Draft preparato per il XX Convegno Nazionale di Economia del Lavoro (AIEL)

Bequest taxation, allocation of talents, education and efficiency

Stefano Staffolani and Enzo Valentini *

7th September 2005

Abstract

This paper provides deep insight into educational aspects of interegenerational mobility. The first part of the paper is devoted to present some empirical findings suggesting that educational attainment of children depends more on their parents status than on their own talent. Then, we present a theoretical model, consistent with the empirical findings, where the decisions concerning education may be financially constrained. As such this would generate a low intergenerational mobility that could imply a negative effect on efficiency. This issue may be faced adopting an intergenerational redistribution which we assume dependent on bequests taxation. We show that bequest taxation has positive effects on average utility.

Keywords: education, bequest, talent allocation

JEL D33, I22, I30, J24

*Università Politecnica, delle Marche, Ancona, Italy. E-mail valentini@dea.unian.it
We thank Massimiliano Bratti, Fabio Fiorillo, Renato Balducci, Riccardo Lucchetti for their useful comments. The usual disclaimer applies

1 Introduction

A large body of empirical findings has shown that a correlation between father/mother and children socio-economic status exists[1]. Among the most recent papers, Chevalier et al. (2005), using the Labor Force Survey database, confirm that, in the U.K., parents' and children's income and education are highly correlated, with stronger effects of maternal education than paternal and stronger effects on sons than on daughters. Comi (2004), using the LIS database, studied intergenerational mobility in income and education in European countries, finding that Italy is the most "immobile" country in Europe.

This paper provides deep insight into educational aspects of interegenerational mobility, which could be the most crucial kind of mobility for a system as a whole, with the aim of checking the relationship between intergenerational mobility and allocational efficiency, which requires that higher educational levels are attained by more talented individuals. The main idea of the paper is that this problem could arise if people endowed with high ability cannot enroll to high educational grades because of some "constraints" and, finally, that this issue could be faced via an intergenerational redistribution of wealth.

Assuming that financial constraints are effective in driving educational decisions (as section 3 seems to show) the theoretical model of section 4 predicts a lower ratio of educated individuals coming from non-educated families than from educated ones and affirms the existence of "misallocated" [2].

One of the main finding of the model is that intergenerational redistribution via bequests taxation is desirable, because, helping children endowed with high ability and coming from poor families to circumvent financial constraints, it increases the average talent of skilled people, generating a better ability allocation and an efficiency gain measured in term of average utility[3].

The paper is organised as follows. Section 2 report a brief survey concerning the intergenerational persistence in status inequality and the influence of bequest taxation on it. In section 3 we examine the (well known) intergerational transition matrixes of Italy, US and UK, trying to study more deeply the links

[1] See, among others, Charles and Hurst (2003), Ermisch and Francesconi (2001), Behrman and Rosenzweig (2002), Erikson and Goldthrope (2002).

[2] In the model people are assumed to be heterogeneous in their talents so that we refer to "misallocated individuals" as those whose position is dependent on the family: unskilled children of unskilled parents who would have been skilled and skilled children of skilled parents who would have been unskilled if the allocation in the skilled position were not dependent on social class but on individual's talent alone.

[3] Noteworthy, this results appear only in the case that the fiscal yield coming from bequest taxation is redistributed throughout all the population and it does not appear if it is used to finance education.

between the persistence of educational attainment and ability allocation. In section 4 we present a theoretical model where an efficiency problem in talent allocation appears and where both parents' "bequest" and state redistribution are crucial in determining schooling financing and educational attainment. Section 5 concludes.

2 Brief overview of the literature on intergenerational mobility and bequest

Although there are no doubts about the persistence of status inequality, there is no general agreement on the causal mechanisms behind it. Focusing on differences in schooling decisions, two main theories have been developed and empirically checked by economists[4]:

- the most popular theory, started by Becker and Tomes (1979, 1986), emphasizes the role of "short-run" financial constraints, which make it difficult for low income families to enroll their children in high education levels, even if children show high ability during compulsory school[5].
- the second hypothesis, recently emphasized by Carneiro and Heckman (2002), gives more importance to "long-run" factors, so that high-status children are, on average, the ones who posses the talent required to take advantage of higher education[6].

Actually, both "short-run" financial constraints and "long-run" family factors play a role in educational attainment persistence, the latter mainly via cultural influences and "ability" acquired in family environment. Moreover, we must consider the genetic transmission of talents from mother to children. Therefore, "nature" and "nurture" components of parental background are important in determining children's educational outcomes. "Scholastic ability",

[4]Checchi (2005) present a complete survey of education related topics and show some conclusions linked up with our issues.

[5]Checchi D. (2003), with a cross country analysis, suggests that financial constraints limit access to secondary school. Shea (2000) empirical results are potentially consistent with the hypothesis that credit market imperfections constrain low income households to make suboptimal investments in their children; Krueger (2004) reviews various contributions supporting the view that financial constraints have a significant impact on educational attainment. See also Kane(1994), Ellwood and Kane(2000).

[6]Carneiro and Heckman (2002): "most of the family income gap in enrollment is due to long-run factors that produce the abilities needed to benefit from participation in college", however, they found that also "short-run" financial constraints play a (minor) role in socio-economic inheritance.

usually measured by grade attainments, comes from different sources, because it is both genetically transmitted (*nature*) and acquired into the family at early ages: richer and more educated families are better off in assisting children to develop cognitive ability (*nurture*)[7].

Bowles and Gintis (2002) decompose status persistence between generations in various channels, concluding: "wealth, race and schooling are important to the inheritance of economic status, but IQ is not a major contributor and (...) the genetic transmission of IQ is even less important". Even if the correlation of IQ between parents and children ranges between 0.42 and 0.72 and if a positive relation between cognitive ability and earnings is well documented in economic literature (Bowles, Gintis and Osborne (2002), between others), Bowles and Gintis pointed out that IQ is not a relevant determinant of economic success by itself. Plug and Vijverberg (2003), considering differences in educational attainment between adopted children and children who are their parents' own offspring, found that it is only to a certain extent that ability is an important factor in explaining the educational attainment, but that about 50% of ability relevant for education is inherited [8].

There are many theoretical models that consider the influence of bequest taxation on inequality and/or on production and growth[9]. Few attempts have been made to strenghten the role of bequest taxation by relaxing financial constraints. Becker and Tomes (1986) consider financial constraints in education, but they do not contemplate bequest taxation and its consequences, simply emphasizing that income taxes reduce incentives to invest in education. More recently, Grossman and Poutvaara (2005), in a framework with a representative agent and intended bequest, suggested that a small bequest taxation may favor efficiency because parents evaluate children education and bequest leaving as substitute goods.

If financial constraints are relevant in leading to educational attainment and the bequest left to children contributes to determining schooling performance, the investigation of the motives for bequest becomes a crucial point. Four categories of motives are mentioned in economic literature:

- the first is based on the idea of *altruistic bequests*: parents care about the

[7]See, among others, Mulligan (1999), Bowles and Gintis (2002), Plug and Vijverberg (2003).

[8]One must be careful with these results, because the dataset used in the analysis reports IQ only for one parent.

[9]Atkinson and Stiglitz (1976), Kopczuk (2001), Blumkin and Sadka (2003), Cremer and Pestieau (2001), Michel and Pestieau (2004).

utility of their children[10].

- the second refers to *exchange-related motives* that induce old men to remunerate their children for their care taking with an implicit "promise" of a bequest[11].

- the third considers that, in an uncertain world, *accidental bequests* should exist because people do not know the date of their death[12].

- lastly, parents may receive utility from the act of giving (*joy of giving*)[13]. Formally, this sort of bequests are included in the utility function as a consumption in the last period of life.

In the model we assume the *joy of giving* motive as the cause for bequest, because it seems to be supported by (few) empirical studies on this topic. Bernheim et al. (2001) and Joulfanian (2005) found some evidence that bequests are clearly intentional and Page (2003) added that "there is a significant positive correlation between the amount of gift given and tax rates, especially for older households". This last evidence suggests that what matters to the donor is the "net" and not the "gross" amount left to children and reduces the relevance of the *accidental bequests* hypothesis. In particular, we consider bequests as a sort of consumption in the last period.

3 Empirical transitions and abilities

Individual data needed to produce empirical evidence about mobility and abilities are social background (e.g parents education), educational attainment and a proxi for talent. The last information is particularly difficult to be obtained. The economic literature considers IQ level, results of literacy and mathematical proof made at early ages, or grades obtained at the end of school courses[14]. All these indicators, referring to students aged usually above 12, are obviously influenced by the ability acquired in families, hence they measure the "scholastic" talent and not the "genetic" one. We will go deeper into this issue in paragraph 3.3.

Our analysis is based on three different databases: the Italian 2002 SHIW

[10]Barro(1974), Becker and Tomes(1986).
[11]Cremer and Pestieau(1991).
[12]Davies(1981), Abel(1995).
[13]Cremer and Pestieau (2004), Glomm and Ravikunar(1992).
[14]See Woessman (2004), Bowles and Gintis (2002), Carneiro and Heckman (2002).

database[15], the British 1999 BCS database [16], the US NLSY 1997 database[17].

Given that these three databases collect information in a very different way, that they refer to different cohort of individuals (all ages for Italy, people aged around 40 in 2000 for Great Britain and people aged between 17 and 23 in 2002 for the US) and that they present different classification for educational attainment, we will not use them for comparisons between countries[18].

Using these databases, we present[19]:

- the two states intergenerational transition matrix (educational attainment of parents and children), defined in different ways according to the avail-

[15]The 2002 SHIW database is built by the Bank of Italy. Families are the object of the survey. Our individuals are householders and spouses/partners (whose father's and mother's education is available from the survey) as well as children living in the family who have stopped studies (4690 individuals). The talent can be proxied for those people who get the *maturità* title (higher secondary school certificate) or more alone, by means of the grade obtained at the end of the educational process (we use the standardised relative grade). Therefore, we consider as unskilled all those individuals whose highest educational level is *maturità* , and as skilled all those individuals who completed university. In order to increase the number of skilled parents, we consider "skilled" all fathers and mothers with the "maturità" or more.

[16] We analyze the cohort of individuals who answered to propensity scores in 1970, and who were re-interviewed in 1999 (5613 individuals). For these observation we know parents' education, the result of propensity score at the age of 10 and the highest educational level obtained at the age of around 40. Our categories of skilled/unskilled distinguish between people who obtained the *A-level* (at school until about the age of 16) or more from people who do not get it. As a measure of talent, we consider the *British Score Assessment* (BSA) in verbal method (the sum of *acceptable* answers to "word definition" and "similarities") and the BSA in quantitative methods (the sum of *acceptable* answers to "recall of digit" and "matrices items"). The data presented in the text refer to the standardized sum of answers of both indicators.

[17]The NLSY97 consists of a nationally representative sample of approximately 9000 individuals who were aged between 12 and 16 in 1996. Round 1 of the survey took place in 1997. In that round, both the individual and one of her parents were personal interviewed. Youths are consecutively interviewed every year collecting extensive information about labor market behavior and educational experiences over time. We analyse data from round 5, considering the children educational status in 2002 and defining skilled those who enrolled in college. We use the standardised PIAT score (whose results, corrected by the age of the answerers, are available from 1997 to 2002) as a measure of individual talent; for students who answered the test more than once, we use the earlier score (using the average score does not affect our results). The sample is composed of 4415 individuals.

[18]Countries can be compared using the TIMSS database that presents scores in Literacy and Math for students aged 14-18 in different countries and information on parents' education. Unfortunately, educational attainment of students has not been recorded. However, their *future intentions* with respect to their studies have been asked. Obviously, this is a different information from the one considering educational attainment. Therefore we will not use the TIMSS database here.

[19]In Appendix we present some estimated probabilities of becoming skilled, for both children of the skilled and of the unskilled with respect to ability

ability of data in the three datasets; section 3.1);

- the *ability matrix*, where we compute the average talent differentiating by educational attainment of parents and of the individuals (section 3.2);
- a rough proxy of “inborn” talent to compute an *inborn ability matrix* (3.3);
- the quota of *bad allocated* individuals, defined by the ratio of unskilled (skilled) individuals with unskilled (skilled) parents who, given their talent, should have (not) obtained the higher degree (section 3.4).

3.1 Transitions

As emphasised by the economic literature, intergenerational mobility is far from being perfect[20]. These results are strongly confirmed for Italy (table 1), UK (table 2) and the US (table 3). In fact we always obtain that unskilled families show a lower percentage of skilled children than skilled families.

Table 1: Transition matrix, Italy, 2002 - Individuals with at least the secondary school

		Education		
Parents' education		Secondary Sch.	University	Total
Below Secondary Sch.	obs	2581	588	3169
	%row	81.45	18.55	100
Secondary Sch. or above	obs	925	596	1521
	%row	60.82	39.18	100
Total	obs	3506	1184	4690
	%row	74.75	25.25	100

Source: SHIW database

It emerges that the probability of getting education for children of unskilled parents is less than a half of the same probability for children of skilled, both for Italy and the US, whereas in the UK this measure is slightly higher than one half. As it is well known, Italy is between the countries with lower intergenerational mobility[21] .

3.2 Talent and transitions

The availability of data on transitions and some proxies for talent (see notes 15, 16 and 17), allows us to calculate the average individual ability for the four

[20] As said in introduction, see i.e. Chevalier et al. (2005), Ermisch and Francesconi (2001).
[21] Comi(2004).

Table 2: Transition matrix, Great Britain, 1999 - cohort of individuals born in 1970

		Education		
Parents' Education		Below A Level	A level or above	Total
Below A level	obs	3232	1341	4573
	%row	70.68	29.32	100
A level or above	obs	498	542	1040
	%row	47.88	52.12	100
Total	obs	3730	1883	5613
	%row	66.45	33.55	100

Source: BCS database

Table 3: Transition matrix, USA, 2002 - cohort of individuals born between 1980-84

		Education		
Parents' Education		Below College	College or above	Total
Below College	obs	1655	625	2280
	%row	72.59	27.41	100
College or above	obs	844	1291	2135
	%row	39.53	60.47	100
Total	obs	2499	1916	4415
	%row	56.60	43.40	100

Source: NLSY97 database

groups outlined by the transition matrix. Our aim is to calculate the level of individual talent that allows, on average, access to a higher educational level, considering separately children of skilled and unskilled parents.

Tables 4, 5 and 6 all confirm that, on average, the "talent", measured by the score obtained, is higher for children of skilled individuals[22].

Defining average talent as $\overline{a}^{JJ}$ for $J = S, U$, where the first index[23] identifies the parents' educational status (the highest between father and mother) and the second index identifies educational attainment of the individual, we have: $\overline{a}^{SS} > \overline{a}^{US} > \overline{a}^{SU} > \overline{a}^{UU}$.

At this stage, results suggest that an allocation problem should not arise because children of skilled parents get education more easily, but they are also the more talented, meaning that educated parents make the most educable children.

[22]Scores have been standardized for all countries.

[23]Obviously, S=Skilled, U=Unskilled.

Table 4: Average talent by group of individuals, Italy, 2002 - all population

		Education		
Parents' education		Below Secondary Sch.	Secondary Sch. or above	Total
Below Secondary Sch.	avg	-0.39	0.99	-0.14
Secondary Sch. or above	avg	-0.25	1.11	0.29
Total	avg	-0.36	1.05	-0.00

Source: SHIW database

Table 5: Average talent by group of individuals, Great Britain 1999- individuals born in 1970, talent at the age of 10

		Education		
Parents' Education		Below A Level	A level or above	Total
less than A level	avg	-0.30	0.39	-0.10
A level or more	avg	0.02	0.68	0.36
Total	avg	-0.25	0.47	-0.01

Source: BCS database

Table 6: Average talent by group of individuals, USA 2002 - individuals born in 1980-84, talent at the age of about 18

		Education		
Parents' Education		Below college	College or above	Total
Below college	avg	-0.50	0.14	-0.32
College or above	avg	-0.02	0.58	0.34
Total	avg	-0.34	0.44	0

Source: NLSY database

Table 7: Average talent by group of individuals, residuals, Italy, 2002 - all population -

		Education		
Parents' education		Secondary	University	Total
Below secondary Sch.	avg	-0.26	1.12	-0
Secondary Sch. or more	avg	-0.53	0.83	-0
Total	avg	-0.33	0.98	-0

Source: SHIW database

3.3 Transition and a rough proxy of "innate ability"

Different measures of talent imply different results in the empirical evidence. We know that the measure used in the previous section is a "Scholastic ability", affected by the talent acquired in family in the early years of life (and by the quality of school and many others factors) that is likely to be greater in an "educated family".

In order to build a proxy of "inborn" talent, or at least purified by every family factors, we estimate our measure of talent on parents educational attainments and we use the residuals to compute an *inborn ability matrix*[24]. Hence, our measure of "inborn" talent is the residual of the following regression:

$$a_i = \beta_0 + \beta_1 Parents_i + \epsilon \tag{1}$$

where $Parents$ is a dummy indicating the highest degree obtained between father and mother of the individuals.

Tables 7, 8 and 9, present the results.

The ability ranking among the four groups of individuals is the same in all countries: $\overline{a}^{US} > \overline{a}^{SS} > \overline{a}^{UU} > \overline{a}^{SU}$. The more talented individuals are those coming from unskilled families who get education and the less talented are those coming from skilled parents and not getting education.

Therefore, if residuals of equation 1 are a "good" proxy for talent, allocation problems arise: some "talented" children of unskilled parents can not get education because of the position of their parents, whereas some children of skilled parents get education even if their talent is low.

[24]We are obviously aware that the *inborn ability matrix* does not reflect the true "genetic" ability, because of the genetic transmission of talent, documented by Bowles and Gintis (2002) and others. Our "inborn ability" is, in fact, simply the "scholastic ability" constrained to the same average both for children of skilled and unskilled. It may represent "genetic" ability only assuming no genetic transmission of ability between generations.

Table 8: Average talent by group of individuals, residuals, Great Britain 1999- individual born in 1970, talent at the age of 10

		Education		
Parents' Education		Below A Level	A level or above	Total
Below A level	avg	-0.20	0.48	0.00
A level or above	avg	-0.34	0.31	0.00
Total	avg	-0.22	0.43	0.00

Source: LCS database

Table 9: Average talent by group of individuals, residuals, USA 2002- individual born between 1980-1984 , talent at the age of about 15

		Education		
Parents' Education		Below College	College or above	Total
Below College	avg	-0.18	0.46	0.00
College or above	avg	-0.36	0.24	0.00
Total	avg	-0.24	0.31	0.00

Source: YLSY97 database

3.4 Misallocated individuals

Now, we will show that an allocation problem actually appears for both the two ability measures presented in the previous section.

We define the probability of being skilled as $q^{\cdot S}$, the probability of being skilled conditional on having unskilled parents as q^{US} and the probability of being skilled conditional on having skilled parents as q^{SS}.

Let $G(a)$ be the cumulated distribution of talent in the whole population, $G^{U}(a)$ the cumulated distribution of talent conditional on having unskilled parents and $G^{S}(a)$ the cumulated distribution of talent conditional on having skilled parents.

Therefore, $\widetilde{a}^{\cdot S} \equiv [G(q^{\cdot S})]^{-1}$ represents the minimum talent required to become skilled for the whole population, $\widetilde{a}^{US} \equiv [G^{U}(q^{US})]^{-1}$ represents the minimum talent required to become skilled if children of unskilled parents and $\widetilde{a}^{SS} \equiv [G^{S}(q^{SS})]^{-1}$ represents the minimum talent required to become skilled if children of skilled parents.

We define "misallocated individuals" those people whose ability is such that:

- $\widetilde{a}^{\cdot S} < a_i \leq \widetilde{a}^{US}$ if parents are unskilled
- $\widetilde{a}^{SS} < a_i < \widetilde{a}^{\cdot S}$ if parents are skilled.

Table 10: Probability of misallocation (%)

	SHIW, Italy	BCS, UK	NLSY, USA
p^U_{badA}	3.47	2.25	5.18
p^S_{badA}	7.36	7.21	3.19

In fact, our "misallocated individuals" are those whose position is dependent on the family: unskilled children of unskilled parents who would have been skilled and skilled children of skilled parents who would have been unskilled if the allocation in the skilled position was not dependent on social class.

We define:

$$p^U_{badA} = Prob[\widetilde{a}^{\cdot S} < a_i \leq \widetilde{a}^{US}]$$

and

$$p^S_{badA} = Prob[\widetilde{a}^{SS} < a_i < \widetilde{a}^{\cdot S}]$$

table 10 reports p^J_{badA} values, with $J = U, S$, for the three databases.

For Italy, we obtain $\widetilde{a}^{\cdot U} = 0.86$ and $\widetilde{a}^{\cdot S} = 0.74$: for children of unskilled individuals a higher ability is required, on average, to get a university degree. This result seems to confirm that financial constraints in the short run exist. Given the distribution of talent, these constraints concern about 3.5% of children of unskilled parents.

For Great Britain, $\widetilde{a}^{\cdot U} = 0.43$ and $\widetilde{a}^{\cdot S} = .36$. Considering the talent distribution for children of the unskilled, we can also state that 2.25% of them had an ability level such that, if they had been born in a skilled family, they would have got education.

For the US, $\widetilde{a}^{\cdot U} = 0.40$ and $\widetilde{a}^{\cdot S} = 0.19$ are the "scholastic ability" thresholds giving the frequencies of misallocated individuals showed in table 10. It looks like that the US educational system does not facilitate children of skilled parents in their educational path, but, on the other hand, it does not allow children of unskilled parents to circumvent financial constraints. It is arguable that the educational system is meritocratic, but lack of good public programs in this field forces a relevant number of highly talented individuals coming from unskilled families to abandon their studies.

Table 11 presents the same results calculated using our measure of "inborn ability" as the residuals of equation 1. As expected, the frequency of "bad allocated" individuals is higher for all countries with reference to the frequency calculated in the "scholastic ability case".

It is crucial to remember that, probably, the real "genetic ability" is something between the "scholastic ability" (influenced by early years in family) and

Table 11: Probability of misallocation (%): 0 average in ability both for skilled and unskilled (%)

	SHIW, Italy	BCS, UK	NLSY, USA
p^U_{badA}	6.69	5.07	12.68
p^S_{badA}	17.62	17.88	13.07

our measure of "inborn ability" (cleaned by all parents effects, even genetic transmission); therefore we can argue that the frequencies of bad allocated individuals should be collocated between the values displayed in tables 10 and 11.

4 The model

In this section we present a theoretical model which is able to justify the empirical results concerning efficiency problem in talent allocation appears.

Among the main features of the model:

- individuals are heterogeneous in their talents;
- we do not consider genetic talent transmission;
- we assume that decisions concerning education may be financially constrained, and therefore be depending both on parents' bequest and government's redistribution;
- we opt for the *joy of giving* as a motive for bequests (see section 1);
- by "bequest" we mean every wealth left to children, who are responsible of their own education;
- the decisions concerning education, the amount of bequest to be left to children and the effort on the workplace are the endogenous variables.

4.1 Utility

The economy is composed of a set of agents of unitary mass living for one period and interested both in their consumption and on the bequest they leave to their (only) child[25] . Each of them must choose:

- her skill level (to get or not a given educational level);

[25]Following, for example, Michel and Pestieau (2004) and Glomm and Ravikumar (1992) we consider bequests as a consumption in the last period of life.

- her effort on the workplace;
- the bequest to leave to her child.

Every individual in the economy is exogenously endowed with a given talent, which we label with $a_{i,t}$, for $0 \leq a_{i,t} \leq 1$, where i indicates the family and t the generation. As explained in the introduction, we assume that the talent of an individual is independent of the talent of her mother.

Effort (endogenous), talent (exogenous) and educational level (endogenous, but financially constrained as we will see later) determine the amount of earnings. We assume that, for given effort and talent, the income of skilled individuals is $\mu > 1$ times the one of unskilled ondividuals, and we also assume that the cost of education is decreasing in individual talent.

In what follows we use the notation $y_{i,t}^{SU}$ to indicate the variable y referring to an unskilled individual (second suffix U) born from a skilled mother, (first suffix, S, so that the first suffix always refers to the mother and the second to the individual). The index i indicates the family and the index t the generation. The notation $y_{i,t}^{S\cdot}$ refers to the variable y of an individual born from a skilled mother in case the position of the individual, indicated by the point, is non relevant. The notation $y_{i,t}^{SJ}$, for $J = U, S$ refers to the variable y of an individual born from a skilled mother in the case the position of the individual (which can be both of unskilled or skilled) is relevant.

Consider a skilled individual endowed with talent $a_{i,t}$. We assume that her consumption level is given by:

$$C_{i,t}^{JS} = \Sigma_{i,t}^{J\cdot} - \xi(1 - a_{i,t}) + \mu(x_{i,t}^{JS} + \lambda a_{i,t}) - S_{i,t}^{JS} \quad for \quad J = U, S \tag{2}$$

where:

- $\Sigma_{i,t}^{J\cdot} \equiv S_{i,t-1}^{J\cdot}(1-T)+E(S_{t-1})T$ for $J = U, S$ is the endowment received by individual i from the previous generation, depending on the amount left to her by her mother ($S_{i,t-1}^{J\cdot}$) taxed at rate T and on the amount obtained by redistribution ($E(S_{t-1})T$), depending on the average bequest, as usual with linear taxation[26];
- $\xi(1 - a_{i,t})$ is the cost of education, decreasing in individual talent ($a_{i,t}$);
- $x_{i,t}^{JS}$ is the level of effort which, together with the exogenous talent multiplied by the parameter λ, determines the income of individual;

[26]In our model, the fiscal share T hits all the wealth given in life and left by parents to their children. Actually, only taxes on gifts and bequests exist, so our T can not be interpreted as the actual tax rate on bequests, but should be strongly lower than it.

- $S_{i,t}^{JS}$ is the amount she decides to leave to her child.

The consumption level of an unskilled individual is therefore given by:

$$C_{i,t}^{JU} = \Sigma_{i,t}^{J.} + (x_{i,t}^{JU} + \lambda a_{i,t}) - S_{i,t}^{JU} \quad for \quad J = U, S \tag{3}$$

because she does not spend on education and, for given talent and effort, perceives an income $\frac{1}{\mu}$ times lower than the one of skilled individual.

For all individuals we assume a semi-linear utility function separable in consumption, effort and on the amount of the bequest:

$$U_{i,t}^{JJ} = f(C_{i,t}^{JJ}) - \gamma x_{i,t}^{JJ} + \rho f(S_{i,t}^{JJ}) \quad for \quad J = U, S \tag{4}$$

where ρ is a parameter reflecting altruism toward children and $C_{i,t}^{JS}$ and $C_{i,t}^{JU}$ are defined respectively in equations 2 and 3.

From equation 4 and the definition of $C_{i,t}^{JJ}$ it emerges that $f'_{C_{i,t}^{JJ}} = \rho f'_{S_{i,t}^{JJ}}$. If the f functions is concave, this implies that $C_{i,t}^{JJ}$ and $S_{i,t}^{JJ}$ are linked by the constant parameter ρ.

Choice variables are $S_{i,t}^{JJ}$ and $x_{i,t}^{JJ}$. Let us assume that the utility function of equation 4 is logarithmic in consumption and bequest[27].

Therefore, if an individual chooses to acquire education her utility is:

$$U_{i,t}^{JS} = ln[\Sigma_{i,t}^{J.} - \xi(1 - a_{i,t}) + \mu(x_{i,t}^{JS} + \lambda a_{i,t}) - S_{i,t}^{JS}] - \gamma x_{i,t}^{JS} + \rho ln(S_{i,t}^{JS}) \tag{5}$$

whereas if she remains unskilled, she gets:

$$U_{i,t}^{JU} = ln[\Sigma_{i,t}^{J.} + (x_{i,t}^{JU} + \lambda a_{i,t}) - S_{i,t}^{JU}] - \gamma x_{i,t}^{JU} + \rho ln(S_{i,t}^{JU}) \tag{6}$$

First order conditions of equations 5 and 6 give the optimal choice level for effort $x_{i,t}^{JJ}$ and bequest $S_{i,t}^{JJ}$, respectively in the case the individual gets/does not get the skilled position:

$$S_{i,t}^{.S} = \frac{\rho\mu}{\gamma} \tag{7}$$

$$x_{i,t}^{JS} = \frac{1+\rho}{\gamma} - \frac{\Sigma_{i,t}^{J.} + (\xi + \mu\lambda)a_{i,t} - \xi}{\mu} \quad for \quad J = U, S \tag{8}$$

[27] Using a semi-linear utility function we are able to obtain analytical results for endogenous variables and check for the efficiency of bequest taxation. This specifications of the utility function make the amount of bequest not dependent on the ability, but simply on the status of the individual (skilled/unskilled). Without this simplification, even if it is possible to solve for the *convenience condition* and the *possibility condition* (see below), results are very hard to be manipulated in terms of conditional probabilities. The main results of the model, and in particular the "allocation effect" which we will introduce later, do not depend on this specification.

$$S_{i,t}^{U} = \frac{\rho}{\gamma} \tag{9}$$

$$x_{i,t}^{JU} = \frac{1+\rho}{\gamma} - \left[\Sigma_{i,t}^{J.} + \lambda a_{i,t}\right] \quad for \quad J = U, S \tag{10}$$

where the bequest does not depend on talent and is differentiated among individuals only because of their educational attainment.

Lemma 1 *Definition of endogenous variables*

Bequest and consumption depend on preference parameters only.

Effort is decreasing in talent and in the endowment received from the previous generation.

Individual whose mother left an amount lower than the average bequest should produce a lower effort if the tax rate increases (and viceversa).

If an individual gets a skilled position she produces more effort and she leaves more money to her child.[28]

Substituting these optimal values in equations 5 and 6, we obtain that indirect utility functions are given by:

$$U_{i,t}^{JS} = +\rho ln(\rho) - (1+\rho)ln(\gamma) + (1+\rho)ln(\mu) - \gamma x_{i,t}^{JS} \quad for \quad J = U, S \tag{11}$$

$$U_{i,t}^{JU} = +\rho ln(\rho) - (1+\rho)ln(\gamma) - \gamma x_{i,t}^{JU} \quad for \quad J = U, S \tag{12}$$

where $x_{i,t}^{JJ}$, for $J = U, S$, is defined in equations 8 and 10.

4.2 Getting education

In this economy, people will get the skilled position spending on education if the following two constraints are filled:

1. the *convenience* condition, so that the indirect utility of being skilled is higher than the indirect utility of being in the unskilled position: $U_{i,t}^{JS} > U_{i,t}^{JU}$, for $J = U, S$;

2. the *possibility* condition, depending on the assumption of imperfect capital market: given their talent, only individuals who receive "enough" money from the previous generation can get the skilled position: $\Sigma_{i,t}^{J.} > \xi(1 - a_i)$.

[28]All Proofs are in Appendix 1

Both conditions depend on the mother's qualification and on the individual's talent. To simplify notation, we define:

$$m \equiv \xi \frac{\gamma}{\mu\rho} \equiv \frac{\xi}{S^{S\cdot}} > 1$$

as the ratio between education costs of the worst skilled individual (the one with talent 0) and the bequest left to children by skilled individuals[29].

Let us start with the *convenience* condition of point 1. The difference between equations 11 and 12 gives:

$$U_{i,t}^{JS} - U_{i,t}^{JU} = (1+\rho)ln(\mu) - \gamma(x_{i,t}^{JS} - x_{i,t}^{JU}) \quad for \quad J = U, S \qquad (13)$$

Lemma 2 *The* Convenience condition

An individual finds it convenient *to get education if her talent is higher than a given threshold, which depends on the position of her mother:* $a_{i,t} > \widehat{a}_t^{J\cdot}$*, for* $J = U, S$*.*

The convenience *threshold is lower for children of unskilled mothers* $\widehat{a}_t^{U\cdot} < \widehat{a}_t^{S\cdot}$*, unless* $T = 1$*.*

Taxation increases the threshold for children of unskilled mothers and reduces the one for children of skilled ones.

But not all individuals can get educated: the *possibility* constraint of the previous point 2 is fulfilled only if:

Lemma 3 *The* possibility constraint

An individual finds it possible *to get education if her talent is higher than a given threshold, which depends on the position of her mother:* $a_{i,t} > \widetilde{a}_t^{J\cdot}$ *for* $J = U, S$*.*

The possibility *constraint is always higher for children of unskilled mothers* $(\widetilde{a}_t^{S\cdot} < \widetilde{a}_t^{U\cdot})$*, unless* $T = 1$*.*

Taxation reduces the threshold for children of unskilled mothers and increases it for children of skilled ones.

Which of the two constraints is more stringent? Some of the children of unskilled/skilled mother would like to get education but they can not or they can get educated but they do not want to?

To answer this question we must compare the constraints previously indicated.

[29]We assume that m is higher than 1, so that at least the less talented children of skilled mothers (the one with talent equal to zero) are financially constrained.

Suppose $\widetilde{a}_t^{S\cdot} > \widehat{a}_t^{S\cdot}$. If this inequality holds, we easily obtain (see lemmas 2 and 3) $\widetilde{a}_t^{U\cdot} > \widetilde{a}_t^{S\cdot} > \widehat{a}_t^{S\cdot} > \widehat{a}_t^{U\cdot}$, so that all individuals are constrained solely by the *possibility constraint*.

Given that $\widetilde{a}_t^{S\cdot}$ is increasing in T whereas $\widehat{a}_t^{S\cdot}$ is decreasing, the above inequality is more stringent in the case of $T = 0$. After some algebraic steps, it is possible to show that:

$$\widetilde{a}_t^{S\cdot} > \widehat{a}_t^{S\cdot} \quad if \quad \frac{\rho}{1+\rho} < \frac{ln(\mu)}{\mu} \tag{14}$$

which may be fulfilled or not according to the values of the parameters. For $\rho > \frac{1}{1+e} = 0.582$ it is never fulfilled. For lower values of ρ the previous condition can be respected according to the values of μ. For example, if $\rho = \frac{1}{2}$ it is respected if $1.85 < \mu < 4.5$, if $\rho = \frac{1}{3}$, it is respected for $1.43 < \mu < 8.6$. In the following part of the paper, we make the following hypothesis:

Assumption 1 *The parameters of the model are such that condition 14 is always respected, so that some of the individuals are* financially constrained *(they would like to get education but they can not) whereas none of them can get education but does not want to get it.*

4.3 The steady state

The next step is the definition of ϕ, the ratio of skilled workers in the whole population[30].

The evolution of the skilled ratio follows:

$$\phi_t = \phi_{t-1} + \phi_{t-1} p_t^{SU} + (1 - \phi_{t-1}) p_t^{US}$$

where p_t^{SU} indicates the probability that a child of a skilled mother becomes unskilled and is given by $p_t^{SU} = G(\widetilde{a}_t^{S\cdot})$, and $p_t^{US} = 1 - G(\widetilde{a}_t^{U\cdot})$ is the probability that a child of an unskilled mother becomes skilled, G being the cumulate distribution of talent[31].

In steady state flows between skilled and unskilled individuals are such that the ratio of skilled individuals in the population remains constant over time. Therefore, unless necessary, we will drop the index t. The flow condition: $\phi p^{SU} = (1 - \phi) p^{US}$ must hold, defining a constant skilled ratio:

$$\phi = \frac{p^{US}}{p^{US} + p^{SU}} \tag{15}$$

[30] We assume that the offer of skill creates its own demand. This happens both in the self-employment case or assuming a linear production function of the type $y = \mu\phi + (1 - \phi)$ where y is output. See also note 33

[31] As explained before, we are considering the *possibility constraint* alone for both kinds of individuals.

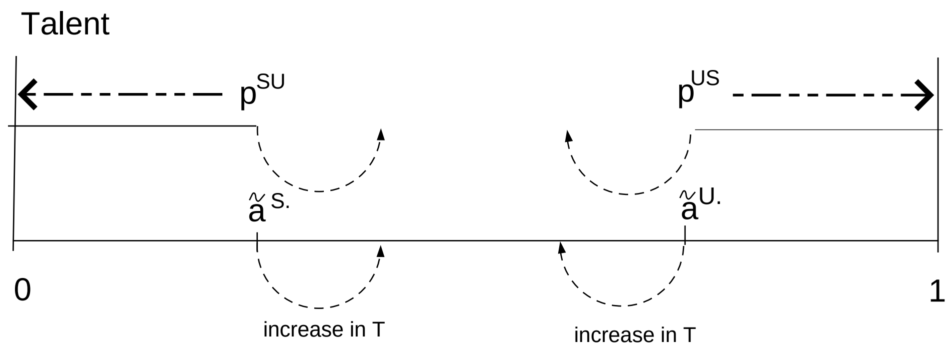


Figure 1: The effects of bequest taxation

Let us now assume that the talent of individuals is uniformly distributed between 0 and 1. Given this hypothesis and the definition of $\widetilde{a}^{J\cdot}$, it is easy to calculate:

$$p^{UU} = \widetilde{a}^{U\cdot} \quad p^{US} = 1 - \widetilde{a}^{U\cdot} \quad p^{SU} = \widetilde{a}^{S\cdot} \quad p^{SS} = 1 - \widetilde{a}^{S} \tag{16}$$

(see figure 1). Solving the system of equations[32] 28, 29, 15 and 16 we obtain the steady state skill ratio:

$$\phi^* = \frac{1}{\mu(m-1)+1} \tag{17}$$

which is not dependent on the tax rate.[33]

Substituting ϕ^* in equations 28 and 29 we can solve for the constant probability of change of state (from skilled to unskilled and viceversa) between sequential generations of the same family, and finally we can write the steady state transition probabilities of equation 16 in an explicit form:

[32]The same result is obviously obtained calculating the ergodic of the transition matrix defined by the probabilities p^{ij}.

[33]The premium for skilled individuals, μ, should depend on the ratio of skilled workers in the population, so that $\mu = \mu(\phi)$. For instance, suppose that aggregate production function is $y = [\zeta\phi^r + (1-\phi)^r]^{\frac{\nu}{r}}$. In that case, given μ the ratio between cost of skilled and unskilled workers (the latter normalized to the unity), it is easy to obtain the demand for skilled individuals: $\phi^D = \left[1 + \frac{\mu}{\zeta}^{\frac{1}{1-r}}\right]^{-1}$. Given the supply of skill defined by equation 17, the equilibrium is described by: $\phi^* = \left[[1+\zeta(m-1)]^{\frac{1}{r}}\right]^{-1}$ and $\mu = \zeta^{\frac{1}{r}}(m-1)^{\frac{1-r}{r}}$ so that both μ and ϕ depend on the parameters of the production function and on the value of m. Given that we are mostly interested in the effect of bequest taxation on aggregate utility and given that ϕ is not dependent on the tax rate, in this version of the paper, we prefer to assume that $\nu = r = 1$ and $\zeta = \mu$ obtaining the result of the text. In fact, the offer of skill creates its own demand.

$$p^{US} = 1 - \frac{m\mu^2(m-1) + (\mu-1)(1-T)}{m\mu[\mu(m-1)+1]} \tag{18}$$

$$p^{SU} = 1 - \frac{m\mu - (\mu-1)[1+T(m-1)]}{m[\mu(m-1)+1]} \tag{19}$$

From equations 18 and 19 we obtain the following:

Lemma 4 *The allocation effect*

The probability that a child of an unskilled mother can achieve a skilled position is increasing in T, whereas the probability that a child of a skilled mother becomes unskilled is decreasing in T. Therefore, an increase in T leads to a higher number of "low talented" children of skilled mothers to the unskilled position and a higher number of "high talented" children of unskilled mothers to the skilled position (see figure 1). Intergenerational educational mobility is increasing in T.

4.4 Bequest taxation and individual utility

What are the effects of bequest taxation on individual utility? From equation 11 and 12, we obtain that utility is affected by bequest taxation throughout effort, as follows:

$$\frac{dU_i^{JS}}{dT} = -\gamma\frac{dx_i^{JS}}{dT} \quad and \quad \frac{dU_i^{JU}}{dT} = -\gamma\frac{dx_i^{JU}}{dT} \quad for \quad J = U, S$$

Therefore, if we want to investigate the effects of bequest taxation on utility we must analyze equations 8 and 10.

Lemma 5 *Individual utility*

Children of unskilled mothers will produce a lower effort when taxation increases so that for all of them utility increases. Furthermore, for some of them the possibility constraint *is relaxed and they can get education.*

Children of skilled mothers will produce a higher effort when taxation increases so that for all of them utility decreases. Furthermore, for some of them the possibility constraint *is strengthened and they can not get education.*

Therefore, bequest taxation raises utility of children of unskilled mothers and reduces utility of children of skilled mothers.

4.5 Bequest taxation and average welfare

In this section, we investigate the relationship between bequest taxation and *average* economic variables, in particular average utility.

We proceed as follows: First of all, we consider that each individual, at each moment of time, can have a skilled or unskilled mother and also herself be skilled or unskilled. Therefore, we have four different "kinds" of individuals. In a second step we will evaluate the average variables, as endowment, ability, effort for each group of individual. Finally, we will analyse aggregate variables through the four groups, obtaining results for the whole economy.

The four possible kinds of individuals are : 1) skilled individuals with unskilled mothers, 2) skilled individuals with skilled mothers, 3) unskilled individuals with skilled mothers, 4)unskilled individuals with unskilled mothers.

For skilled individuals, the probability of having a unskilled mother is:

$$q^{US} = \frac{(1-\phi)p^{US}}{\phi p^{SS} + (1-\phi)p^{US}} = p^{SU}$$

where the last term is obtained substituting the definition of ϕ of equation 15[34]. Furthermore, in steady state the number of stayers must be constant, so that $q^{SS} = p^{SS}$ and $q^{UU} = p^{UU}$.

A skilled individual will receive the endowment of equation 27, for $J = S$, with probability q^{SS} and the same endowment but for $J = U$ with probability q^{US}. To keep notation simple, let us define

$$\Theta(T) = \left(\frac{(\mu - 1)(1 - T)}{m\mu} \right)^2$$

where $\frac{d\Theta}{dT} < 0$.

With some algebraic steps we obtain the average endowment of skilled individuals[35] :

$$\overline{\Sigma}^S = [1 + \mu(m-1)\Theta(T)]\, \phi\xi \tag{20}$$

An unskilled individual will receive the endowment of equation 27, for $J = U$ with probability q^{UU} and the same endowment but for $J = S$ with probability q^{SU}, so that the average endowment of an unskilled individual is:

$$\overline{\Sigma}^U = [1 - \Theta(T)]\, \phi\xi \tag{21}$$

Given $\widetilde{a}^{S\cdot}$ and $\widetilde{a}^{U\cdot}$ (equations 28 and 29), and given the hypothesis of uniform distribution of talent with support on $[0, 1]$, we can easily compute the average

[34]In fact, q^{US} is the probability of having U mother conditional to be a S individual. p^{SU} is the probability of being an individual of type U, conditional to having a mother of type S, hence the two probabilities refer to the same stock of individuals. In steady state the number of movers between the two states must be the same, so that q^{US}=p^{SU}, q^{SU}=p^{US}, and q^{SU}= p^{US}.

[35]All overlined variables indicate the average of the group defined by the suffix.

talent of children of unskilled mothers who remain unskilled ($\frac{\tilde{a}^{U\cdot}}{2}$) and the average talent of the ones who become skilled ($\frac{1+\tilde{a}^{U\cdot}}{2}$); the same for children of skilled mothers (respectively, $\frac{\tilde{a}^{S\cdot}}{2}$ if they become unskilled, and $\frac{1+\tilde{a}^{U\cdot}}{2}$ if they get the skilled position.). The q^{JJ} probabilities, for $J = U, S$, allows us to compute average talent of the skilled ($a^{\cdot S}$) and teh unskilled ($a^{\cdot U}$).

$$\overline{a}^S = \frac{\phi}{2}\left[\mu(m-1)\left(2-\Theta(T)\right)+1\right] \tag{22}$$

$$\overline{a}^U = \frac{\phi}{2}\left[\mu(m-1)+\Theta(T)\right] \tag{23}$$

The average talent of skilled individuals is increasing in bequest taxation (T) whereas the average talent of unskilled individuals is decreasing in T. As expected, our *allocation effect* takes place: bequest taxation pushes more talented individual toward the skilled positions.

In steady state equilibrium, from equation 10 and 8, the average effort of skilled and unskilled workers is given by:

$$\overline{x}^S = \frac{1+\rho}{\gamma} - \frac{\overline{\Sigma}^S + (\xi+\mu\lambda)\overline{a}^S - \xi}{\mu} \tag{24}$$

$$\overline{x}^U = \frac{1+\rho}{\gamma} - (\overline{\Sigma}^U + \lambda\overline{a}^U) \tag{25}$$

where $\overline{\Sigma}^J$ and $\overline{a}^J$ are defined in equations 20, 21, 22, 23. It is possible to demonstrate that effort is increasing in T for skilled and decreasing for unskilled workers.

Finally, average utility in the whole population is given by:

$$U = \phi[(1+\rho)ln(\mu)] + \rho ln(\rho) + (1+\rho)ln\left(\frac{1}{\gamma}\right) - \gamma[(1-\phi)\overline{x}^U + \phi\overline{x}^S)] \tag{26}$$

Lemma 6 *Average utility Redistributive policies based on bequest taxation increase average utility.*

So, even considering the endogeneity of effort determination, we obtain that bequest taxation raises average utility. This result is not surprising because it comes directly from what we called the *allocation effect*. An economy is surely better off if the more talented individuals are those who get education because they spend less money in the educational process and because their contribution to the production process is higher[36].

[36]Obviously, these results are dependent also on the assumption that parents obtain utility directly from the amount of money they left to their children, not from the amount of money that the children receive.

4.6 Financing education

Different results emerge if we assume that bequest taxation, instead of being redistributed among all individuals as assumed above, is used to reduce education costs[37] (our ξ), so that redistribution goes from people who leave bequest to people who get education. In that case, the cost of education becomes $(\xi - \frac{E(S_{t-1})}{\phi_{t-1}}(1 - a_{i,t})$. Using the same utility function of equations 5 and 6, it is possible to show:

Lemma 7 *Bequest taxation and education financing*

In the case that bequest taxation is used to finance education, the steady state equilibrium will remain unchanged because the possibility constraint *is not affected by bequest taxation.*

This surprising result depends on a simple fact: bequest taxation relaxes the *possibility constraint* for both kinds of individuals (at least for realistic parameter values), raising the skill ratio. In this way, the pro-capita amount redistributed is reduced, so that the *possibility constraint* is strengthened, reducing the skill ratio. In steady state, the *possibility constraint* is not affected by the tax rate. Therefore, redistributive policies (where fiscal income goes to all individuals) based on bequest taxation are more efficient in increasing the wellbeing of the economic system with respect to policies where bequest taxation is used in order to reduce the cost of education.

Checchi, Ichino and Rustichini (1999) try to solve the following puzzle: "why the Italian school system, which is strongly egalitarian in the quality and cost of education provided to rich and poor families, fails to generate at least the same degree of interegenerational mobility which prevails in the US, where the school system is instead highly decentralised and non egalitarian?". Their theoretical model suggests that a non standardized school system favours a better design of available education opportinities, favouring a better fit between the demand and supply of labor and, therefore, enhancing the returns of education, expecially for children coming from poor families. While they present a solution involving "incentives", our model refers to "constraints" and suggest that mobility and efficiency are favoured by intergenerational redistribution and not by a system "equal" in the sense that it assigns the same public expenditure to every individuals (as Checchi (2005) signals).

[37]Public education is usually financed by income taxation. This would reduce the cost of education, our ξ, by taxing income produced by the same generation. We tried to analyze this case in our model, but we have not been able to obtain analytical solution. From simulations we obtained the result that utility of individuals is always decreasing in income taxation.

5 Conclusions

A strong link between parents' and children's socio-economic status has been pointed out in many empirical studies on intergenerational mobility. The discussion on the causes of this phenomenon is entirely open and controversial. Different theories have been proposed, some of which take into account genetic transmission of ability, while others consider short-run wealth constraints that restrict options for poor people. Some studies look on "dynastic elements" as long-run factors linked with the family name or with the generic advantage to live in a rich family.

In this paper we focus on the linkages between the educational attainments of parents and the ones of children with the aim of checking the relationship between intergenerational mobility and allocational efficiency, which requires higher educational level to be attained by more talented individuals.

In section 3 we give some empirical evidence concerning intergenerational mobility and talents. Managing data from SHIW (Italy), BCS (UK) and NYLS (US), and using different proxies for talent, it turns out that children of unskilled individuals gain skilled positions with lower probability than children of skilled individuals, partly because they are averagely less talented than children of skilled individuals.

Computing the threshold level of talent that allows to achieve the highest educational level, we show that the ratio of misallocated individuals is between 2.3% and 5.2% in the different countries for children of unskilled individuals and between 3.2% and 7.2% for children of skilled individuals.

These results may be distorted by the definition of "talent" we used. In fact, our measures of talent all refer to scholastic ability, that is surely influenced by environment and in particular by family background. We can not measure the size of this distortion (the debate "nature" versus "nurture" is far from being concluded), but we can compute another measure of misallocation assuming that children of skilled and unskilled individuals have the same average talent (using residuals of a regression of talent on family education). We obtain higher measure of misallocation, now comprised between 5.1% and 12.7% for children of unskilled individuals and between 11.6% and 17.9% for children of skilled individuals. Probably, some "true" measure of misallocation is between the two. These results seem to confirm the Carneiro and Heckman (2002) findings of a 6% of individuals that, in the US, are credit rationed (short-run factors in their analysis).

The theoretical model presented in section 4 considers a world with heterogeneous agents endowed with different "innate" talent. Each individual must chooses her effort level, the amount of altruistic bequests and her educational attainment (which may be bounded by financial constraints). We obtain that effort is decreasing in talent and in the endowment received from the previous generation and that individuals getting a skilled position produce more effort and leave higher bequest. In this context, the efficiency problem revealed in section 3 arises because financial contraints affect schooling decisions. In fact, children of skilled parents require a lower talent to get the highest educational level than children of unskilled parents; the allocation of talent is far from being perfect.

A proportional taxation on bequests (T), whose yield is used for intergenerational redistribution, increases the probability that a child of unskilled parents can achieve the skilled position, whereas the probability that a child of a skilled mother becomes unskilled is decreasing in T. Therefore, intergenerational educational mobility is increasing in bequest taxation.

Furthermore, even considering the endogeneity of effort determination, the model indicates that bequest taxation raises average utility because of the *allocational effect*. Given that an economy is surely better off if the more talented individuals are those who get education , a programme of intergenerational redistribution via bequest taxation has a positive efficiency effect because it partly separates education from wealth. In fact, bequest taxation relaxes the financial constraint for children of unskilled parents and strenghtens the one for skilled families.

We also show that this positive *allocational effect* does not arise if the fiscal yield coming from bequest taxation, instead of being distributed among all youngs, is devoted to finance education, so that it is distributed among students alone.

If a Government aims to improve the national welfare through an efficient school system, it must ensure that every individual with the same talent must have the same probability of getting a given educational level, independently of her family income or social status.

The model has shown that proportional bequest taxation increases both "equity" and "efficiency' of the economic system if its yields are used to redistribute among all individuals of the following generation, pushing the economic system toward an "equality of opportunities" world. It is curius that the tax rate on bequest has been actually reduced (or bequest taxation has been eliminated) in many countries by governments who should be on a path toward liberalism.

Appendix 1: Proofs

Proof 1 *Considering that consumption is given by* $C^{JJ}_{i,t} = \rho S^{JJ}_{i,t}$ *because of the logarithmic form of the* $f(.)$ *function, the first and second results are immediately obtainable from FOC'S,*

The third result comes directly from the definition of $\Sigma^{J\cdot}_{i,t}$ *(see the first point after equation 2). In fact* $\frac{\Sigma^{J\cdot}_{i,t}}{dT} = E(S_{t-1}) - S^{JJ}_{t-1,i}$.

The last result comes from the comparison between equation 8 and 10. $x^{JS}_{i,t} > x^{JU}_{i,t}$ *if* $\xi(1 - a_{i,t}) > \Sigma^{J\cdot}_{i,t}(1 - \mu)$*, where the term on the left is positive and the term on the right is negative.*

Proof 2 *Using equations 8 and 10, the difference* $x^{JS}_{i,t} - x^{JU}_{i,t}$ *in equation 13 depends on* $\Sigma^{J\cdot}_{i,t}$*. Defining* ϕ_t *the endogenous ratio of skilled individual in the population at time t, the average bequest is* $E(S_{t-1}) = \phi_{t-1} S^{\cdot S}_{t-1} + (1 - \phi_{t-1}) S^{\cdot U}_{t-1}$ *and the endowment received by a generic child is:*

$$\Sigma^{J\cdot}_{i,t} = S^{\cdot J}_{i,t-1}(1 - T) + [\phi_{t-1} S^{\cdot S}_{t-1} + (1 - \phi_{t-1}) S^{\cdot U}_{t-1}]T \quad for \quad J = S, U \tag{27}$$

substituting equations 8 and 10 in eq. 13, using eq. 27, and solving for $a_{i,t}$*, we obtain* $U^{JS}_{i,t} > U^{JU}_{i,t}$ *if, respectively for children of unskilled and skilled mothers:*

$$a_{i,t} > \widehat{a}^{U\cdot}_t \equiv 1 + \left((\mu - 1)[\phi_{t-1}(\mu - 1)T + 1] - \frac{1 + \rho}{\rho} \mu ln(\mu) \right) \frac{1}{m\mu}$$

$$a_{i,t} > \widehat{a}^{S\cdot}_t \equiv 1 - \left((\mu - 1)[(1 - \phi_{t-1})(\mu - 1)T - \mu] - \frac{1 + \rho}{\rho} \mu ln(\mu) \right) \frac{1}{m\mu}$$

Comparing the two thresholds, we immediately obtain $\widehat{a}^{U\cdot}_t < \widehat{a}^{S\cdot}_t$ *if* $(\mu - 1)^2(T - 1) < 0$*, which always holds because* $\mu > 1$ *and* $T < 1$.

The last part of lemma 2 comes directly for the definition of $\widehat{a}^{S\cdot}_t$ *and* $\widehat{a}^{U\cdot}_t$

Proof 3 *From the* possibility constraint*, once equation 27 is considered, we obtain that children of skilled mothers are not financially constrained in education if their talent is higher than a critical value, which can be easily calculated:*

$$a_{i,t} > \widetilde{a}^{S\cdot}_t \equiv 1 - \frac{\mu - (\mu - 1)(1 - \phi_{t-1})T}{m\mu} \tag{28}$$

whereas[38] *for children of unskilled mothers the threshold becomes:*

$$a_{i,t} > \widetilde{a}^{U\cdot}_t \equiv 1 - \frac{1 + (\mu - 1)\phi_{t-1}T}{m\mu} \tag{29}$$

[38] We can now reinterpret the meaning of the m parameter. In the case of no bequest taxation ($T = 0$), $\widetilde{a}^{S\cdot}_t = 1 - \frac{1}{m}$; therefore $m = \frac{1}{1 - \widetilde{a}^{S\cdot}_t}$. For example, if $m = 1.25$, $\widetilde{a}^{S\cdot}_t = 0.2$: the probability that for a child a skilled mother the *possibility constraint* is not fulfilled is given by $G(0.2)$, where G is the cumulate distribution of talent.

From equations 28 and 29 we obtain that $\widetilde{a}_t^{S\cdot} \leq \widetilde{a}_t^{U\cdot}$ *if* $(1-T)(\mu-1) \geq 0$, *always verified. Differentiating the same equations with respect to* T, *we obtain the result of the third part of lemma 3.*

Proof 4 *From equation 18 we have* $\frac{dp^{US}}{dT} = \frac{\mu-1}{m\mu[\mu(m-1)+1]} \geq 0$;
From equation 19 we have $\frac{dp^{SU}}{dT} = -\frac{(\mu-1)(m-1)}{m[\mu(m-1)+1]} \leq 0$.

Proof 5 *For an individual endowed with a given talent, the optimal effort depends on the amount received from the previous generation* $\Sigma_{i,t}^{J\cdot}$,*defined in equation 27, which in turn depends on the amount received both directly by the mother and by redistribution; considering* $S_{t-1}^{\cdot S} = \mu S_{t-1}^{\cdot U}$ *(see equations 7 and 9) we obtain:*

- *for* $J = S$, *so that for children of skilled mothers,* $\frac{d\Sigma_{i,t}^{S\cdot}}{dT} = \frac{-(1-\phi)(\mu-1)S_{t-1}^{\cdot U}}{dT} < 0$.
- *for* $J = U$, *so that for children of unskilled mothers,* $\frac{d\Sigma_{i,t}^{U\cdot}}{dT} = \frac{\phi(\mu-1)S_{t-1}^{\cdot U}}{dT} > 0$.

Proof 6 *Plugging equations 20, 21, 22 and 23 into equations 24 and 25, differentiating equation 26 with respect to* T, *we obtain:*

$$\frac{dU}{dT} = [\phi(\mu-1)]^2 \frac{m-1}{m\mu}(2\mu-1)\rho(1-T)$$

which is surely positive.

Proof 7 *Assume that consumption of skilled individual is given by:*

$$C_{i,t}^{JS} = S_{i,t-1}^{\cdot J} - \left(\xi - \frac{E(S_{t-1})}{\phi}T\right)(1-a_{i,t}) + \mu(x_{i,t}^{JS} + \lambda a_{i,t}) - S_{i,t}^{JS} \quad for \quad J = U, S \tag{30}$$

whereas consumption for the unskilled is:

$$C_{i,t}^{JU} = S_{i,t-1}^{\cdot J} + (x_{i,t}^{JU} + \lambda a_{i,t}) - S_{i,t}^{JU} \quad for \quad J = U, S \tag{31}$$

and that the utility function is the one presented in equation 4. From FOCs we can define the optimal level for choice variables and the indirect utility both for skilled and unskilled individuals. We obtain that $S_{it}^{\cdot J}$, *for* $J = S, U$, *is equal to the one defined in equation 7 and 9 whereas the different type of redistribution modifies the optimal effort.*

In the hypothesis that the possibility constraint *holds, we can write it for both skilled and unskilled individuals:*

$$S_{t-1}^{\cdot J}(1-T) - \left(\xi - \frac{E(S_{t-1})}{\phi}T\right)(1-a_{i,t}) > 0 \quad for \quad J = S, U$$

where $E(S_{t-1}) = \phi\frac{\mu\rho}{\gamma} + (1-\phi)\frac{\rho}{\gamma}$. *The minimum level of ability which allows individuals to obtain education becomes:*

$$\widetilde{a}^{S\cdot} = 1 - \frac{\mu(1-T)}{m\mu - \left(\frac{1}{\phi} + \mu - 1\right)T} \tag{32}$$

$$\widetilde{a}^{U\cdot} = 1 - \frac{1-T}{m\mu - \left(\frac{1}{\phi} + \mu - 1\right)T} \tag{33}$$

Given these two thresholds, the transition probabilities are the ones defined in equation 16 and the definition of ϕ *is the same as the one in equation 15. Therefore, we can solve for the steady state quota of skilled* ϕ^*, *obtaining that the steady state quota of skilled is the same of equation 17, and substitute it into equations 32 and 33, obtaining:*

$$\widetilde{a}^{S\cdot} = 1 - \frac{1}{m}$$

and

$$\widetilde{a}^{U\cdot} = 1 - \frac{1}{m\mu}$$

which are independent on the tax rate T.

Appendix 2: probabilities of getting education

We estimate probabilities of getting the higher educational level using the following probit model: $q^{\cdot S} = \beta_0 + \beta_1 Parents + \beta_2 a_i + \epsilon$ where $Parents$ is a dummy for parents' education, whereas a_i is the talent of individuals measured as:

1) the scholastic talent, measured by standardised value of some score obtained during the previous educational process(see note...)

2)the "rough" inborn talent, measured by residuals of equation **??**

Results of our estimation are presented in the following table[39]:

The following figures show the estimated probabilities of the previous equation. Figures on the left refer to point 1, whereas figures on the right refer to point 2 for the three countries we are considering

[39] We are aware that the estimation of column 2, 4, 6 should be made using instrumental variable methods. The problem is that good instruments, that is variables which influence ability without affecting the probability of getting the highest educational level, do not exist, at least in our opinion. Results of columns 2, 4, 6 (and graphics on the right of table 13) should therefore be considered simply as descriptive statistics. In fact, they assume that the error term in equation estimating ability with respect to family education and the error term in equation estimating probabilities of getting the highest degree with respect to ability and family education are unrelated, which is probably not arguable.

Table 12: Probit Estimation of the probability of getting the highest education

		IT	IT	UK	UK	US	US
		1	2	3	4	5	6
skilled	Coef	0.404	0.916	0.419	0.662	0.641	0.939
parents	z	(7.75)**	(17.05)**	(9.15)**	(14.54)**	(15.36)**	(22.91)**
	mfx	0.090	0.224	0.156	0.250	0.247	0.356
talent	Coef	1.214		0.529		0.451	
	z	(34.24)**		(24.68)**		(20.14)**	
	mfx	0.251		0.187		0.176	
Residuals	Coef		1.214		0.529		0.451
of talent	z		(34.24)**		(24.68)**		(20.14)**
	mfx		0.251		0.187		0.176
Constant		-1.279	-1.445	-0.555	-0.606	-0.512	-0.657
		(32.77)**	(34.52)**	(27.02)**	(29.11)**	(17.51)**	(22.32)**
Obs		4690	4690	5613	5613	4415	4415
Pseudo R^2		0.41	0.41	0.12	0.12	0.15	0.15

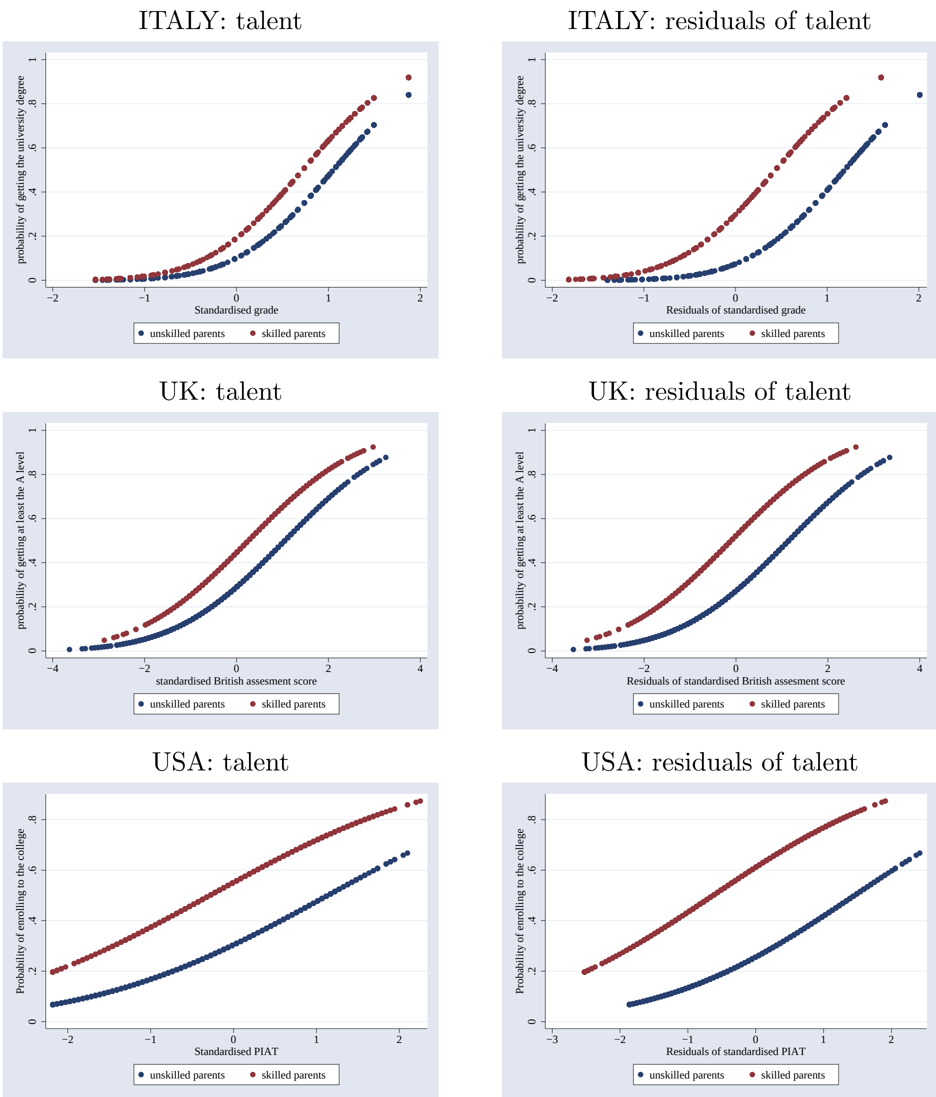
Absolute value of z statistics in parentheses

* significant at 5%; ** significant at 1%

mfx calculates the marginal effects at the means of the independent variables

Source: Italy: SHIW, UK: LCS, US; NSLY

Table 13: The probability to get higher education with respect to talent



References

[1] Abel A.B. (1995), “Precautionary Saving and Accidental Bequests”, *American Economic Review*, vol. 75(4), pp. 777-791.

[2] Atkinson A.B. and Stiglitz J.E. (1976), “The Design of Tax Structure: Direct Versus Indirect Taxation”, *Journal of Public Economics*, vol. 6 (1-2), pp. 55-75.

[3] Barro R. (1974), “Are Government Bonds Net Wealth?”, *Journal of Political Economy*, vol. 82, pp. 1095-1117.

[4] Becker G.S. and Tomes N. (1979), “An Equilibrium Theory of the Distribution of Income and Interegenerational Mobility”, *Journal of Political Economy*, vol. 87(6),, pp. 1153-189.

[5] Becker G.S. and Tomes N. (1986), “Human Capital and the Rise and Fall of Families”, *Journal of Labor Economics*, vol. 4, S1-S38.

[6] Behrman J. and Rosenzweig M. (2002), “Does Increasing Women’s Schooling Raise the Schooling of Next Generation”, *American Economic Review*, vol. 92, pp. 323-334.

[7] Bernheim D.B, Lemke R.J. and Karl J. (2001), “Do Estate and Gifts Taxes Affect the Timing of Private Transfers?”, NBER Working Paper n. 8333.

[8] Blumkin T. and Sadka E. (2003), “Estate Taxation with Intended and Accidental Bequests”, *Journal of Public Economics*, vol. 88, pp. 1-21.

[9] Bowles S. and Gintis H. (2002), “The Inheritance of Inequality”, *Journal of Economic Perspectives*, vol. 16, n.3, pp. 3-30.

[10] Bowles S., Gintis H. and Osborne M. (2002), “The Determinants of Individual Earnings: Skills, Preferences and Schooling”, *Journal Economic Literature*, vol. 39, n.4, pp. 1137-1176.

[11] Carneiro P. and Heckman J.J. (2002), “The Evidence on Credit Constraints in Post-Secondary Schooling”, *Economic Journal*, vol.112, pp. 705-734.

[12] Charles K.K. and Hurst E. (2003), “The Correlation of Wealth across Generations”, *Journal of Political Economy*, vol. 11, n.6, pp. 1155-1182.

[13] Chevalier A., Harmon C., O Sullivan V. and Walker I. (2005), “The Impact of Parental Income and Education on the Schooling of Their Children”, IZA Working Paper n. 1496.

[14] Checchi D. (2003), "Inequality in Incomes and Access to Education: A Cross-country Analysis (1960-95)", *Labour*, vol. 17(2), pp. 153-201.

[15] Checchi D., Ichino A., Rustichini A. U (1999), "More equal but less mobile? Education financing and integenerational monility in Italy and in US", *Journal of Public Economics*, vol. 74, pp. 351-393.

[16] Checchi D. (2005), "The economics of education: Human Capital, Family Background and Inequality", Cambridge University Press.

[17] Comi (2004), "Intergenerational mobility in Europe: evidence from ECHP", Department of Economics, University of Milan , Working Paper n. 2003-3.

[18] Cremer H. and Pestieau P. (1991), "Bequest, Filial Attention and Fertility", *Economica*, vol. 58, pp. 359-375.

[19] Cremer H. and Pestieau P. (2001), "Non Linear Taxation of Bequests, Equal Sharing Rulesand the Tradeoff between Intra and Inter-Family Inequalities, *Journal of Public Economics*, vol. 79, pp. 35-53.

[20] Cremer H. and Pestieau P. (2003), "Wealth transfer taxation: a survey", The Levy Economic Institute Working Paper n. 394.

[21] Davies J.B. (1981), "Uncertain Lifetime, Consumption and Dissaving Retirement", *Journal of Political Economy*, vol. 89, pp. 561-577.

[22] Ellwood D. and Kane T. (2000), "Who is Getting a College Education?: Family Background and the Growing Gaps in Enrollment", in Danziger S. and Waldfogel J. eds, *Securing the Future*, Russel Sage, New York.

[23] Ermisch J. and Francesconi M. (2001), "Family Matters: Impact of Family Background on Educational Attainments", *Economica*, vol. 68(270), pp. 345-350.

[24] Erikson R. and Goldthrope H. (2002), "Intergenerational Inequality: A Sociological Perspectives", *Journal of Economic Perspectives*, vol. 16, n.3, pp. 31-40.

[25] Glomm G. and Ravikunar R. (1992), "Public versus Private Investment in Human Capital: Endogenous Growth and Income Inequality", *Journal of Political Economy*, vol. 100, pp. 818-838.

[26] Grossman V. and Poutvaara P. (2005), "Pareto-Improving Bequest Taxation", Working Paper University of Zurich, *mimeo*.

[27] Joulfanian D. (2005), "Choosing Between Gifts and Bequests: How Taxes affect the timing of Wealth Transfers", *Journal of Public Economics*, forthcoming.

[28] Kane T. (1994), "College Entry by Blacks since 1970: The Role of College Costs, Family Background, and the Returns of Education", *The Journal of Political Economy*, vol. 102, n.5, pp. 878-911.

[29] Kopczuk W. (2001), "Optimal Estate Taxation in the Steady State", *mimeo*.

[30] Krueger A.B. (2004), "Inequality, Too Much of a Good Thing", in J.J. Heckman and A.B. Krueger *Inequality in America*, Cambridge, MIT Press.

[31] Michel P. and Pestieau P. (2004), "Fiscal Policy in an Overlapping Generations Model with Bequest-as-Consumptions", *Journal of Public Economic Theory*, vol. 6(3), pp. 397-407.

[32] Mulligan C. (1999), "Galton vs. the Human Capital Approach to Inheritance", *Journal of Political Economy*, vol. 107(6), pp. S184-224.

[33] Page B.R. (2003), "Bequest Taxes, Inter Vivos Gifts, and the Bequest Motive", *Journal of Public Economics*, vol. 87, pp. 1219-1229.

[34] Plug E. and Vijverberg W. (2003), "Schooling, Family Background, and Adoption: Is it Nature or is it Nurture?", *Journal of Political Economy*, vol. 111, n.3, pp. 611-641.

[35] Shea J. (2000), "Does Parents Money Matter?", *Journal of Public Economics*, vol. 77(2), pp. 155-184.

[36] Woessmann L. (2004) "How Equal Are Educational Opportunities? Family Background and Student Achievement in Europe and the United States", IZA Working Paper n. 1284.

Contents