Supply of Education

Pragyan Monalisa Sahoo
&
Himanshu Sekhar Rout

Supply of Education

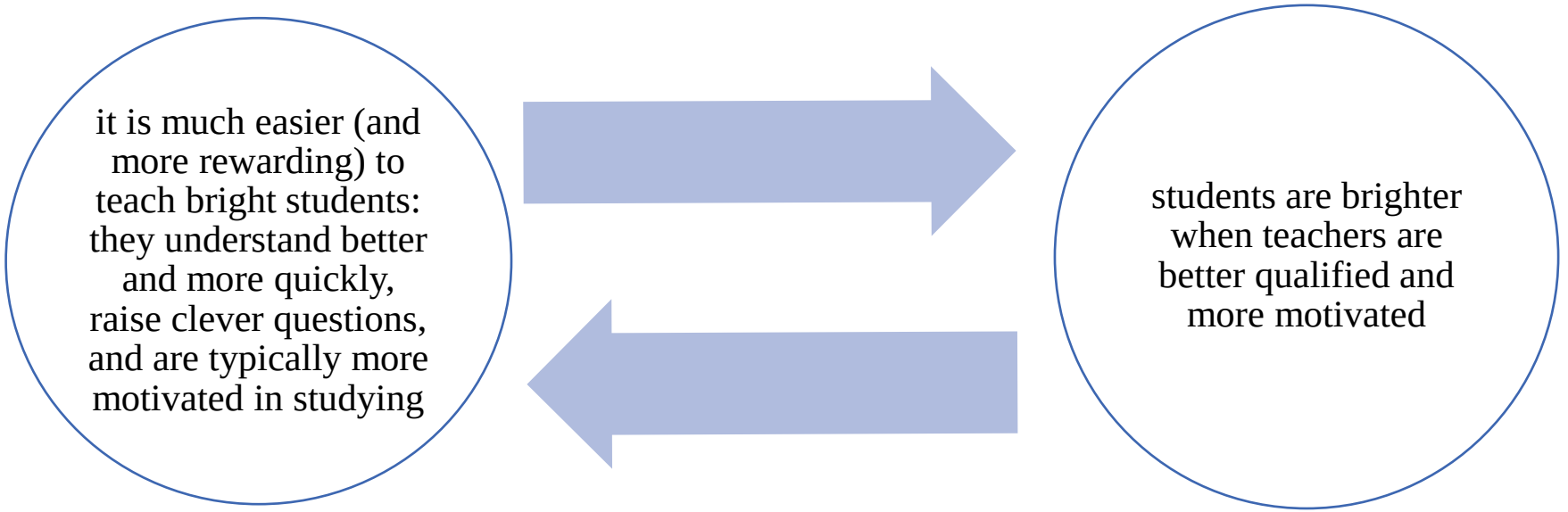
- $\Delta H_{it} = f(A_i, S_{it}, E_{it}, H_{it})$ (4.1)
- Equation (4.1) is known as the educational production function (Lazear, 2001; Pritchett and Filmer, 1999)
- It relates some inputs (student abilities, schooling resources, environment) to the output of human capital formation.
- However, this production function has the peculiarity of considering student activity (here denoted by S_{it}) as inputs and outputs at the same time.
- More resources employed in schooling (higher E_{it}) induce longer school attendance (higher S_{it}), and presumably higher educational attainment; at the same time, longer attendance in schools (higher S_{it}) favours greater formation of new human capital (higher ΔH_{it}).

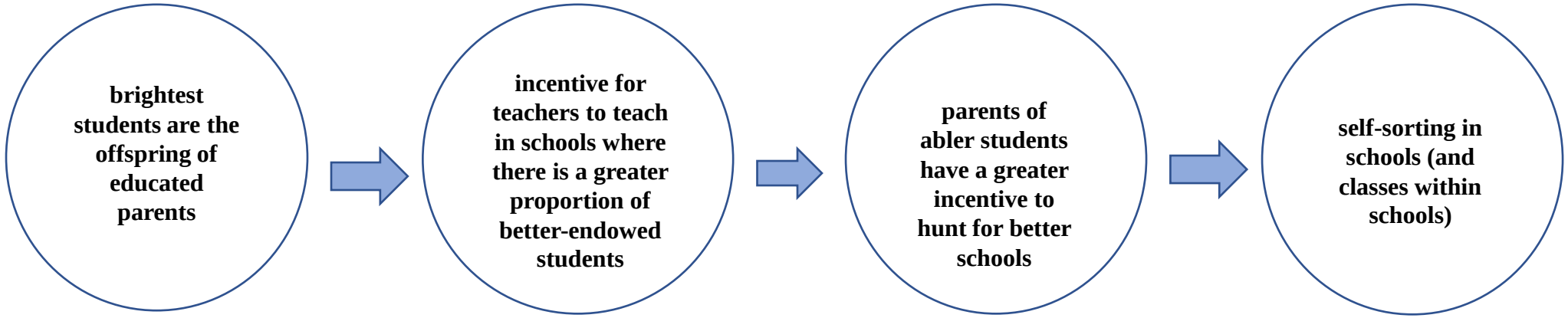
Supply of Education

- This describes a sort of **multiplicative effect of educational resources** ($\boldsymbol{E_{it}}$): there is a direct impact on the current production of new human capital (given by $\frac{\partial(\Delta H_{it})}{\partial E_{it}}$), and an indirect effect via the optimal plan revision induced by newly added resources (given by $\frac{\partial(\Delta H_{it})}{\partial S_{it}} . \frac{\partial S_{it}^{*}}{E_{it}}$).
- Example: the opening of a new library within a school: the direct impact on children's education is given by the newly added opportunities of browsing through new volumes and learning about new subjects. At the same time, a new library makes the school more attractive to families and children, who are now encouraged to remain longer at school in order to take greater advantage of it. Both effects strengthen the formation of new human capital.

Supply of Education

- **The problem of self-sorting in schools (and classes within schools):**





Supply of Education

- **Peer Effect:**
- While individual ability may be important when interacting with teacher quality, it could also become relevant at the aggregate level of the class (or of the school).
- The overall effect of average ability in a class depends on the hypothesized effect of the social interaction (peer effect), which can be either of the ‘complement’ variety (human capital formation improves only when there is a generalised increase in the quality of all students) or of the ‘substitute’ variety (the ability of a better-endowed student can – at least partially – compensate for the low performance of a less endowed student).

Supply of Education

- **Actual human capital formation emerges as the equilibrium result of supply and demand for school quality:**
- By varying student qualities (whenever schools can sort students according to their observable abilities, as in the admission to some private schools and/or to most high schools) and class size, school managers can vary the potential for human capital formation in each class. (**Class Formation**)
- Since families choose schools according to their expectations with respect to admission and class formation policies, actual human capital formation emerges as the equilibrium result of supply and demand for school quality.

Class Formation and Peer Effects

- There are three main problems in defining optimal class formation: (i) *the selection of students according to their ability, (ii) the class composition (i.e. mixing students of different ability in the same class or creating ability-homogeneous classes) and (iii) the class size.*
- The first two issues arise whenever students are differently endowed with abilities that are relevant in educational achievement (attentiveness, brightness, cooperativeness). Otherwise, only the third issue remains relevant.
- (i) *the selection of students according to their ability:* The problem of screening students arises from the unobservable nature of individual ability.
- Problem arises due to the existence of asymmetric information.
- The schools have two alternative ways to find the best students: either through submitting all applicants to specific **examination**, or by selecting them in accordance with their **willingness to pay**.

Class Formation And Peer Effects

- *But the allocation mechanism based on testing is inefficient!*
- It wastes resources: students spend time to prepare for the admission tests, families spend money in order to provide extra tutoring for the same aim and schools have to pay teachers (or external examining agencies) to mark exams.
- In addition, student performance is very often correlated to family background, and therefore the final result does not always identify ‘pure’ ability in the students.
- *The market mechanism (selecting students by means of admission fees that increase with perceived school quality) is in principle more efficient.*
- By ordering people according to the maximum fees they are willing to pay, they indirectly reveal their hidden abilities.
- Seen from this perspective, in order to obtain the best students it is sufficient to raise fees adequately.
- Under the maintained assumption that private schools provide better-quality education, the empirical counterpart is that we should observe better-ability students in private schools, because only for high-ability children is it rational to pay more for better education.

Class Formation And Peer Effects

- However, the market allocation mechanism works properly only when financial markets operate perfectly – that is, when families can borrow money to pay high fees on the expectation of high-ability children.
- Otherwise, if markets for education financing do not exist, poor parents of high-ability children will be outspent by rich parents of lower-ability children.
- *Solution: the combination of meritocratic selection and publicly financed scholarships contingent on family income can yield the most efficient matching of students to schools.*
- *(ii) the class composition (i.e. mixing students of different ability in the same class or creating ability-homogeneous classes):*
- The problem of sorting students in order to obtain an appropriate match between students and schools arises not only in schools of different qualities.
- *Learning activity in class is affected by the ability and behaviour of classmates. (Peer Effect i.e.*, the externality created by each individual on other people. *)*

Class Formation And Peer Effects

- Peer effects can take different forms: conformity, competition, envy, and so on. School classes are a typical example where peer effects reveal themselves.
- Consider, for example, the case where student abilities are technical complements. In such a case each student benefits from being in a class of bright students, because he/she gets more insights in class discussion, feels more pressure to compete and, in general, obtains additional stimuli by being associated with intellectually rich classmates.
- But the empirical relevance of peer effects is far from being ascertained on empirical grounds but it has strong implications with respect to class formation and class size.
- Lazear (1999) has proposed an interesting model that shows the importance of interaction between students' abilities.
- If student ability is correlated with attending classes without disrupting other people's learning activities, one can empirically measure it by the fraction of time during which a student pays attention to the teacher;

Class Formation And Peer Effects

- let us define it as $p_i, 0 \leq p_i \leq 1$.
- As a consequence, teaching is possible only when all students in a class pay attention – that is, for a fraction of time equal to $\prod_{i=1}^{n} p_i, where\ n = class\ size$.
- When all students in a class are of equal quality, then the teaching activity is possible for a fraction p^n of time: in such a context teaching and learning directly depend positively on students' quality and negatively on class size (since $p_i \leq 1$).
- Example: each student is able to pay attention for 98 per cent of his/her class time; then teaching and learning activities in a class of twenty-five similar students will be possible only for 60 per cent of time (as a result of $0.98^{25} = 0.60$). If student quality declines, paying attention only 94 per cent of the time, learning and teaching become possible only for 21 per cent of the time, and it would be necessary to reach a class size of just eight students in order to restore the ability to teach the 60 per cent of the time.
- Hence, schools themselves have incentives to attract better students.

Class Formation And Peer Effects

- Whenever a pre-assigned school order exists, the first school will choose the best students.
- Since being admitted to the best school can be priced, the school can use either exams or market mechanisms.
- Then the second school chooses the second-best students, and so on.
- The final outcome: perfect segregation of students according to their abilities and of schools according to the average quality of admitted students, irrespective of whether sorting occurs either through tests or through market channels.
- However, a stratified educational system does not necessarily represent the most efficient allocation of students.
- If the peer effect linearly affects the educational production function then exchanging students between schools does not alter the overall production of human capital.
- In contrast, when the educational production function exhibits increasing marginal returns in terms of the peer effect, then perfect segregation is effectively the most efficient allocation of students.
- However, whenever we observe a decreasing marginal productivity of average ability, mixing students of different abilities may prove superior in terms of human capital production.

4.3 Integration or segregation?

- In order to show how the previously introduced elements interact in the process of class formation, we now propose a simplified version of a model that was originally proposed by Roland Benabou (1996a) to analyse territorial segregation (i.e. the endogenous formation of rich and poor neighbourhoods) but that can easily be adapted in terms of class formation.
- The model predicts social integration or segregation as an endogenous result of optimizing agents according to the role played by social capital in human capital formation. (School choice will shape the distribution of human capital in the society, and is strictly related to income inequality).

4.3 Integration or segregation?

- Let’s consider an overlapping generation model in which agents live for two periods.
- Each agent attends the school chosen by his/her parents in the first period of his/her life.
- School attendance provides newly formed human capital, which depends on family background (summarised by parent human capital) and by the quality of the school attended.
- The quality of the school is determined by a peer effect (here proxied by the average human capital possessed by parents of schoolmates) and by a resource effect (the amount of resources available from local taxation).
- Then the agent earns an income that is proportional to the newly formed human capital, becomes a parent and chooses a school for his/her child’s education.
- Given the fact that schools gather students from local neighbourhoods, school choice and residential choice coincide; it is therefore plausible that the agent gets indebted in order to finance the school/residence choice.
- Labour earnings are used for consumption and payment for school/residence sunk costs in the first period of life.
- In the second period of life the agent works, consumes, repays the possible debts and dies.
- In the meantime, the child starts attending the school chosen by his/her parent.

4.3 Integration or segregation?

- Assumptions for the model:
- Only two schools serve the whole society (be it a district or a metropolitan area), indexed by index j, j = 1, 2; each of them can host one-half of the student population.
- The schools have access to the same teaching technology and therefore, ex ante, they are identical.
- There exist only two possible levels of human capital: H_A corresponds to the case of high-education type (call it ‘college graduate’ or ‘skilled worker’ type), while H_B corresponds to low-education type. By definition, $H_A > H_B$ holds.
- The population is assumed constant. When n indicates the high educated fraction in the population, the average human capital in the society is given by;
- $\overline{H} = nH_A + (1-n)H_B \qquad (4.2)$
- Denote n^j as the fraction of students from high-educated parents in each school.
- We also take as convention the first school to be the ‘best’ school in terms of social capital, given the assumption of $n^1 > n^2$.

4.3 Integration or segregation?

- Altruistic individual preferences are defined over individuals' own consumption in the two periods of life.
- C_t^t and C_{t+1}^t indicate the consumption of generation t when young and when old, respectively and consumption over the human capital accumulated by the child H_{t+1}.
- Each agent chooses the school in which to enroll his/her child E^j , j = 1, 2, by maximising his/her indirect utility function, which corresponds to the solution of the following problem,
- $U^j(H_t) = \max_{D_t} U(C_t^t, C_{t+1}^t, H_{t+1})$
- $U^j(H_t) = \max_{D_t} U(logC_t^t + logC_{t+1}^t + logH_{t+1})$ (4.3)
- subject to constraints:
- $C_t^t + \beta^j = H_t(1-\tau) + D_t$ (4.4)
- $C_{t+1}^t + D_t\big(1 + R(D_r, H_t)\big) = H_t$ (4.5)
- $H_{t+1} = f\big(H_t, L^j, E^j\big)$ (4.6)

4.3 Integration or segregation?

- $C_t^t + \beta^j = H_t(1-\tau) + D_t$ (4.4)
- The budget constraint (4.4) specifies that consumption when young plus enrolment fees (β^j) for sending one's child to school E^j can be financed either through labour income (for simplicity, equal to the endowment of human capital), net of taxes, τ (to be used to finance local schools), or through borrowing an amount D_t.
- $C_{t+1}^t + D_t\big(1 + R(D_r, H_t)\big) = H_t$ (4.5)
- The budget constraint (4.5) for the second period indicates that consumption when old and debt repayment (where financial market imperfections make the borrowing rate R dependent on earning capability and the extent of the loan) must balance second-period earnings (which, for simplicity, are not taxed).

4.3 Integration or segregation?

- $H_{t+1} = f\left(H_t, L^j, E^j\right)$ (4.6)
- The constraint (4.6) corresponds to the educational production function, where the newly produced human capital depends on parents' human capital H_t, on the quality of the school attended L^j (the peer effect) and on the resources available to the same school E^j.
- To characterise the effect of social capital, it is crucial to define whether heterogeneity of family backgrounds within the same school is beneficial or detrimental to human capital formation. To formalise this idea, we assume that school environment quality L^j takes the form;
- $L^j = L\left(n^j; H_A, H_B\right) = (n^j H_A^\sigma + (1 - n^j) H_B^\sigma)^{\frac{1}{\sigma}} = L(n^j)$, L>0

4.3 Integration or segregation?

- $L^j = L\left(n^j; H_A, H_B\right) = (n^j H_A^\sigma + (1 - n^j) H_B^\sigma)^{\frac{1}{\sigma}} = L(n^j)$, L>0
- n^j= the fraction of students from high-educated parents
- $(1 - n^j)$= the fraction of students from less-educated parents
- H_A= high-education type
- H_B= low-education type $[H_A > H_B]$
- $\delta = \left.\frac{\partial\left(\frac{K}{L}\right)}{\frac{K}{L}}\right/\frac{\partial\left(\frac{w}{r}\right)}{\frac{w}{r}} = \frac{\partial\left(\frac{K}{L}\right)}{\partial\left(\frac{w}{r}\right)} \times \frac{\frac{w}{r}}{\frac{K}{L}}$ $\left[\frac{K}{L} = \frac{H_A}{H_B}; w = \frac{\partial L^j}{\partial H_A}, r = \frac{\partial L^j}{\partial H_B}\right]$
- $\frac{\partial L^j}{\partial H_A} = \frac{\partial}{\partial H_A}(n^j H_A^\sigma + (1 - n^j) H_B^\sigma)^{\frac{1}{\sigma}} = \frac{1}{\sigma}(n^j H_A^\sigma + (1 - n^j) H_B^\sigma)^{\frac{1}{\sigma}-1} \times \sigma n^j H_A^{\sigma-1}$

4.3 Integration or segregation?

- $\frac{\partial L^j}{\partial H_B} = \frac{\partial}{\partial H_B}(n^j H_A^\sigma + (1-n^j)H_B^\sigma)^{\frac{1}{\sigma}} = \frac{1}{\sigma}(n^j H_A^\sigma + (1-n^j)H_B^\sigma)^{\frac{1}{\sigma}-1} \times \sigma(1-n^j)H_B^{\sigma-1}$
- $\frac{w}{r} = \frac{\frac{\partial L^j}{\partial H_A}}{\frac{\partial L^j}{\partial H_B}} = \left(\frac{n^j}{1-n^j}\right)\left(\frac{H_A}{H_B}\right)^{\sigma-1}$
- $\frac{\partial\left(\frac{w}{r}\right)}{\partial\left(\frac{K}{L}\right)} = \frac{\partial\left(\frac{\frac{\partial L^j}{\partial H_A}}{\frac{\partial L^j}{\partial H_B}}\right)}{\partial\left(\frac{H_A}{H_B}\right)} = (\sigma-1)\left(\frac{n^j}{1-n^j}\right)\left(\frac{H_A}{H_B}\right)^{\sigma-2}$
- $\delta = \left.\frac{\partial\left(\frac{K}{L}\right)}{\frac{K}{L}}\right/\frac{\partial\left(\frac{w}{r}\right)}{\frac{w}{r}} = \frac{\partial\left(\frac{K}{L}\right)}{\partial\left(\frac{w}{r}\right)} \times \frac{\frac{w}{r}}{\frac{K}{L}} = \frac{1}{(\sigma-1)} = -\frac{1}{1+\sigma}$
- $\delta = Elasticity\ of\ substitution$ [between two individuals]

4.3 Integration or segregation?

- $L^j = L\left(n^j; H_A, H_B\right) = (n^j H_A^\sigma + (1 - n^j) H_B^\sigma)^{\frac{1}{\sigma}} = L(n^j)$, L>0
- n^j= the fraction of students from high-educated parents
- $(1 - n^j)$= the fraction of students from less-educated parents
- H_A= high-education type
- H_B= low-education type $[H_A > H_B]$
- $\sigma < 1$; the heterogeneity is detrimental because the two individual types are complements among themselves in 'producing' the quality of social capital
- $L^j < \bar{H}\ for\ n^j \neq 0\ and\ n^j \neq 1$
- $\sigma > 1$; The two individuals are substitute of each other in producing social capital and heterogeneity is beneficial for L^j
- $L^j > \bar{H}\ for\ n^j \neq 0\ and\ n^j \neq 1$

4.3 Integration or segregation?

- Educational attainment also depends on the local neighborhood through the channel of funding, obtained through local taxation.
- If, for simplicity, we do not take into account the effect of differing tax rates in each area, we may say that educational expenditure per student E^j is financed by admission fees that are made progressive by a lump sum payment β^j plus an additional component that is proportional to family income.
- As a consequence, schools attended by students from educated parents receive more financial resources.
- Given its nature of discrete choice (choose the ‘good’ school 1 or the ‘bad’ school 2), each agent will consider the cost of school enrolment and the benefit provided by the presence of n^j children from educated families (i.e. type H_A parents).
- Having classmates from richer families increases the local funds available for the school.

4.3 Integration or segregation?

- If marginal rate of substitution between costs (the denominator) and benefits (the numerator) $[MRS\ \left(\frac{BENEFIT}{COST}\right)]$ of attending a given school is increasing in the parent's human capital, this implies that educated (type H_A) and richer parents obtain greater benefit from school quality, are more willing to spend, and therefore outspend poorer parents.
- The symmetric equilibrium i.e. the two schools have identical composition is unstable, because it is sufficient for just one rich family expressing its greater preparedness to pay to fuel a cumulative rise of admission fees for the better school, up to the point where all highly educated parents would like to send their children there.
- A stratified equilibrium will take place.
- Whenever stratification conditions apply, all H_A -type parents will spontaneously opt for the better school 1, whereas all H_B -type parents will prefer the worse school 2.

4.3 Integration or segregation?

- School stratification has **intergenerational implications**, because all children from good family backgrounds obtain better social capital from their school environment, attend schools with more financial resources and get H_A units of human capital.
- *School stratification converts into social stratification.*
- Vice versa, when school integration prevails, all human capital levels (incomes) converge to the same level, and an egalitarian society should emerge.
- While integration may seem socially desirable, nevertheless the spontaneous allocation of students could go in the opposite direction.
- In such a case, only public intervention to force such integration can lead to more efficient outcomes in terms of human capital formation.
- This may provide a rationale for a widely diffused practice of reserving quotas for various minorities and those who are socio-economically deprived.

4.4 Class Size

- A profit-maximising school (i.e. a private school) will optimally choose greater class sizes the bigger the student pool, the higher the teacher salary and the lower the average effect of school resources (or peer effect) on individual human capital formation.
- Symmetrically, a private school will hire more teachers the bigger the student pool, the lower the teacher salary and the higher the average effect of school resources (or peer effect) on individual human capital formation.
- *A higher return to education would suggest smaller classes and/or more teachers*, because families would be available to pay the monetary cost of additional resources on the expectation of greater rewards in the labour market.

4.4 Class Size

- *Effect of Class Size:*
- Empirical evidence is mixed!
- High variability in the impact of class size on student performance.
- The average student in small classes performed better (Krueger, 1999)
- Students assigned to smaller classes were more likely to apply for college and outperformed those in regular classes. (Krueger & Whitmore, 2001)
- Class size variation does not have a statistically significant effect on student achievements. (Hoxby, 2002a; Woessman & West, 2002)

- *Therefore, while in principle we could identify an optimal class size by equating marginal costs to marginal benefits, in practice the benefit can be hardly detected, given the high variability of the estimated impact of class size on student performance.*

4.5 Resource Effectiveness

- Many other indicators of school resources (such as the student/teacher ratio, teachers' salaries, teacher education, school size, the availability of books and/or libraries) have been found to have ambiguous effects by those trying to estimate educational production function.

1. Eric Hanushek has repeatedly provided reviews of this literature. The general puzzle to be addressed is that 'the constantly rising cost and "quality" of the inputs of schools appear to be unmatched by improvement in the performance of students'.

- Family and neighborhood are generally found to exert a greater impact on school achievement than aggregate indicators of school resources.
- While early studies directly tested the potential impact of school resources on *test score achievement (1)*, more recent ones have focused on the acquisition of cognitive abilities as the main output of the educational production function.

4.5 Resource Effectiveness

- *While the effect of school resources is uncertain with respect to student achievement, stronger effects are found through continuation in school.*
- Lee and Barro (2001) using information for fifty-eight countries over the period 1960 to 1990 found significantly positive effects for school resource variables.

4.5 Resource Effectiveness

- Card and Krueger, in various studies (1992, 1996a, 1996b), have argued that an abundance of school resources is reflected in longer stays at school and higher returns on education.
- Their basic idea is described by figure 4.2. Individuals differ in terms of ability, whereas schools differ in terms of resource endowments.

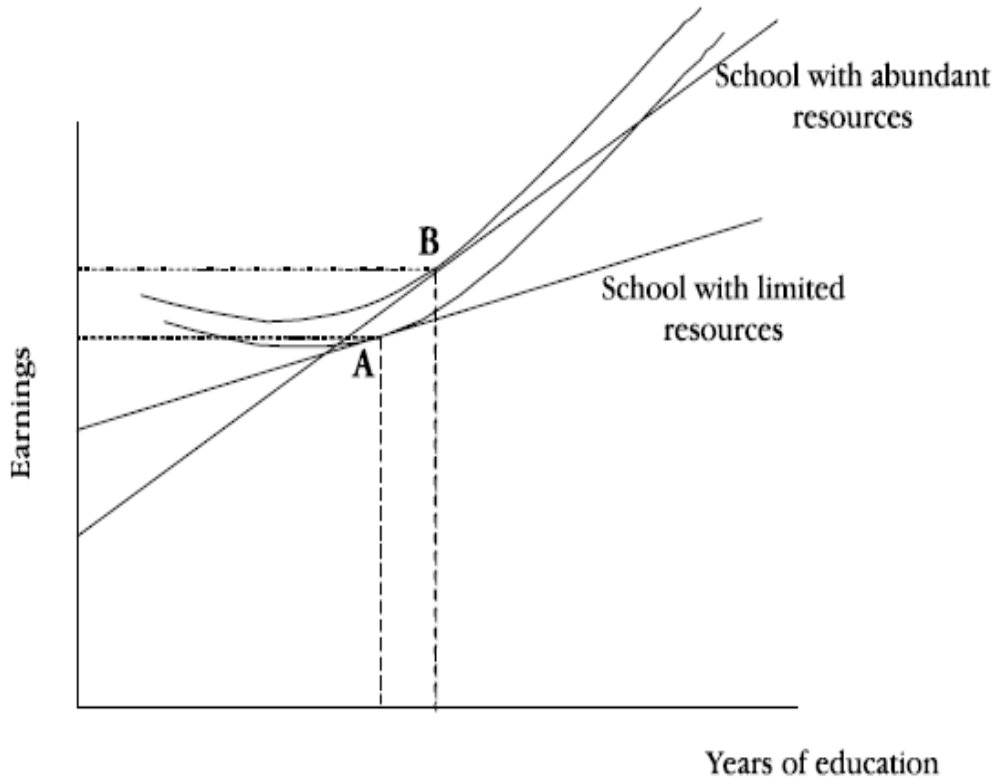


Figure 4.2 – Educational choice under different endowments of school resources

4.5 Resource Effectiveness

- If school resources are inputs in the educational production function then student self-sorting gathers better students in schools with more abundant resources (because they have a lower cost of school attendance and/or expect a higher return per invested unit of school resources). This corresponds to point **B** in figure 4.2.
- The remaining low-ability students will choose less education and will experience lower earnings (point **A**).

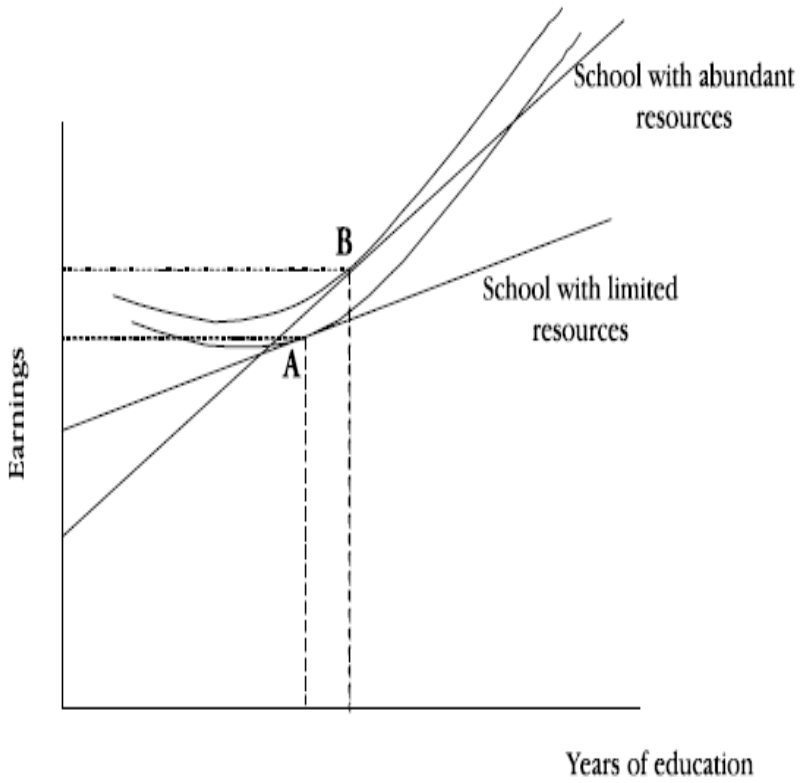


Figure 4.2 – Educational choice under different endowments of school resources

4.5 Resource Effectiveness

- By estimating a regression line for each sub-sample, a researcher would expect two different slopes.
- The ‘high resource’ schedule being characterised by lower intercept (a high-talent individual choosing not to acquire education will be penalised in the labour market) and higher slope (student attending better schools will experience higher returns on education).

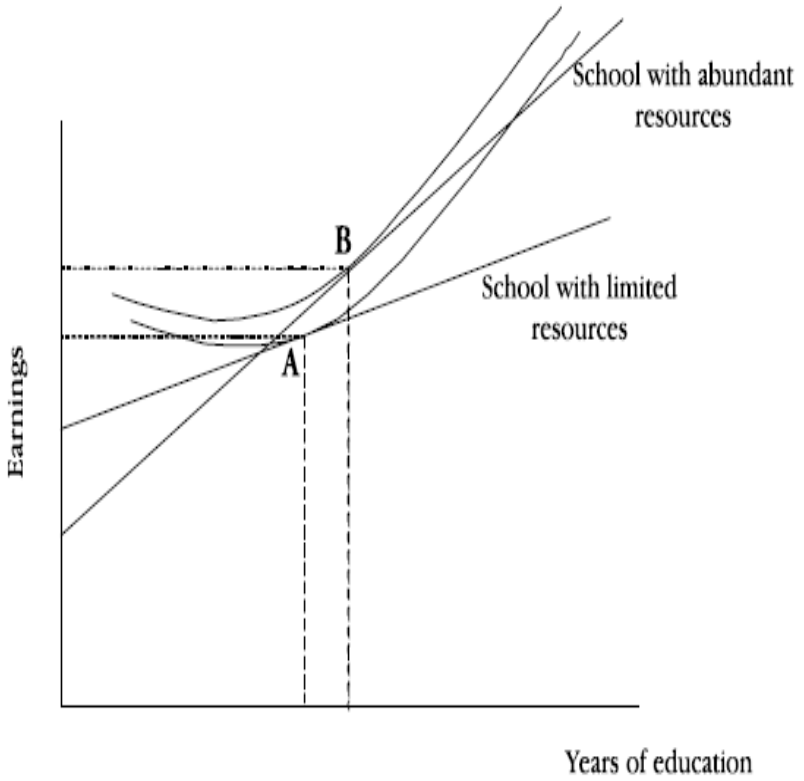


Figure 4.2 – Educational choice under different endowments of school resources

4.5 Resource Effectiveness

- Card and Krueger model yields three theoretical predictions: greater school resources are positively correlated with longer stays at school, higher returns to education and lower intercepts in the earning–education function.
- *Card and Krueger (1992, 1996a, 1996b,) confirmed that on average educational resources are associated with increase in students' subsequent annual earnings.*

4.5 Resource Effectiveness

- On the one hand, we find that educational resources are scarcely related to school performance (as measured by test scores and/or literacy tests); nor do test scores have any impact on subsequent earnings. On the other hand, we find that average educational resources per student affect educational attainment and subsequent labour market earnings.
- If mass scholarisation takes ‘low-quality’ students in schools (i.e. students from a poor background, who require increasing inputs for identical outputs), we would observe constant (or even declining) school productivity (as measured by test scores), but increased educational attainment in the population.
- Extended attendance can explain the positive correlation between school resources and earnings, **but we still lack a convincing (and testable) explanation for the correlation with marginal return rates of education.**

4.6 Resource efficiency

- With decreasing marginal productivity of inputs, an intensive use of one input can reduce the impact of its productivity to a negligible level (statistically indistinguishable from zero).
- Extensive use is not justifiable under cost minimisation.
- we can define a cost function linked to an aggregate educational production function;
- $Min \sum_{j=1}^{m} p_j E_j$, Subject to $\Delta H = f(E_1, E_2 \ldots . E_m)$ (4.17)
- where E_j represents a generic input (say teachers, books, libraries, and so on) linked to a market price p_j .
- Considering the first-order conditions associated with problem (4.17) and taking their ratio we get;
- $\frac{p_j}{p_k} = \frac{f_{E_j}(E_1, E_2 \ldots . E_m)}{f_{E_k}(E_1, E_2 \ldots . E_m)}$ (4.18)

4.6 Resource efficiency

- $\frac{f_{E_j}(E_1,E_2 \ldots E_m)}{p_j} = \frac{f_{E_k}(E_1,E_2 \ldots E_m)}{p_k}$ (4.19)
- *Cost effectiveness defined as the condition that achievement gains per unit of currency spent have to be equalised across inputs.*
- As Pritchett and Filmer (1999) demonstrate, the vast majority of studies on educational production function are inconsistent with this condition.
- In a similar vein, Gundlach, Woessman and Gmelin (2001) find that the educational sector in OECD countries has exhibited a productivity decline in the order of two to four percentage points a year over the period 1970 to 1994.

Why Technical Inefficiency

- How can we account for this evidence of technical inefficiency?
- Several explanations are at hand. The easiest one is that the educational production function is a **multi-output technology**. Schools aim to improve competences of students (often proxied by test scores), but they are also expected to foster civic attitudes, self-control, an aesthetic sense, the ability to cooperate with fellows, and so on.
- *As long as educational resources are relevant in fostering these attributes, we cannot satisfy the efficiency condition and still be on the efficiency frontier.*
- The problem is that these other outcomes are hardly measurable, and therefore this claim goes unchecked.

Why Technical Inefficiency

- An alternative explanation invokes the **lobbying activity** of teachers and families.
- If school resources are chosen under teachers' influence (i.e. in accordance with teachers' welfare) then we will observe an excessive use of the resources that are more relevant in his utility function.
- Hoxby (1996a) finds that the unionisation of teachers can account for a greater use of educational inputs.
- Teachers' unions may also be able to change budget allocation in favour of inputs that reduce teachers' workload (such as reducing class size and/or teaching load per teacher) or increase teachers' salaries.

Why Technical Inefficiency

- Woessman (2003) ‘public schooling systems still differ substantially across countries in their institutional structure of educational decision-making processes.
- They give different amounts of **decision making power** to the different agents involved in educational production, which creates different incentives for their behaviour.
- These differences in institutions and incentives will affect the agents’ decisions on resource allocation and thereby the effectiveness of resource use in the education sector, which should impact on the educational performance of the students’.
- He proved that the degree of school autonomy has a positive bearing on student performance;
- **Institutional features** such as external examinations and a competitive environment set by a large private schooling sector have statistically significant positive effects on student performance.

Why Technical Inefficiency

- Woessman (2003) interpretation is given in terms of the **agency problem**:
  - greater autonomy for schools implies more effective monitoring of teachers by parents concerned about students' learning, thereby being conducive to better student performance. Conversely, greater influence by teachers' unions in the education process leads to lower performance levels.
- Increased competition among public schools (i.e. **greater availability of choices**) can be beneficial for resource efficiency.

4.7 Efficiency versus equity

- While in competitive markets unprofitable firms will be driven out of the market by the (prospective) losses incurred by their owners, in the quasi-market for education less efficient schools need to be retained in order to supply a minimum of education to some pupils.
- This discussion on the legal obligation to provide at least some education to all citizens, irrespective of the attained level of efficiency, leads us to the potential **trade-off existing between efficiency and equity in education provision.**
- Educational expenditure has an intrinsic equalising content, which can be strengthened if it is decided to allocate these resources in a compensatory manner (namely by favouring individuals from poor backgrounds).
- A society as a whole produces more human capital by concentrating resources on the best students; equality can be achieved by the subsequent redistributive taxation of labour incomes.

4.7 Efficiency versus equity

- As in other spheres of public economics, the public provision of education faces a trade-off between equity and efficiency, with the result that a **society can improve in one dimension only at the expense of a worsening in the other.**

- *Improvements in the efficient use of resources can certainly be achieved by means of appropriate incentive schemes for schools and teachers, but as long as parents' education remains one of the most significant predictors of children's schooling there is scope for compensatory action by public authorities, in order to improve on the equity side.*