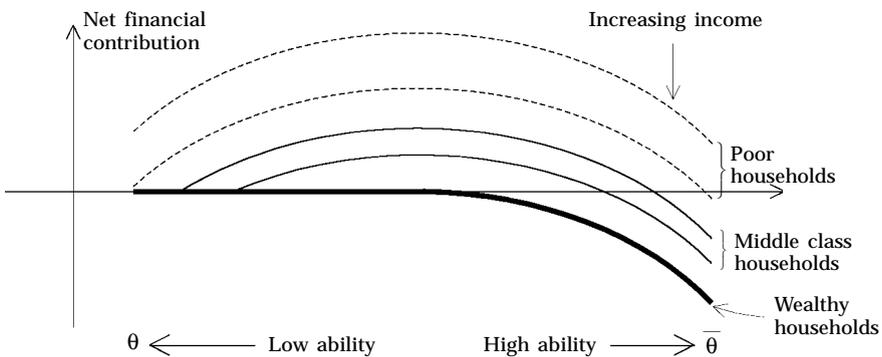
tween the cost paid by an individual (or her family) and the cost sustained by society for that individual's education: if this is negative, the individual is subsidised by society, if it is positive, the individual pays a tax to society. The horizontal axis measures the ability of the individual, and the horizontal axis the net financial contribution.

As the Graph illustrates, wealthy households (whose contribution is given by the bold curve) never pay for education more than they receive, and the most able individuals, those with the highest capacity to earn income in the labour market, are those who receive the highest subsidy. Poorer households contribute to the education of the better-off. This is due the fact that, because of capital market imperfections, the poor benefit more from the state intervention than the rich and therefore it is possible for the government to extract more financial resources from them. Specifically, the government lends the funds necessary to finance education to households who cannot afford to pay for it, and these households are asked to pay interest on the loan. Wealthier households do not need to borrow, and the total they pay to the government is therefore less, as indicated in Graph 1.

In the most general model, therefore, the most efficient education policy is regressive. And this, I believe, is at the heart of

GRAPH 1

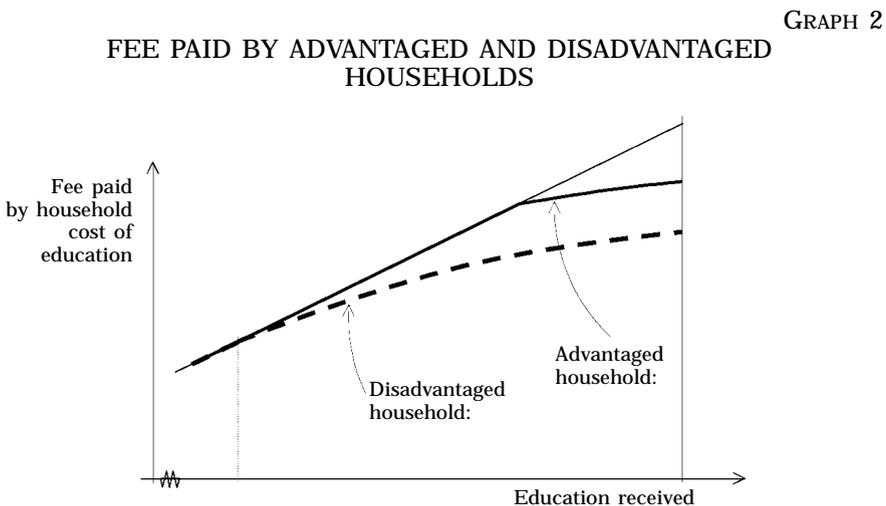
HOUSEHOLDS NET CONTRIBUTION TO
THE EDUCATION BUDGET, ACCORDING TO ABILITY AND INCOME



the problems encountered in the design of education policies: using education as an instrument to improve equity has a high cost in terms of efficiency. There is a sharp conflict between equity and efficiency in education, sharper than for other fields of government intervention, for example, health.

What is the source of this conflict? The crucial fundamental assumption in the analysis is $y_{e\theta}(\cdot) > 0$, where y is a person's labour market (post-education) income: $y_{e\theta}(\cdot)$ measures the marginal benefit of education, and $y_{e\theta}(\cdot) > 0$ implies that this is higher for higher ability individuals, in line with Arrow's general analysis. When considerations different from income are taken into the picture, then the regressive character of the optimal education policy is somewhat tempered. It may happen that underprivileged groups (such as deprived social background, or blacks) are favoured in the sense of being offered a given education level at a lower price (fee) than individuals from privileged backgrounds (De Fraja, 2005). Graph 2 shows the net financial contribution for individuals with the same income, but in different social and ethnic groups: the advantaged groups are those with better labour market opportunities than the average population.

This general discussion indicates the nature of the potential conflict between equity and efficiency: efficiency considerations



would suggest helping the better-off (because of the assumption that $y_{e\theta}(\cdot) > 0$ money spent on them is more productive), but of course equity considerations would indicate the opposite direction. However, the assumption $y_{e\theta}(\cdot) > 0$ comes into life because of two other underlying assumptions: both the presence of an externality and asymmetry of information. Without either of these assumptions, individuals from all income levels receive the same education level, which depends only on their ability to benefit, not on their capacity to pay: there is no conflict between equity and efficiency, even when the assumption of complementarity between ability and education holds, that is when $y_{e\theta}(\cdot) > 0$. The presence of an externality requires government intervention on efficiency grounds, and, except in the extreme and unlikely case where there is no shadow cost of public funds, this intervention must be paid for with general taxation or revenue raised by tuition fees. Asymmetric information, and the concurrent informational rent, creates a conflict between giving rent to the better-off individuals, which is costly, and an efficiency loss, which is also costly. Without either of these effects there would be no conflict between efficiency and equity.

2.3 The Dimensionality of the Users' Space

In many models individuals differ along one dimension only, typically either ability or family income. These models may study important aspects of education policy, as we will see later, but in order to appreciate the complexity of the redistribution mechanisms in education, it is essential, here more than for other goods, view the differentiation among individuals as a two-dimensional space. These two dimensions are in most cases variations on the theme of "ability to benefit" and "ability to pay". To understand the relationship between these two dimensions and the institutional mechanism in place, it is useful to consider another model of mine, which depicts these two dimensions rather starkly. Individuals are continuously distributed in a space $[\underline{Y}, \bar{Y}] \times [\underline{\theta}, \bar{\theta}]$. Where Y is family income (capacity to pay for education) and θ individ-

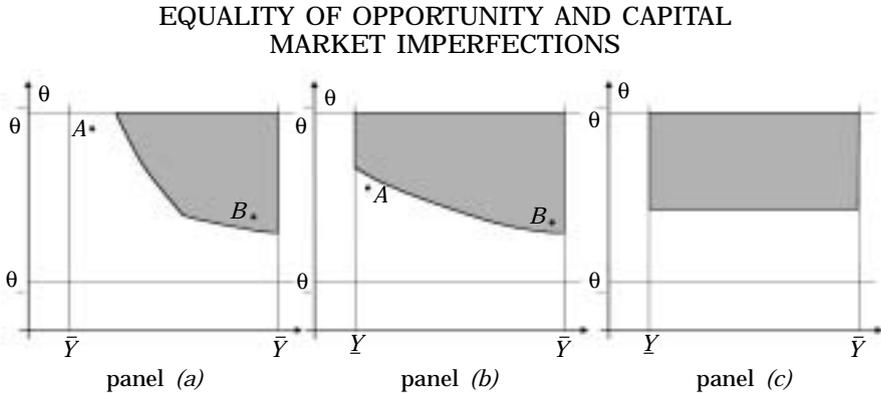
ual ability (capacity to benefit from education); the joint density in this space can be quite general (i.e. there can be positive or no correlation). To keep things simple, let education be a binary decision (either go to university or not), with a given cost. Decision are taken by households, who maximise the sum of current and future utility⁸ and do so by comparing the utility of going to university and of not going to university.

We can divide the parameter space into two subsets, those individuals that go to university and those who do not. This is illustrated in Graph 3 under three separate regimes; in each panel of the Graph, a point in the diagram represents a combination of family income, Y , and ability, θ , and the decision taken by individuals characterised by that combination; individuals characterised by points in the grey area go to university, those characterised by points in the light area do not. In panel (a) there are imperfect capital markets (including the extreme case of no capital markets), and in panel (b) there are perfect capital markets (the extreme case where the lending and borrowing rates available to individuals are the same). Consider first of all the viewpoints of equity and efficiency. One side of what intuitively, people would consider part of an equitable society is that of equality of opportunity in education: access to educational resources should not depend on family and personal circumstances, other than talent, ability, motivation and merit: these are deliberately vague terms, which are summarised by θ . This assimilates equality of opportunity with meritocracy.⁹ This suggest that the line

⁸ The model can be seen as a family model, or as the decision process of a single individual, who has a certain amount of monetary resources, and maximises her lifetime utility.

⁹ The philosophical debate is of course much richer and is part of the debate about what justifies inequalities in outcome. In one "commonsense" view, «inequalities of outcome are legitimate when they arise from a background of equal opportunities, or equal access» FLEURBAEY M. (2001, p. 502) thus summarises the position of ARNESON R. (1989) and COHEN G.A. (1989). There are of course many problems with this, from the fact that some people may be less capable of making the correct choice than others, even if they have the same opportunity set, to the fact that some people have more expensive tastes (or needs), and therefore can reach the same welfare level as other if they receive more resources. See also, ROEMER J.E. (1998), DWORKIN R. (1981a; 1981b; 2000), HURLEY S.L., 2003 and the essays in ARROW *et al.* (1999).

GRAPH 3



separating the two sets of individuals, those who go to university and those who do not, should be horizontal, as depicted in panel (c): attendance to university does not depend on family wealth/income/connections/background. And this is an area where equity considerations give the same answer as efficiency consideration: a downward sloping line separating the goers from the non-goers does not maximise the total “income” in society: suppose an individual characterised by a point like *A* in panels (a) or (b) went to university instead of an individual whose characteristics place him at point *B*, then, if the assumption equivalent to $y_{e\theta}(\cdot) > 0$ holds (yes, that assumption again), total society income increase. The pictures in panels (a) or (b) illustrate some of the trade-offs involved, and indicates avenues for empirical research. It is clear that, with imperfect capital markets education is more costly for the poor: giving up a euro of current consumption in order to finance education is inherently more expensive for poor people than for rich people: the latter may need to forgo the third holiday home, the former the third hot meal in the day. Formally, the first derivative of the utility function is decreasing, implying a different trade-off between current consumption and future consumption at various (current) income levels. This explains why, when education needs to be financed out of current income, poorer people are less likely (need higher θ) to invest in education,

that is, it explains why the curve is downward sloping left of the kink point in Graph 3(a). However, with perfect capital markets, this problem disappears: education can be financed by reducing “future” consumption, not current consumption. However, this is not so, as shown by panel (b), and by the portion of the curve to the right of the kink point in panel (a), where households are not liquidity constrained. Here the curve separating those who go to university from those who do not is also downward sloping. The reason is not marginal decreasing utility of consumption, as would be the case with no capital markets, but has to do with risk aversion: loosely speaking, university education is a risky investment, and if wealthier people are less risk averse (as empirically seems to be the case) then they will be more willing to take the risk of investing in education: the «risk adjusted cost of going to university is lower for them, and so they will require a lower benefit. This illustrates how even a very effective policy such a student loans, does not, unlike what is often claimed, ensure equality of access to university education» (Barr, 1997).

2.4 Human Capital and GDP

Or indeed efficiency: since as shown above, efficiency requires equality of opportunity. How important is efficiency in education, that is efficiency in the production of human capital? This is clearly an empirical matter, but all the studies suggest that the answer is very very important.

We need to distinguish two points of view, the individual's and the economy as a whole.

All the empirical evidence suggests that individual earnings are heavily affected by education. An earlier survey is due to Blaug (1965), but the findings he reports have been duplicated by an extremely large number of empirical studies. Psacharopoulos gives a recent update, and an extensive bibliography (Psacharopoulos and Patrinos, 2002).

A naive approach regressing earnings (or income, or other measures of labour market success) against years of education suf-

fers of course from serious estimation problems. These are essentially due to self-selection (Heckman, 1979; Willis and Rosen, 1979): it is, on average, brighter individuals who receive more education, and a naive regression of average earnings on years of education would an over-estimate of the returns to education, because it would include the returns to higher ability, as well as the returns to education. By and large, these problems can be overcome: several ingenious ways of doing so have been devised, from using identical twins who have received the same level of education (Ashenfelter and Krueger, 1994; Bonjour *et Al.*, 2002), to using the difference in months of schooling due to the fact that people «born early in the calendar year are typically older when they enter school than children born later in the year [and] will have less schooling, on average, than those born at the end of the year» (Angrist and Krueger, 1991, p. 982). After all care has been taken to weed out biases and measurement errors, the rate of return to education seems to be very robustly in the region of between six and ten percent per year: these are very large numbers by all accounts (Psacharopoulos, 2002).

But of course there is a difference between the benefit received by an individual, and the benefit received by society: high individual earnings for educated people could simply be achieved at the expense of individuals with low education. So it becomes important to estimate the benefits a nation receives from education. Education is viewed as creating “human capital”, in much the same way that investment in machines, plants and equipment creates physical capital. And just like the latter, the former is subject to depreciation.

At aggregate level, human capital can be measured in a variety of ways. Barro's earlier study (1991) proxies it with the schools enrolment rates. The idea is that if more people go to school, the human capital in society is higher. Barro finds a positive effect of human capital on growth rate. Another early study is Benhabib and Spiegel (1994). Depending on how human capital is entered into the aggregate production function it may or may not enter insignificantly in explaining per capita growth rates. They find that if «the growth rate of total factor productivity [is made to]

depend on a nation's human capital stock level [...] a positive role for human capital» is obtained.¹⁰

Quantity of education matters, but quality matters too, though, as noted by Hanushek (1986) the effects of improved student achievement on economic growth are substantial, but elusive. This elusiveness, and the related difficulty to measure it has important consequence for redistribution. Hanushek and Kimko (2000) attempt to quantify them. They combine the available test scores into a single composite measure of quality of education and try to explain differences in growth rates across nations during the period 1960 to 1990: Their basic models, which include the initial level of income, the quantity of schooling, and population growth rates, explain a substantial portion of the variation in economic growth across countries. Interestingly, the quality of the human capital, measured by mathematics and science scores is extremely important: one standard deviation difference on test performance explains 1 percent difference in annual growth rates of GDP per capita. This, over a long period, is an enormous difference, and would alone, explain the gap in current GDP in, say South Korea and the Philippines.

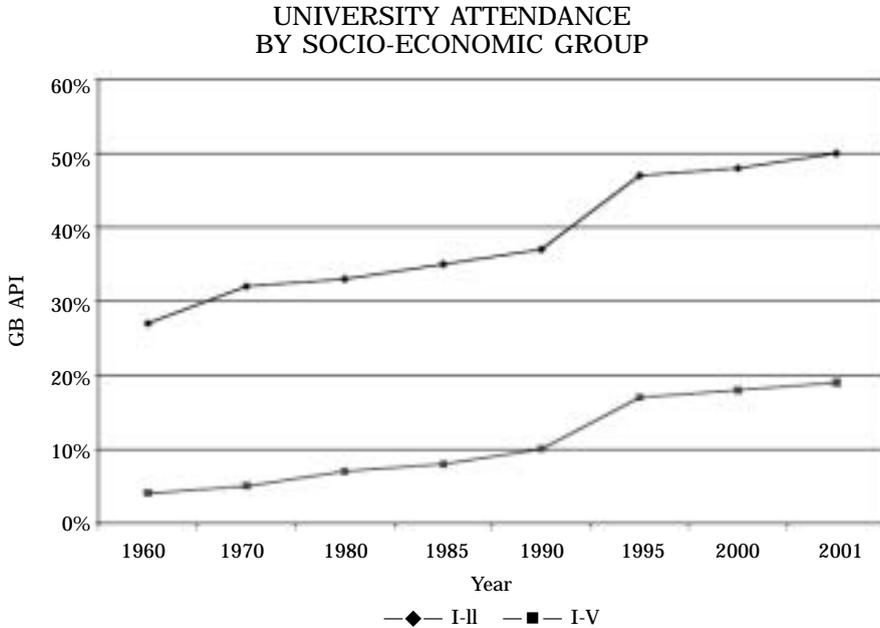
2.5 *Demand for Education*

Efficiency gains in education can therefore be very important. And returning to the theme addressed in Section 2.3, we have an important unresolved question, asked by Jim Mirrlees more than twenty years ago. (Mirrlees, 1982). Why do children of unprivileged background not go to university? Given that their attendance to university is essentially free (and it has been so for a long time), a picture like Graph 4, which shows how persistent the gap remains between attendance by the better-off and better educated and by the less well-off and less educated is puzzling.

It is hard to believe that there is such an enormous difference

¹⁰ For an extensive literature survey see BARRO R.J. - SALA-I-MARTIN X. (1995); see also Engelbrecht's recent survey of the relationship between expenditure and economic growth in OECD (2003) countries.

GRAPH 4



Source: SCHWARTZ S. (2003, p. 42).

in behaviour by the two social groups could be explained by difference in preferences due to mechanism similar to the different degree of risk aversion discussed in Section 2.3, by differences in information available about university attendance, or more controversially, by differences in innate ability in the children born to the two groups of households. It does seem too big; there must be something else, especially in view of the fact that, in the US and in the UK universities go out of their way to attract students from unprivileged background.

The answer to this question is at the core of the theme of this article, and in the rest of the paper we analyse various viewpoints and possible explanation for this difference, however, my belief is that there is no definite answer to this question, and that further research will need to focus on it.

One candidate explanation is that the schools attended by children of unprivileged background have lower standards and offer

lower achievement/motivation than the schools attended by children of more privileged background. This was investigated recently by Marcenaro-Gutierrez *et al.* (2004). This would imply that, to address differences in higher education participation, it is necessary to reform the school system.

For whatever reason, it appears that demand for education is not homogeneously distributed across social groups; this is confirmed by the early analysis by Bishop (1977), who assumes that demand for higher education depends on costs (implying liquidity constraint), and studies how (price) demand elasticities varies with the income and the ability of individuals. He found the highest elasticity in the lower income and low/middle ability group. These demand differences imply, in turn, that which education level is funded affects the redistributive effects of education expenditure. Roughly speaking, subsidising university is likely to be regressive, subsidising primary education is likely to be progressive. This is taken up in the next section.

2.6 Subsidies to Higher Education

We can now turn to the more specific theme of redistributive effects of “targeted” education expenditure, specifically to subsidies to post-compulsory education. Quantitatively, in the developed world, these are subsidised university attendance.

2.6.1 A Utilitarian Approach

The policy conundrum is simply put by Garcia-Penalosa and Walde (2000). They argue that «[i]f the average tax payer has a lower lifetime income than the average university graduate [...], a subsidy to higher education financed from general taxation implies reverse lifetime redistribution». There have been various attempts to justify subsidies to higher education on the ground that they benefit all groups in society: they all involve some externality, and as such they suffer from the criticism that such exter-

nalities are difficult to detect empirically, at least to an extent sufficient to justify the considerable intervention which Table 1 describes above. An earlier attempt is Johnson (1984). He suggests that unskilled individuals may be made better off by a tax-financed subsidy to higher education. There is an externality in production: unskilled are more productive if there are more skilled individuals, that is individuals with higher education. This complementarity between skilled and unskilled labour is similar to an investment in physical capital, which also increases the unskilled's productivity: unskilled individuals are better off if there is more investment in productivity enhancing machines (Bovenberg and Jacobs, 2001, consider a similar mechanism, with three groups). Other recent contributions also stress the positive effect on long run economic growth of subsidies to higher education (Poutvaara and Kanniainen, 2000; Dur and Teulings, 2001). A different argument is provided by Lommerud (1989): he assumes that individuals derive utility from their absolute income level (which allows more consumption), but also derive utility from their relative income, that is their position in the income ranking. If this is the case, then the redistributive effects of progressive taxation dampen the incentives towards investment in higher education, because the higher income which can thus be obtained will be taxed at a higher marginal rate, and will lower a graduate's position in the income scale. To restore the incentive to undertake this investment, the marginal cost should also be lowered, in order to bring the level of investment in higher education closer to its efficient level.

A subsidy at a given rate does precisely that (Kang, 1991 for a similar, more direct, mechanism). At an intuitive level, this is an appealing argument, and for example, might be an explanation for the epochal shift in both the rate of progressivity of income taxation and the rate at which higher education is subsidised, both of which appear on a trend towards lower levels. The usual difficulty with this sort of arguments is the paucity of empirical tests, in view of the fact that the importance of relative income levels in individual preferences is very difficult to quantify.

2.6.2 A Political Economy Approach

A different approach is to introduce political economy considerations into the picture. This is a more “American” approach: in the US, where voting takes place at local level and the voters choose the local board of education, rather than local councils, normally choosing between candidates who favour a high local (property) tax and high education spending, and candidates who advocate low tax and low spending on education; note however, that the importance of this voting mechanism is lower than it is assumed in most theoretical models, in consequence of the *Serrano v. Priest* ruling of the California Supreme Court, and other similar state court rulings, which effectively required the state to equalise per pupil education expenditure. In most European countries education policies are decided by the central (or state) government, which is elected by voters at a general election, where education considerations jostle for importance with all other issues of concern to the voters.

An important point with very stark redistributive consequence, highlighted very clearly in Fernandez and Rogerson’s (1995, p. 250) elegant model is the link between «the fact the subsidies to public education redistribute income towards higher income individuals and the fact the education is only partially public provided». In their model there are three groups of individuals: with full subsidisation of education (financed by proportional taxation), all groups are educated, and the richest group pay the most for education. If, however, education is only partially subsidised, then the rich benefit, because the poor find the subsidy insufficient to fund the gap which must be filled in order to go to university, the total cost of the education subsidy, and hence the total amount of taxation required is lower, and the rich are better off. The middle income may also be better off: depending on income levels and preferences, they may prefer the lower subsidy and the lower taxation, and vote accordingly. When this partial subsidy commands a majority of the votes, the individuals in the poorest group subsidise the education expenditure of the rich and the middle class.

In the Fernandez and Rogerson model there is a coalition of

the rich and the middle class to expropriate the poor. In a model in a similar spirit a different possibility is considered by Epple and Romano (1996). The title is an excellent summary of the contribution itself: *Ends Against the Middle: Determining Public Service Provision when there Are Private Alternatives*. The model is slightly different in that there is a continuum of income levels; rather than a three "atoms", but the crucial difference is the possibility that individuals have of not using the public sector, but resorting instead to private education. Here, like in many other models, they would do so in order to obtain higher quality of provision. In this set-up, Epple and Romano (1996) show that it is possible that rich and poor voters gang-up against the middle class to lower the education expenditure below the level preferred by the median voter. This happens with proportional taxation: the poor, who would pay (in absolute terms) the least for education prefers low education because for them it is preferable to consume the "other goods" (the third hot meal mentioned above) even at the lower cost determined by the subsidy, rather than receiving education, and the rich because the education level provided by the state sector is so low that they prefer to send their children to private schools, and therefore view any tax-financed expenditure on education as a reduction of their consumption in "other goods" (fewer cruises), with no benefit. Together they vote for a lower level of taxation and education expenditure. Note the importance of the private education option. The rich vote for a zero education subsidy even though they have a stronger preference for education, because they do not send their children to the state provided school anyway.

3. - Other Features of the Education Mechanism Interact with Distribution

3.1 Rationing Mechanism and Distribution

The overwhelming majority of markets ration through price, some through queuing (egregiously the old Soviet Union, but also many state provided health services). Education is probably

unique in that the balancing of supply and demand is obtained in many cases through some tests of the ability to benefit. There are of course exceptions. Many private schools in the UK and elsewhere are in a competitive equilibrium (or monopolistic competition equilibrium): demand at the current price equal supply at that price, as are many lower quality fee-charging universities. And anyone familiar with the UK university admission system, will have certainly formed the opinion that there are substantial elements of allocation by a random mechanism. Many universities in continental Europe operate a variant of the queuing system, whereby every applicant is admitted, but only a percentage survive to complete the degree: attrition is obtained through exams or through exhaustion: only the students who survive overcrowded lecture rooms, who have the time and stamina to endure lengthy commuting, unsuitable accommodation, queues for library books, and for instructors' time; or of course those whose parents can afford to pay to avoid all of these, can proceed to obtain a degree. Gary-Bobo and Trannoy (1999) call this "selection by failure", and the benefits and costs of this system relative to one where test are used is analysed theoretically by Oliveira (2004).¹¹

But for non-compulsory high quality education (surely the type we are all most familiar with), admission tests are used pervasively. Why? An early analysis is a paper by Fernandez (1998). She builds a model where households differ along the two dimensions of ability to pay and ability to benefit, and starts from the comments which could be made that, if there are liquidity constraints, then an admission system based on examination would be fairer, and so preferable both from efficiency and equity viewpoint, in that rationing would not depend on ability to pay. But she also notes that to some extent it is possible to train for exams (teaching to tests), and the market would exploit the profit opportunity of training students to pass the test:¹² ability to pay

¹¹ The costs are the teaching resources which are wasted because students do not graduate, the benefits are due to the fact that selection is more accurate if students take exams after one year of study: fewer type 1 and type 2 errors occur.

¹² As indeed the market does, as a quick visit to the Kaplan website (<http://www.kaptest.com>) will convince the reader: as an example, a 32-hour tutoring course for SAT in New York is charged at \$4200.

would once again determine admission to university, albeit by the back door, by ensuring that children from wealthier households have a higher probability of passing the test. Fernandez shows that, with perfect capital markets, prices and tests achieve exactly the same admission pattern; but prices are socially preferable because they avoid the wasteful expenditure on exam training. The picture changes with liquidity constraints. In this case tests are superior with regard to the admission policy, as they match schools and students better. Whether they are socially preferable depends on the accuracy of the exam test, as this determines which of the two sources of inefficiency prevail associated with the two instruments, the mismatch caused by prices, and the wasteful test expenditure cause by tests.

In Fernandez's paper admission is based on either prices or tests, but not both. More recently Gary-Bobo and Trannoy (2004) build a model, where, in line with practice, universities use both fees and tests. There is an important difference with Fernandez (1998), in that they posit double-sided asymmetry of information: they assume that students have private information about their own ability, and that universities also have private information about the student's ability. This can be due to the fact that admission officers understand the potential of a given applicant better than the applicant herself (which of course is something we all agree with). In this case, Gary-Bobo and Trannoy (2004) show, social optimality requires universities to use both fees and tests. The intuition is appealing: fees are needed to give a disincentive to students who know they are weak from enrolling into university, and tests prevent students who are too optimistic about themselves from enrolling. In analogy with a standard market, prices select those with willingness to pay, but unlike a conventional market, tests select those with capacity to benefit, among those who have willingness to pay the fee or more. Interestingly, the same mechanism works for a profit maximising university, the fee extracts the student's willingness to pay for education, and the test keeps weak students (more expensive to teach) out of the system.

It is very easy to see how a distributive concern interacts with

this mechanism. It seems likely the case that the variance of the signal is differently distributed in different social and ethnic groups. Children whose parents and grandparents are university educated are likely to have a better understanding of their own abilities and potential once they obtain a degree. An open question is how this affect a university optimal admission policy.

This has important consequence for the pursuit of social justice objectives. Consider affirmative action. The generally acceptable aim of helping disadvantaged children is turned into a hot potato by the existence of a non-price allocation mechanism. Giving the place to someone who “deserve it less”, but happens to have a different skin colour, heats tempers. If the disadvantaged were helped solely via the price mechanism I believe that it would be much less contentious: after all opera houses are not taken to the Supreme Court for offering discounts to students and pensioners. The book by Bowen and Bok (1998) is an excellent account of how American university implement affirmative action in practice, and of its consequences. My paper (De Fraja, 2005) illustrates how the practice can be justified on purely efficiency grounds (so there may be no conflict between equity and efficiency). The papers by Chan and Eyster (2003) and by Epple *et al.* (2004), are somehow a mirror image of my paper, as they illustrate how there can be large costs if universities have a preference for admitting students from disadvantaged groups, but are prevented from doing so explicitly by law.

3.2 The Location of Education Activities

An important factor in the “consumption” of the good education is the fact that consumers and suppliers are not very mobile: children must go to school, and must therefore live nearby (or board). This has powerful consequences for distribution. On the one hand house prices act as a pricing device for nominally free schools. Here the invisible hand shows its power: if it is prevented from adjusting prices of one good (education services), it operates indirectly, by adjusting the price of a complementary

good, housing. This is an application of Tiebout's early deep intuition of community formation (Tiebout, 1956); when there are goods which are provided to and paid for by a community, individuals tend to sort themselves in communities according to their willingness to pay. Becker and Murphy's (2001) analysis show how small differences in willingness to pay among groups can in fact lead to very strong differences in provision as a consequence of stratification.

The subsequent literature has shown how pervasive the phenomenon is for schooling, and how complexly it interacts with other features of the education market, such as the presence of private schools, or peer group effects (de Bartolome, 1990). Intuition here, as in much else in the area of the economics of education, is not a good guide. It is possible, for example, contrary to what one would expect, that private schools are used by relatively poor households, while wealthier households send their children to state schools. This has been shown to be possible, in a theoretically rigorous set up, by Martinez-Mora (2004). The intuition behind his formal analysis is compelling, and follows from the interaction between house prices and schooling: an area may have very good schools, and is populated by very wealthy households, which have a high willingness to pay for education, and do so by pushing the price of housing up. This makes it too expensive for lower income households to purchase a house in the area, and therefore they choose to live in an area where housing is cheap, but, because they value education, send their children to private schools, since public schools in their area have insufficient quality. Recently, Gibbons and Machin (2003) have attempted to quantify the value on the quality of primary schools, by determining how much higher house prices are in areas where there are better schools.

A related issue, which again is suggested to be important by intuitive consideration, and appears to be relatively neglected by theoretical analysis, is the link between the quality of teachers and the location of the school. It is a fact that it is easier/more pleasant/less stressful to teach well behaved middle class kids with books and computers at home, whose parents take them to

trips to the British museum and the National theatre, rather than children whose time is spent watching television and playing with their playstation (or worse). Some teachers relish the challenge of motivating deprived kids, but, given the choice, most teachers will opt for a middle class school. And of course, in most systems, teacher do have the choice, and consequently better/more experienced teacher will tend to concentrate into middle class schools: this is true both in systems where appointments are local (good teachers only apply to good schools), and in systems, like in Italy, where there is a ranking, based on experience and qualifications, and top placed applicants have first pick of places available. In addition, teacher appear to have a geographical preference for where they teach (Boyd *et al.*, 2003). This clearly perpetuates the disadvantage of deprived areas, where fewer pupils become teachers. Note again the clash between equity and efficiency: it being more costly to educate children from deprived background, because, for example, teachers need to be offered monetary incentives to teach in schools in deprived areas, efficiency considerations would indicate that they should receive less education.

3.3 *Peer Group Effects*

Education has been defined a “customer-input technology”: the characteristics of the customers affect the quality of the output (Rothschild and White, 1993; 1995). This is because of the “peer group” effect: students learn better if they are in a group of abler students. This is a reasonably well documented phenomenon; see Moreland and Levine (1992) for a survey from a psychology/education viewpoint, Summers and Wolfe (1977), Henderson *et al.* (1978) for early economic empirical studies, and Epple *et al.* (2003) and Zimmer and Toma (2000) for more recent ones. The theoretical analyses of Arnott and Rowse (1987) and de Bartolome (1990) were among the first to take the peer group effect explicitly into account. The recent contribution by Winston and Zimmerman (2003) puts the role played by the peer

group effect into the right methodological perspective. They argue that peer group effects help explain some large and awkward anomalies in the economic behaviour of colleges and universities and the economic structure of higher education as an industry. Peer group effects may also justify as economically efficient the observed segmentation of student quality and resources — the institutional disparities we observe in American higher education — if they are appropriately non-linear. And finally, they lead to trade in peer quality in a market inextricably linked with that for educational services. Both of those markets and their interaction are essential to understanding pricing, admissions, and competition in higher education. The organisation of these markets points convincingly to the existence of peer group effects, though not whether they are approximately linear or sufficiently non-linear.

The strength and importance of the peer group effect — and whether it is approximately linear or not — has important influence on the technology of education provision. There is a big debate about streaming (tracking in US English, see Argys *et al.*, 1996), commonplace in UK and virtually unknown elsewhere, for example in Italy. This is the practice of differentiating education provision according to the ability of the children: it goes from having completely separate classes for abler and less able children, to, more modestly, putting children in the same class in groups for some activities which are formed according to the children ability to perform that particular activity. If the peer group effect is strong, then the practice of streaming will reinforce differences between pupils, and if pupils' differences in ability are related to differences in socio-economic background, then these differences affect the provision of education. Note the importance of linearity: if peer groups effects are approximately linear, the positive (negative) externality that a student of higher (lower) ability than the average bestows on her peer is approximately the same irrespective of the average quality of her peers, and therefore there is no efficiency rationale for putting more able pupils in the same class, it only affects the equity of the provision of education, by increasing the benefit of expen-

diture on abler pupils and correspondingly decreasing the benefit of expenditure on less able pupils. A related point is the “timing” of streaming: Brunello and Giannini (2004*a*; 2004*b*) study how equity and efficiency considerations affect the choice of the age at which pupils are allocated to a school type: some students will attend more “academic” schools, which would normally lead to university education, other more vocational schools, leading to less academic career, such as childcare, hairdressing, brick-laying, tourism, and so on. Brunello and Giannini (2004*a*; 2004*b*) study the different effects of the timing at which pupils need to make this choice: this is clearly a policy variable, as the debate on the 11-plus and comprehensive education in Britain showed. One can see the similarity of this trade-off to that of the timing of the selection of university students mentioned in Section 3.1 identified by Oliveira (2004) between early selection, which saves teaching costs, and late selection, which selects more accurately. Note, however, that the efficiency-equity trade-off is different: in university admission, late selection helps the better-off (who have more resources to sustain the attrition of queues and miserable accommodation); in school selection, the initial advantage of growing up in a socially and culturally favourable environment is attenuated as time goes by. These considerations suggest that we need a better theoretical understanding of this facet of education provision.

Finally, it is worth noting that it is also the case that the peer group affects demand for education. This may be part of the explanation of the lower attendance of pupils from less privileged background alluded to in Section 2.5, but it has not been captured in a formal model. This however may well be an important factor: clearly, if all your friends and class mates go to university, spend all their lunch breaks leafing through undergraduate prospecti, and ask their teacher how to improve from B to A at their final exams in order to gain access to the institution of their choice, you are more likely to apply to university than if your friends main worries are underage drinking (their own, that is) unwanted pregnancies (their own, or their girl-friends’) or passing their driving test.

3.4 *School Production Function*

The quality of the school matters. The previous two sections highlighted two factors which affected the quality of schools, its teachers and its pupils. Both, we argued, work in the direction of amplifying inequalities in social background. The government could of course, operate a countervailing mechanism, by allocating more resources to schools in less privileged areas. And of course governments across the world do so. However, the effects of more monetary resources are hard to quantify, or even determine. Hanushek (1986) finds that “aggregate data [indicates] that there is at best an ambiguous relationship and at worst a negative relationship between students performance and the inputs supplied by schools” (Hanushek, 1986, p. 1148; an excellent survey is Vignoles *et al.*, 2000).¹³

At a very basic level, we need to know the production function for education: how inputs combine to determine the educational output. An earlier study in this line of research is the celebrated Coleman report (1966); this has been criticised by subsequent literature (Hanushek, 1986, p. 1150), but it has inspired a large literature attempting to identify the inputs in the education production function. Among the inputs, class size has received much attention is (recent studies are Krueger, 1999 and Lazear, 2001 for the US, and for the UK, Dustmann *et al.*, 2003). Class size, counterintuitively, appears to have little effect on educational achievement; more recently, and more generally, Hanushek, 2004 analyses the apparent paradox that there has been a very large increase in the amount of money invested in the education process, but with only very marginal improvement in performance; confirming and somehow extending his 1986 work.¹³

¹³ At least a passing reference must be made to the relative quality of private and state schools. A naive view may argue that private schools must be better: otherwise why pay for something that you can get for free: many earlier models are built precisely on this assumption (EPPLÉ D. - ROMANO R.E., 1998; IRELAND N., 1990). It is however not difficult to find reasons why this need not be the case. FIGLIO D. - STONE J. (1999) argue that religious schools in the US do not offer a superior educational experience: presumably parents choose because they offer better religious education. In the same vein, a recent scandal in Italy where private

Other factors, which are not determined by the government enter the education production function. Family size appears to affect educational achievement (Blake, 1989). One possible explanation of why this should be the case is that parents have a utility function that depend on their own effort, that parental effort affects positively children's attainment, and that parent effort is subject to decreasing returns to scale, as proposed by Becker and Tomes (1976), and tested by Hanushek (1992) and De Fraja *et al.* (2004).

Also, family composition may be relevant, both with regard to the number of children, to the presence of step-siblings and to the presence of both parents or just one. These are hot topic, because of the strong political feelings that arouse, and it is interesting to note the results by Ginther and Pollack (2003), who, in line with much of the literature find that step children have lower educational attainment than children who grew up in intact families an intact family is one where all the children are biological children of both parents. This is in line with the intuition of the role of parental affection as an educational input. One of the novelties of their paper is their comparison between biological children of both parents and step-children living in the same family (the latter are biological children of only one of the parents). Their result, which somehow contradicts the "parental love" explanation, is that the achievement of these two groups of children is not significantly different and it is also statistically significantly lower than the achievement of children from intact families, and similar to the achievement who grew up in single parent families. They offer two possible explanations for this finding. It could be due to the presence of some unobserved variable, correlated with both family structure and children achievement (they don't

schools were selling diplomas, by providing the answers in advance has prompted BRUNELLO G. - ROCCO L. (2004) to observe that private schools need to be superior to (free) public schools in some respect, but that this respect need not be education, but can be leisure. It is also the case that some public institutions, such as universities impose ability thresholds for admissions, and therefore private institutions may emerge as residuals for those students who cannot be admitted to free state institutions: they prefer to pay rather than not receive any university education at all (OLIVEIRA T., 2003).

use this word, but “adult altruism” seems a good name for such variable), or it could be due to the fact that step-children disrupt families, lowering not only their own educational achievement, but also that of their step-siblings who are biological children of their parent.

4. - Conclusion

This paper illustrates sufficiently, I believe, the complexity of the interaction between education provision and redistributive policies. There is however, much more in the education market that impinges on distribution. How competition affects the allocation of public education expenditures and especially its benefit is a topic that I have not mentioned here, and that, incidentally, has not received the attention it deserves. To the extent that competition needs the diffusion of information about schools’ performance to operate effectively, then it seems likely that educated, well informed parents will be able to make a better use of the information available, and therefore to select the better schools for their children. Competition, therefore, while enhancing the efficiency of the education system, may well have adverse distributive effects.

Also intergenerational distributive considerations should be taken into account. Clearly, the introduction of tuition fees for one generation of students reduces the tax burden of the previous generation, who, having received “free education”, funded by their parents’ taxes, now finds that it does not have to pay for the education of the current young individuals. There are equity and efficiency considerations. The paper by Boldrin and Montes (2001), considers the role of other institutions, such as public pensions.¹⁴

¹⁴ Intergenerational considerations may become important in evaluating the efficiency and equity trade-off, when for example, by altering the social background of today’s deprived households economic policies affect the social background and therefore possibly the marginal benefit of education of the grandchildren of today’s deprived households. As far as I am aware, there is no theoretical analysis along these lines.

They show that, when designed jointly with the education policy, it is possible to implement an intergenerational transfer identical with the market allocation, which is efficient and equitable. They show that the young “borrow” from the previous generation to invest in human capital. They “pay back” their debt when they earn in the labour market via a social security tax, the proceedings of which finance pension payments to the now elderly lenders.

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