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Enhancing the public provision of education

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Abstract

Educational systems in developing countries show widespread problems that hinder delivering the service in adequate quantity and quality, as well as equity issues are still unresolved in many cases. The paper provides a flexible framework to deal with educational provision and public policies in developing countries, linking the impact of quality-quantity-equity of educational policies on labour markets. It adds to the education production function and human capital accumulation theoretical literature in which it includes the presence of inefficiencies, modelling the role of educational policies on tacking at them. Educational policies designing is discussed, which leads to suggest that more sophisticated educational policies ("multiple targets") may increase the efficiency of the expenditure in education in terms of the quantity-quality of the output (skills).

I. Introduction

The education systems in developing countries show widespread problems that hinder delivering the service in adequate quantity and quality, as well equity issues are still unresolved, for example across income groups or gender (see for instance UNESCO, 2000).

Not only is wide coverage to be ensured but also the completion rates as progression in time to subsequent levels. Middle income countries as those in the Latin American region have already successfully achieved universal coverage at entry level (primary school) though retention rates are poor especially after completing primary education (Carlson, 2002, Tedesco and Lopez, 2002). High repetition rates are also an endemic problem in Latin American countries even at entry level (Tedesco and Lopez, 2002).

The access to education affect the individuals' chances to access the labour market and their probabilities of being successful (ILO, 2003). According to OECD (1997) there is a significant link between formal schooling and basic skills as literacy and numeracy required to enter the labour market. It seems apparent that the role of schooling in economic development, especially in developing countries, is central (Lopez et al, 1998, Carlson, 2002).

But as noted by Carnoy and de Moura (1999) education quality is poor in the Latin American region compared with the developed world, measuring schooling quality by students' knowledge (following Hanushek, 1979, etc.). Shiefelbein, et al (1998) suggest that although educational reforms have been implemented throughout the region they were costly and ineffective.

Another relevant aspect of education both in developed and developing countries is the high proportion of publicly provided education. Public provision ensures equal access of individuals, though inefficiency is an important problem in the public provision of education (for instance Levačić and Vignoles, 2002). In particular for Latin America Birdsall et al (1998), Lopez et al (1998), Nelson (1999) and Paus (2003) suggest that inefficiency and inequity in the provision are major culprits for the poor performances of educational systems in the region.

This work aim to provide a flexible framework to deal with educational provision and public policies in developing countries, linking the impact of quality-quantity-equity of educational policies on labour markets. It adds to the education production function and human capital

accumulation theoretical literature in which it includes the presence of inefficiencies and in which it models the role of the public provision on tacking them. The link between provision of education and trade will be analysed elsewhere.

This work is organised as follows. Section II the basic settings of the education provision are presented. Section III discusses the role of the educational policies. Section IV concludes. There is an Annex that presents a description of the public education sector in Uruguay and also relevant education and labour statistics.

2. Modelling the education sector

The education sector is modelled here following the approach of the education production function literature in which inputs (students, teachers, schools, equipment, etc.) are transformed into skills using a given technology, though it is closer to the specification used in the literature relating education, human capital and trade as in Findlay and Kierzkowski (1983). It differs from Findlay and Kierzkowski (1983) is what follows.

A detailed specification of the schooling process is introduced in order to analyse the process of accumulation of knowledge and its interaction with the labour market. The production of education is disaggregated by level, grade and type2: individuals accumulate knowledge gradually through passing successfully from one grade/level to the next. This will show when (sooner or later depending on how successful or unsuccessful his/her schooling life has been) and how (more or less qualified, depending on the last grade successfully completed and the quality of education received) the individual enters the labour market.

The introduction of a sequential process as well as well as a public provider of education will prove to be a flexible framework for analysis of efficiency, quality and equity issues. The accumulation process is enhanced by the quality of the education but damaged by systemic inefficiencies in the public provision. Due to inefficiencies the output of the education activities does not measure the contribution of the activity to the accumulation of human capital, and it is a policy matter whether or how to affect the system's performance.

2 : A level is a sub-system (e.g. secondary education), a grade is a step in a level, and type refers to student's characteristics (innate ability, socio-economic background, etc.)

A feature of the model is that the resource intensity per student is a key variable for quality, equity and efficiency matters, which may be thus targeted by the education policy. For example, it is up to the policy to improve the qualification of prospecting workers by increasing both quantity and quality received by students (i.e. increasing years of schooling and units of skills per year), particularly to improve the quality of the prospect inputs to the system itself (i.e. future teachers/staff), and to reduce the cost of the production of skills by lowering repetition rates.

Repetition, dropouts, poor quality and unsuccessful transitions throughout the system or to the labour market are particularly serious problems in Latin American countries. This sequential approach allows taking into consideration the obstacles to progression throughout the system, that is repetition and dropouts.

In the case of repetition, it requires "reprocessing" students to effectively endow them with the corresponding units of skills. This means that in practice they will be finally more resource intensive than the rest. The current system all over the Latin American region seems to rely on students to select themselves (by failing) who need to be reprocessed, and makes them share the cost by applying more of their time and effort.

However, this is not to be an efficient policy. One the one hand students that eventually fail not only fail to accumulate skills themselves but they also damage the process of accumulation of the rest of the students, moreover, making repetition occurrence even more likely for the whole school population. Thus an improvement in the allocation of what is actually spent counting also for subsequent reprocessing of students may give a better educational outcome, and sooner. Which means that, increasing the educational budget today is better than spend the same amount over a longer period required to reprocess part of the students. On the other hand, repetition is closely tied to dropout rates. Early dropouts diminish the average qualification of students leaving the system, which may generate external inefficiency as the system do not deliver a good enough mix of workers to the labour market.

2.1. General settings

The output of education activities, as a flow variable grade-level-type specific, is given by:

$$Q_{ijk} = F_{ijk}(K_{ijk}, E_{ijk}) \qquad (1)$$

where the sub-index i represents the grade, j the level, and k the student's type, Q_{ijk} is the output of the education activities (subject to constant returns to scale) of grade i in level j using the resources allocated to it, K_{ijk}, and given the number and type of students currently enrolled, E_{ijk}.3

The amount of knowledge offered to each student (q_{ijk}) and embodied by him/her on the successful completion of a grade is an inverse function of the total enrolment, given a fixed amount of resources. As Q_{ijk} is subject to constant returns to scale, q_{ijk} is:

$$q_{ijk} = \frac{Q_{ijk}}{E_{ijk}} = F_{ijk}\left(k_{ijk}\right) \qquad (2)$$

where k_{ijk} measures the intensity of educational resources per student, where $\frac{\partial q_{ijk}}{\partial E_{ijk}} < 0$ and $\frac{\partial q_{ijk}}{\partial K_{ijk}} > 0$.

The schooling quality is reflected by the value of q_{ijk}. Low values of the indicator imply that even when the students complete many years of study they will have obtained only small amounts of educational output. So the quality of education may be improved by increasing the intensity of resources per student.

Learning is an accumulative process. Individuals enter the system without previous knowledge and after completing basic education they have acquired elementary literacy and numerical skills, which made them capable to engage in working activities as unskilled workers. So, basic education produces unskilled workers and intermediate inputs to higher education and higher education produces skilled and semi-skilled workers

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3 Note that the following identities also hold:

$Q_j = \sum_i Q_{ij}$

$Q = \sum_j Q_j$

where Q_j is the output of level j and Q is the total output of the whole public education sector, and the variables Q, Q_j and Q_{ij} are not observable.

The accumulation of knowledge during schooling can be analysed by means of the following expression:

$$f_{nmk} = \sum_{j=1}^{m} \sum_{i=1}^{n} q_{ijk} \qquad (3)$$

where f_{nmk} is the total endowment of knowledge accumulated per student of group k who has completed up to grade n of level m.

The indicator f_{nmk} measures the amount of efficiency units of skills that a student of group k has accumulated up to grade n and level m, and equals the concept of human capital.

This indicator will be also useful to distinguish "real" from "nominal" qualifications: while f_{nmk} represents the real qualification of the individual, the formal completion of grade n and level m is the nominal qualification. Students progress inside the system or exit the system into the labour market carrying the efficiency units of skills they have managed to accumulate during their schooling.

Ideally, f_{ij} should reach a value f_{ij}^{*} which are the qualifications to be embodied following the best practice. Overall failures in the subsystem might prevent the students to reach f_{ij}^{*}, reason for which there will be a gap between "nominal" and "real" qualification of students, for instance, after finishing basic education individuals will not be suitably prepared for work or higher education. Achievement below the best practice will undermine future success of students within and outside the education system, as will be seen below.

Expression (1) reflects the fact that the student's characteristics affect the technology of education production. Individuals differ in their ability and in their context. Individuals with lower ability will process with more difficulties the educational services provided to them. For instance, they will require more teaching hours to be able to catch up the more able students. Also poor socio-economic background will affect negatively the embodiment of knowledge. For instance, they will require school meals or counselling services for them or their families. Let thus consider that individuals with lower ability or poor socio-economic background belong to the same group, the disadvantaged one.

Assuming a Cobb Douglas functional form for (2), the educational output per student is given by:

$$q_{ijk} = A_{ijk}\left(\frac{K_{ijk}}{E_{ijk}}\right)^{\alpha} \qquad (4)$$

where A_{ijk} regulates the student's type effect parameter for level j, the sub-index $k = F, D$ for favourable and disfavourable groups respectively, with $A_D < A_F$.

In expression (4) is apparent that the resource intensity per student and the group parameter (A_{ijk}) are combined to obtain a certain level of educational output per student (q_{ijk}). Henceforth, for the same level of resource intensity, the technology of education (driven by the group parameter) is less able to provide quality education to low ability students than for more advantaged ones. Being A_{jk} an exogenous parameter, the resource intensity per student may be adjusted to obtain any level of educational output per student.

2.2. Transitions

The flow of students throughout the system starts at basic education, which produces both unskilled workers as well as inputs to higher education. Individuals enter into the system as raw inputs and pass to later stages as processed inputs as they accumulate skills. Whether they continue studying or go to the labour market they take with them the amount of knowledge accumulated through the education process.

The repetition and dropout rates affect the size of the total number of students and the average duration of studies. Repetition causes delays in the progression to higher grades, increasing not only the opportunity cost of the investment in education for the student but also increasing the actual cost of the education received by them.

Birdsall et al (1998) suggest that expanding quantity and improving quality at basic education level stimulates the demand of higher education. Early dropouts not only reduce the potential demand for higher education but also as, as Anderson and Randall (1999) argue, early dropouts tend to perpetuate a low productivity workforce.

The flow of students and production of skills can be described as follows. Considering a general case (any grade-level-type, thus abstracting from sub-indexes), the total production of skills takes the form:

$$L = q\,n \qquad (5)$$

where

$$n = E(1-\gamma) \qquad (6)$$

Of this new production, $1-\theta$ is the fraction of students continuing inside the system (both repeaters and non-repeaters). So,

$$\theta\,L = \theta\,q\,n = \theta\,qE(1-\gamma) \qquad (7)$$

units of skill go into the labour market, and

$$(1-\theta)\,L = (1-\theta)\,q\,n = (1-\theta)\,qE(1-\gamma)$$

units of skill progress inside the system.

So the inflow into the labour market depends on the number of students that exit the system ($\theta\ n$) and the productivity (q) they have acquired during their schooling.

Being more precise about notation table 1 shows a quick overview of the students/workers flows.

Table 1: Students workers/flow

Total of students	Repetition rate	Dropout rate	Distribution of students		
			Repeat	pass	exit the system
E_{ij}	γ_{ij}	θ_{ij}	Go on studying: $\gamma_{ij}(1-\theta_{ij})E_{ij}$ Go to the labour market: $\gamma_{ij}\theta_{ij}E_{ij}$	Go on studying: $(1-\theta_{ij})(1-\gamma_{ij})E_{ij}$ Go to the labour market: $\theta_{ij}(1-\gamma_{ij})E_{ij}$	$\theta_{ij}E_{ij}$

The table shows the inflow and outflow from the education system. E_{ij} students enrol each year in grade i level j, from which:

i) A fraction $1-\gamma_{ij}$ of them pass and the rest is due to repeat the grade.

ii) A total of $\theta_{ij}E_{ij}$ students dropout at the end of the academic year. From these:

- The number $\theta_{ij}(1-\gamma_{ij})E_{ij}$ of students that dropout at grade n and level m go to work endowed with f_{nm} efficiency units of skill.

- The repeaters that dropout, $\gamma_{ij}\theta_{ij}E_{ij}$, go to work with a lower endowment given by $f_{(n-1)m}$ due to the fact that they have not successfully completed grade n.

2.3. Repetition and dropout rates

Repetition and dropouts are widespread problems in Latin America (see for instance Randall and Anderson, 1999, Tedesco and Lopez, 2002). Schiefelbein and Schiefelbein (1999) argue that the main factors affecting repetition in the region are poor teaching methods and the lack of adequate material. However, other non-school factors, as socio-economic family background, are regarding as important as school factors for students success both in Latin America as well other countries (Corman, 2003, Jensen and Seltzer, 2000, Peralta and Pastor, 2000).

Taking into consideration the referred literature, a general expression for repetition rates may be as follows:

$\gamma_{ijk} = \gamma_{ijk}(k_{ijk})$ where $\frac{\partial \gamma_{ijk}}{\partial k_{ijk}} < 0$.

I shall assume the following functional form:

$$\gamma_{ijk} = b_{ijk} k_{ijk}^{-\rho_{ijk}} \qquad 0 < \rho < 1 \quad , \quad b_{ijk} > 0 \tag{8}$$

where b_{ijk} is a scalar which is grade-level-type specific and ρ_{ijk} indicates the responsiveness of the rate to the resource intensity.

Similarly, the dropout rate may be expressed as follows:

$$\theta_{ijk} = a_{ijk} k_{ijk}^{-\delta} \quad 0 < \delta < 1 \quad , \quad a_{ijk} > 0 \tag{9}$$

where a_{ijk} is a scalar which is grade-level-type specific.

2.4. Educational output and human capital

As there are frictions in the system, some resources are wasted during the schooling process, so not all the educational output results in the accumulation of human capital.

Q is the output of the education activities resulting from applying resources to the processing of E students, however, only n successful students will embody an amount of knowledge equal to q. The difference, $E-n$ is an indirect measure of the waste of resources. If there is no friction in the system then $E-n=0$, only in this case will all the output of education activities result in accumulation of knowledge.

The output of new skills units is given by (5) or equivalently:

$$L = q\,n = Q(1-\gamma) \quad = Q - \gamma Q \qquad (10)$$

In a poorly functioning system $qn < Q$. From (10) waste caused by inefficiencies depends on the resource intensity, waste being equal to $\gamma\, Q$.

2.5. Properties

Property 1: For constant level of enrolment (E) the amount of students finishing in time (n) will raise with any increase of the educational budget allocated to the level.

Differentiating (6) and using (8), after some manipulation results:

$$\hat{n} \;= \rho \frac{\gamma}{1-\gamma} \hat{K}$$

Property 2: The elasticity of the production of skills relative to the use of resources is greater for the production of skills than that for the educational output, reflecting the effect on efficiency.

From (2):

$$Q = qE$$

which is the output education activities, and coincides with the production of new skills (nq) when $E = n$ (full efficiency outcome).

For a constant enrolment the number of efficiency units embodied into students (L) increases with increases of the educational budget. Differentiating (5) and using (6) and (8), gives after some manipulation:

$$\frac{dL}{L} = \left(\alpha + \rho \frac{\gamma}{1-\gamma} \right) \frac{dK}{K} \qquad (11)$$

The elasticity of the production of skills to resources is thus:

$$\frac{dL}{dK}\frac{K}{L} = \alpha + \rho \frac{\gamma_j}{1-\gamma_j}$$

Thus the elasticity of the production of skills is greater than the elasticity of output with respect to resources, which is equal to α.

Property 4: The production of skills (L) grows faster than the supply of new efficiency units to the labour market (θL) as progression rates within the system are improved.

Differentiating (7) and rearranging:

$$\frac{d(\theta L)}{\theta L} = \left(\alpha + \rho \frac{\gamma_j}{1-\gamma_j} - \delta \right) \frac{dK}{K} \qquad (12)$$

where the coefficient of $\frac{dK}{K}$ in (12) is lower than in (11), which proves the property.

The production of skills grows faster than the efficiency units to the market due to improved internal efficiency as more students continue studying. To be more precise, for a constant enrolment the number of workers delivered to the labour market (θE) falls with increases of the educational, while the number of efficiency units delivered to the labour market (θL) increases.

3. Education policies

Nelson (1999) argues that in many middle income countries the allocation rather than the level of expenditure is the main problem in the education sector. In the case of Latin American countries Birdsall et al (1998) shows that the levels of expenditure are not low compared with other developing countries, however, the results are poorer. In particular these authors report that average schooling attainment is two years lower of what would be expected from the same level of per capita income.

According to this, this section analyses the design of educational policies. Education is publicly provided, which leaves the problems of coverage and retention of the system dependent on the performance of the sector itself. All students have the same opportunities to enter, but the quality of education offered to them will depend on policy decisions. The ability of the system to obtain good systemic performances depends on educational policies.

The government allocates an exogenously determined budget for education activities. This is modelled as a two step process: in the first step the government distributes resources within the educational sector given a total budget, and in the second, educational institutions allocate internally the resources received across types and grades.

3.1. Government

An issue frequently found in the literature is whether the government's priority should be basic or higher education. This is an important issue in developing countries where several weaknesses in basic education undermine the overall performance of the system. On this point Birdsall et al (1998) argue that in Latin American countries the share of higher education in public expenditure tend to be high (20% average) compared to East Asian countries (15% average).

I assume that the government's utility function takes the following form:

$$U = \prod_j \left(n_j\right)^{\phi_j}$$

where n_j is the number of student successfully completing each level. The parameter ϕ_j represents the government's preferences, and it is an indicator of the weight given by the government to the development of human resources. The government can tackle inefficiencies across the system selectively, according to its preferences, by adjusting the parameter ϕ_j

The optimisation programme can be formulated as follows:

$$\underset{K_j}{Max} \quad U = \prod_j \left(n_j\right)^{\phi_j} \qquad \sum_j \phi_j = 1$$

$$s.t.\ \overline{K} = \sum_j K_j$$

$$n_j = \left(1 - \gamma_j\right) E_j$$

$$\gamma_j = c_j k_j^{-\rho}$$

$$E_j = E_{j-1}(1 - \theta_{j-1})(1 - \gamma_{j-1})$$

$$\overline{K},\ E_j \ \ given$$

where $\overline{K}$ is the total resources destined to education.

The Lagrangean for the above programme is given by:

$$L = \prod_j \left\{ \left[1 - b_j \left(\frac{K_j}{E_j} \right)^{-\rho_j} \right] E_{j-1} \left(1 - \theta_{j-1}\right)\left(1 - \gamma_{j-1}\right) \right\}^{\phi_j} - \lambda \left(\sum_j K_j - \overline{K} \right)$$

The optimal allocation ensures that the capital intensity per student is such that the average rates of repetition and dropout are reduced so as to increase the number of students completing each

level, and hence the government's utility. There is no closed analytical solution to the problem, but it can be solved numerically. So, the model allows the government to affect 'completion in time' rates by changing the level and allocation of the budget.

3.2. The education authority's policy

Once resources are allocated to each level, the education authorities will seek to optimise the use of these resources by students' type and grades, which is discussed below.

i) Types

The presence of student heterogeneity may impose a efficiency-equity dilemma to policymakers. Applying relatively more resources to the disadvantaged group operates towards obtaining similar results across groups, however, this comes to a cost of sacrificing better quality of education to the advantaged group.

By one hand, the efficiency in the production of knowledge is diminished when resources are diverted from those that assimilate it faster. By the other hand, efficiency is also diminished when resources are wasted by applying so insufficient amounts to some students (the disadvantaged) that they are unable to learn (they have to repeat), making the return to those resources equal to zero. On this point Birdsall et al (1998) argue that universal access to primary education in Latin America has become a "false entitlement" for the poor as the education they receive is of such a poor quality that it makes little real benefit.

Allowing for heterogeneity of students, equal access to the educational system does not imply equal benefits for all the students. Moreover, Lopez et al (1998) argue that the distribution of education matters for economic development. These authors show empirical evidence that unequal distribution of education tends to have a negative impact on per capita income in many countries.

So, rather than equal access to education individuals may, or should as OCDE (2004) put it, be offered access to "equivalent learning opportunities". According to this, I shall assume that he education authority's utility depends on overall quality across groups, as follows:

$$\underset{K_{jk}}{Max} \quad \prod_k (q_{jk})^{u_k}$$

$$s.t.\ K_j = \sum_k K_{jk}$$

$$q_{jk} = f(k_{jk})$$

where K_j is the amount of resources allocated by the government to level j, and the parameter μ_k represent the educational authority's preferences over education provision across groups.

The Lagrangean for the above programme is:

$$L = \prod_k \left[\left(\frac{K_{jk}}{E_{jk}} \right)^{\beta_{jk}} \right]^{\mu_{jk}} - \lambda \left(\sum_k K_{jk} - K_j \right)$$

When there are two types of students, advantaged ($k = A$) and disadvantaged ($k = D$), the following Lagreangean results:

$$L = \left[\left(\frac{K_{jA}}{E_{jA}} \right)^{\beta_{jA}} \right]^{\mu_{jA}} \left[\left(\frac{K_{jD}}{E_{jD}} \right)^{\beta_{jD}} \right]^{\mu_{jD}} - \lambda \left(K_{jA} + K_{jD} - K_j \right)$$

The allocation resulting from the first order conditions to the above program is

$$K_{jD} = \frac{\beta_{jD}\mu_{jD}}{\beta_{jD}\mu_{jD} + \beta_{jA}\mu_{jA}} K_j$$

$$K_{jA} = \frac{\beta_{jA}\mu_{jA}}{\beta_{jD}\mu_{jD} + \beta_{jA}\mu_{jA}} K_j$$

The general result for any number of types is represented by:

$$K_{jk} = \frac{\beta_{jk}\mu_{jk}}{\sum_k \beta_{jk}\mu_{jk}} K_j$$

In particular, an egalitarian approach towards the benefit the individuals receive from education ensures that $q_F = q_D$. In this case the following two equations determine the allocation of resources.

$$q_F = q_D$$

$$K_j = \sum_k K_{jk}$$

As we have a system of two equations and two unknowns (K_{jk}), it gives the solution:

$$K_{jk} = \frac{E_{jk} A_{j\bar{k}}^{\frac{1}{\alpha}}}{\sum_k E_{jk} A_{j\bar{k}}^{\frac{1}{\alpha}}} K_j$$

where $k = F, D$ and the sub-index $\bar{k}$ indicates different from k.

It is apparent then that by choosing μ_k appropriately the authorities can delivered egalitarian, elitist or progressive policies.

ii) Grades

Allocation of resources across grades may be an important issue when, as is often the case, some grades present a particularly difficult situation. For instance, in the Latin American case first year of primary school shows high rates of repetition (above 50% in some cases), in the case of Uruguay not only first year of primary but also the first year of high school and University show serious problems of repetition and dropout.

The education authority optimisation problem may take the following formulation:

$$\underset{K_{ijk}}{Max} \quad \sum_i q_{ijk} n_{ijk}$$

$$s.t. \quad \overline{K}_{jk} = \sum_{i=1}^{T} K_{ijk}$$

$$q_{ijk} = A_{ijk} k_{ijk}^{\alpha}$$

$$n_{ijk} = E_{ijk}\left(1 - \gamma_{ijk}\right)$$

$$\gamma_{ijk} = b_{ijk} k_{ijk}^{-\rho}$$

The Lagrangean for the above programme is:

$$L = \sum_i q_{ijk} n_{ijk} - \lambda \left(\sum_i K_{ijk} - K_{jk} \right)$$

Considering that there are two grades (1 and 2), the first order conditions to the above program (omitting type and level sub-indexes) are:

$$\frac{\partial L}{\partial K_1} = \left[\alpha\left(1 - \gamma_1\right) + \gamma_1 q_1 + q_2\left(1 - \gamma_2\right)\left(\rho_1 + \delta_1\right)\right]\frac{q_1}{K_1} - \lambda = 0$$

$$\frac{\partial L}{\partial K_2} = \left[\alpha_2\left(1 - \gamma_{21}\right) + \rho_2 q_2\right]\frac{q_2}{K_2} - \lambda = 0$$

$$\frac{\partial L}{\partial \lambda} = \sum_i K_{ijk} - K_{jk} = 0$$

The above conditions determine the optimal allocation of resources across grades which ensures the maximum production of skills across the level.

4. Some final remarks

Due to frictions in the educational system resources are wasted during the schooling process, and hence the output of the education activities does not measure correctly the contribution of the activity to the economy. Building up the economy's educational capital requires that the students effectively embody the qualification that the system is offering to them. That is, failures in doing so imply that the output of the sector and the generation of educational capital may differ significantly. This gap shows that there is an excessive cost in building up the economy's educational capital in comparison with an optimal performance of the educational system.

Efficiency, equity and quality in the education system depend on well targeting from government and authorities. There is a trade-off between the quality of education and the amount of students to be educated, given a fixed amount of resources. An excessive emphasis and only focused target on increasing the coverage of aged-school population could lead to a deterioration of the quality of education and so to a devaluation of the "nominal qualifications".

The model, by mapping links from education to labour market, suggests clear lines along which some of the major drawbacks in the education system affects the labour production. The policies discussed allow us to suggest that more sophisticated educational policies ("multiple targets") may increase the efficiency of the expenditure in education in terms of the quantity-quality of the output (skills) delivered to the labour market.

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Annex

Uruguay Outlook

Education and labour force

Statistics

Annex 1. Education

Under the present scheme in Uruguay compulsory basic education is composed of one year of Pre-primary Education, Primary Education and Lower Secondary Education totalling 10 years. People who go on study at higher levels enrol in Upper Secondary Education. After completion of which people can choose to go either to University or to the Teachers' Training School. This structure is presented in table 1.

Table 1: Uruguayan educational system

Level	Age*	Grades	Compulsory/not compulsory
Pre-primary	5		Compulsory BASIC EDUCATION
Primary	6-11	1st to 6th	
Lower Secondary (incl. Tech. Ed.)	12-14	1st to 3rd	
Higher Secondary (incl. Tech. Ed.)	15-17	4th to 6th	Not compulsory HIGHER EDUCATION
Teachers Training School	18-20/21	1st to 3rd Primary teachers 1st to 4th Secondary teachers	
University	18-22	1st to 4th **	

Source: Table taken from MEMFOD, ANEP, web site www.memfod.edu.uy, modified.

Notes: * age corresponding to official length of each level. ** average length.

In this work Primary Education is the first relevant step in the educational system (i.e. Pre-primary is not included). Students enter the system without previous knowledge and the rate of enrolment in Primary Education is assumed to be exogenous. Students entering the Lower Secondary Education have already accumulated some knowledge during the years of Primary Education. On the completion of basic education students have acquired elementary literacy and numerical skills, and at this stage they can enter the labour market as unskilled workers. On continuation to higher education the qualification of individuals increase and graduates enter the labour market as skilled workers. Those who leave higher education earlier will have a qualification increasing with the number of grades successfully completed. These individuals will be able to enter the market as semi-skilled workers.

The mass of students in the public education system presents a "pyramidal" structure, as shown in table 2.

Table 2: Composition of students by levels in public education- 2002

	Students	%
Primary (pre-primary incl.)	404914	51.2
Lower SE	125315	15.8
Upper SE.	108009	13.7
Technical school	65182	8.2
S teacher	17374	2.2
University.	70100	8.9
Total	790894	100

Source: Data from MEMFOD (2003/2004), except for University. University data for 2001 from INE.

The proportion of private provision of education is low at all levels, so the main responsibility for the education of the population rests on public provision, as shown in table 3.

Table 3 Students in public and private education in 2002 (percentages)

	Public	Private
Total	88.1	11.9
Pre-primary education	81.3	18.7
Primary education	88.3	11.7
Lower secondary education	88.0	12.0
Upper secondary education	88.9	11.1
Technical education	93.9	6.1
Teacher's Training School	98.5	1.5
University and other tertiary	90.1	9.9

Source: National Institute of Statistics (INE), Uruguay.

In recent years enrolment rates have had significant increases at all levels of the public education system, as table 5 shows.

Table 4 Enrolment growth in the public education system (base 1995)

	1995	2000	2002
Total	100	118.0	124.6
Pre-primary education	100	187.9	188.5
Primary education	100	155.8	156.1
Lower secondary education	100	124.3	135.6
Upper secondary education	100	122.6	146.3
Technical education	100	97.2	106.1
Teacher's Training School	100	182.8	237.8
University	100	112.5	n.a

Source: Elaborated on MEMFOD (2003/2004), ANEP, Uruguay, except for University. University data from INE.

Increases in enrolment rates higher than the target age population growth reflects improvements in the system coverage. Population growth rates are presented in table 5.

Table 5 Total population growth and by school-age level (base 1995)

	1995	2000	2002
Total population	100	104	105
Pre-primary (3 to 5)	100	102	102
Primary (6 to 11)	100	104	106
Lower Secondary(12 to 14)	100	102	104
Higher Secondary (15 to 17)	100	92	93
University (18 to 24)	100	102	100

Source: Own elaboration on data from CELADE.

International comparisons of net enrolment and graduation rates and average education capital show similarities between Uruguay and the region, but the gap is wide respect to OECD countries, as shown in table 6.

Table 6 International comparison of educational indicators (in percentages)

	Uruguay	Latin America (average)	OECD (average)
Net enrolment rates			
Primary	95	92	97
Lower Secondary	65	60	86
Upper Secondary	45	35	80
University	19	15	30
Graduation rates			
Primary	90	80	99
Lower Secondary	50	n.a.	n.a.
Upper Secondary	34	30	72
University	10	12	22
Average years of schooling in the population above 25 years old	9	6	11

Source: MEMFOD, ANEP, web site www.memfod.edu.uy

The educational capital of the population shows and increasing trend. Notoriously, the newer generations have more educational capital, shown in table 7.

Table 7 Educational capital by age groups of adult population. 1996

Age	Structure (% age group over total population)	Years of schooling
25 – 29.	7.1	9.12
30 – 34	6.9	9.00
35 – 39	6.6	9.02
40 – 44	5.9	8.75
45 – 49	5.4	8.22
50 – 54	5.0	7.67
55 – 59	4.7	6.98
60 – 64	4.6	6.39
65 – 69	4.2	5.97
70 – 74	3.4	5.62
75 – 79	2.3	5.32
80 – 84	2.5*	5.13
85 +		4.68

Source: Own elaboration on data from Census 1996, INE, Uruguay, and CELADE.

Note: * corresponds to 80+

The distribution of the public budget by functions in table 8 shows the relative size of the expenditure on education.

Table 8 Government expenditures – 2000

	Millions	%
General public services	5953	7.8
Defence	3265	4.3
Education	5515	7.2
Health	4483	5.9
Social Security	46554	60.9
Dwellings	1302	1.7
Other social services	884	1.2
Others	8533	11.2
Total	76489	100.0

Source: INE

Increases in enrolment in recent years have been not completely matched by increases in the budget allocated to education, which is presented in table 9.

Table 9: Evolution of education budget in real terms (base 1995)

1995	100
2000	126.1
2002	120.1

Source: Own elaboration with data from INE

The distribution of the public budget on education by levels is shown in table 10.

Table 10 Structure of public expenditure in education -2000/2001

Level	%
Pre-primary	9.2
Primary	32.6
Lower Secondary Education	18.8
Upper Secondary Education	19.0
Teachers Training School	3.1
University	17.3
Total	100.0

Source: UNESCO, web site www.unesco.org

The main share in the public educational expenditure is for teachers' salaries. The composition of the expenditure by resource is shown in tables 11.

Table 11 Resource composition of public expenditure on education-1999

	Total		Current		
	%		%		
Level/Composition	Current	Capital	Teachers	Other staff	Other
Primary and Secondary.	92.7	7.3	72.9	12.3	14.8
Tertiary Education	94.2	5.8	64.0	21.6	14.4

Source: UNESCO, web site www.unesco.org

For simplification, Primary education is considered to be the first relevant step in the process of formal schooling, leaving aside pre-primary education. I also will leave aside the Technical Education and public and private provision of training, which has a very important role in the improving the qualifications of the labour force, but only for simplification, in this preliminary version.

Annex 2. Labour force

A picture of the Uruguayan population by activity condition shows the relative size of the labour force in table 12.

Table 12 Composition of the population by activity condition –2002*

TOTAL	2731.2	%
Active	1249.5	45.75
Working	1038.3	38.02
Unemployed	211.3	7.74
Non active	858	31.42
Students	179.7	6.58
Household work	194.4	7.12
Retired	449.3	16.45
Renters	7.1	0.26
Others	27.5	1.01
Under 14	623.6	22.83
	2731.1	100

Source: INE, Encuesta Continua de Hogares 2002.

Note: * only urban areas

The composition of the labour force by skills is dominated by unskilled workers. However, new generations have been gradually increased the average years of schooling complete and hence the current inflows into the labour market have a better composition in terms of skills than the stock of workers.

Table 13 Composition of the active population by educational capital-2001*

	Thousands	%
Incomplete primary	100.0	8.0
Complete primary	259.9	20.8
L Sec Ed	234.9	18.8
U Sec Ed	271.1	21.7
Tech ed.(complete or inc.)	167.4	13.4
University incomplete	103.2	8.3
University complete	74.2	5.9
Military, teachers	38.7	3.1
	1249.4	100.0

Source: INE, Encuesta Continua de Hogares 2001.

Note: * only urban areas

In general, people who leave the system with only basic education will enter into the labour force as unskilled workers. Those with more years of schooling will enter into the market as semi-skilled workers, while graduates will enter as skilled workers. The composition of the labour force by these categories is shown in table 14.

Table 14 Estimation of skill categories for active population- 2002*

	Thousands	%
Unskilled	594.8	47.60
Semi-skilled	541.8	43.36
Skilled	113.0	9.04
	1249.4	100.00

Source: own estimates on data from INE.

Note: * only urban areas

The returns to education, in terms of wages by skill category, increase with the years of schooling, as can be seen in table 15.

Table 15 Average wages by category – 2001 (Uruguayan pesos)

	monthly wage
Incomplete primary	4001
Complete primary	4478
L Sec Ed	4926
U Sec Ed	7300
Tech education (complete or inc.)	6065
University incomplete	10129.5
University complete	12959
Military, teachers	7146

Source: INE, Encuesta Continua de Hogares 2001

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