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EDUCATION REGULATION AND INCOME DISTRIBUTION: THE CASE OF CEARA

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Textos para Discussão do Instituto de Pesquisa e Estratégia Econômica do Ceará (IPECE)

A Série Textos para Discussão do Instituto de Pesquisa e Estratégia Econômica do Ceará (IPECE), tem como objetivo a divulgação de trabalhos elaborados pelos servidores do órgão, que possam contribuir para a discussão de diversos temas de interesse do Estado do Ceará.

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SUMÁRIO

I. INTRODUCTION

The concern regarding the quality of public educational systems is becoming increasingly important in recent years. Countries such as Portugal, Canada, United States, and Brazil are developing or refining their monitoring and evaluation techniques since the 80's.

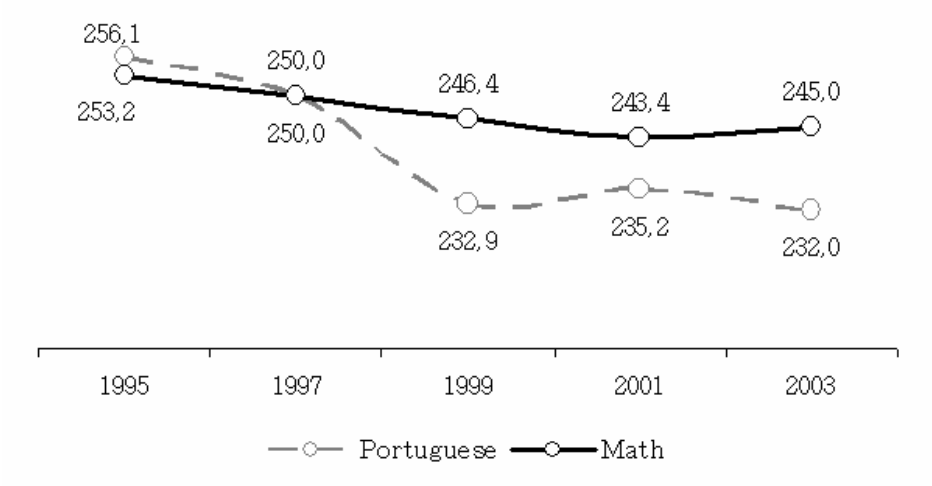
In general, a common but yet concerning result is being observed: *the quality of public education is not improving over the years* [e.g., see Carneiro & Heckman (2003)]. In Portugal, for example, math teaching methods and pupils' willingness to study were questioned recently, when 70% of the students were not able to achieve the minimum passing grade in the subject[4].

In Brazil, the *Sistema Nacional de Avaliação da Educação Básica*[5] (SAEB), created in 1995, evaluates primary and secondary students every two years. And, in Ceara, the *Sistema Permanente de Avaliação da Educação Básica*[6] (SPAECE), created in 1992, conducts annual evaluations only in public schools. They both measure the students' performances based on standardized tests in math and Portuguese. Grades are contained in the interval between 0 and 500.

As an illustration of what is being happening in recent years regarding the quality of public education in Brazil, Graph 01, below, presents the Brazilian average grade in SAEB during the period 1995-2003. As the graph illustrates, quality has been declining during the period in consideration.

[4] Jornal Diário de Notícias from 13/07/2005, "Matemática é no ensino só a ponta do icebergue".
[5] Basic Education National Evaluation System.
[6] Basic Education Permanent Evaluation System.

GRAPH 01 – Average grade in SAEB – Portuguese and Math



Source: SAEB INEP/MEC Report. Average grades of the 2nd cycle.

Many factors may explain why the quality in public education has not been improving. In Brazil, educators have listed several of these factors such as the poor quality of teachers, the lack of parent participation in schools, the need to enter the job market early to help on the family's income, the negative influence of the media, drug related problems and so on.

Empirical works that have tested these hypotheses in Brazil are still scarce. The problem is that these evaluation systems mentioned before did not include, up until recently, a survey regarding students' academic and family backgrounds. As an example, only last year SPAECE started to apply questionnaires to the students with questions about their family background and their situation in school. This new information will be very important in future studies in order to understand not only the quantitative context of grades, but also its qualitative context.

The importance of this discussion for a state such as Ceara, one of the poorest in Brazil, is that education is one of the most important instruments to promote economic development and income distribution[7]. Relevant transformations can only occur in society if the public educational system is able to give a good response in terms of quality so that students that are provenient from poorer families are able to compete with those that come from richer families and are able to afford private

[7] See, for example, the seminal work in Brazil written by Langoni (1974).

schools. But, many limiting factors can prevent that public schools spontaneously achieve high-quality levels. Therefore, there is the need for government regulation in order to guarantee minimum quality standards in public schools.

Thus, the main objective of this paper is to analyze, in the context of the State of Ceara, two public educational regulatory systems: a public voucher system and a system based on teacher incentives. In each case, the pros and cons will be discussed in detail and, as a conclusion, the system that was actually proposed to Ceara will be described.

Besides this introduction, this paper is composed by four additional sections. In section II, the need for regulation in education will be discussed. In section III, the analysis about alternative educational regulatory systems will be made. In section IV, the case of Ceara will be described in detail. Section V concludes.

II. THE PROBLEM: THE NEED FOR REGULATION IN EDUCATION

The importance of education has increased considerably in recent years, specifically because it is one of the primordial factors on the determination of the competitiveness of firms and of the levels of economic development attained by nations in the modern stage of capitalism that is marked by the globalization of the world economy and by intense technological innovation.

The growing competition in world markets has stimulated the technological rivalry amongst companies and nations resulting in an increasing systematization of technology in productive activities. In this context, knowledge and formal education has become fundamental as they make research and development activities possible and more dynamic, which will allow the development of new products of better quality or lower prices as well as new production techniques.

In general, improvements in education are fundamental to the development process of a country or region because it enhances the capability of individuals to

produce more and, as they increase their productivity levels, they tend to be rewarded in the labor market by receiving higher wages, i.e., "*the commitment of current resources to improving an individual's health or education, therefore, increases that person's future productivity and income*" [Bardhan & Udry (1999)].

Furthermore, those investments are justified not only for their importance to the national economy but also because they strongly affect the quality of life of an entire population. The lack of those investments generates an enormous human and economic waste as it condemns a fraction of a population to a vicious cycle of low productivity levels and therefore low incomes, relegating these individuals to a situation of practically unchanging poverty.

One of the main factors that determine the accumulation of education is income inequality. More specifically, in poor countries income distribution is generally very asymmetric and the most visible manifestation of such phenomenon is the wide dispersion in the health and education attained by the people. The main consequence is that if it is assumed that there is a joint causation between income distribution and education and imperfect credit markets, those who do not have resources to make such investments will be caught in a *poverty trap*, which will negatively influence the development process of such countries. As Ray (1998, p. 237) points out, "*inequality has a built-in tendency to beget inefficiency, because it does not permit people at the lower end of the wealth or income scale to fully exploit their capabilities*".

The importance of education was highlighted in modern economic theory in the studies of Gary Becker and Theodore Schultz in the late 60s and early 70s. According to these authors, investments in formal education, that is one of the main forms of human capital, should be made until its private marginal benefits equal its private marginal costs. More specifically, it would be possible to construct for any individual marginal benefits and marginal cost curves and then determine the optimal amount that should be invested (when those curves intercept). And, if all markets function perfectly everyone should invest in education until the expected rate of return is equal to the next best investment alternative.

Normally, the marginal benefits curve is downward sloping, reflecting the fact that there are diminishing returns to these investments, while the marginal costs curve is upward sloping basically because education is costly and the longer the period somebody spends investing in formal education, the smaller is the period that it has to recover the amount invested as well as all of its forgone earnings.

Then, how could this theory be related to income distribution? According to this fairly simple framework, if private marginal benefits and costs are associated with family background and markets present some form of imperfection (e.g., imperfect credit markets), then different families would present different marginal benefits and/or marginal cost curves. In general, one could expect that higher private marginal benefits and lower marginal costs would be associated with higher-income households with better-educated parents [Behrman, Birdsall & Székely (2000)].

Why should this be the case? Basically, if there are imperfect credit markets then only higher-income households will be able to afford a better education for their children. Furthermore, since these families on average tend to be better-educated, then they could indirectly improve the performance of their children in school through tutoring and through investments in their health and nutrition.

In fact, low levels of income and poverty may completely jeopardize productive educational choices for the poor because of the failure of credit markets. Usually, educational loans are difficult to be obtained because human capital often cannot be offered as a collateral for such loans, giving no guarantee for financial intermediaries in case of default. Therefore, the poor should be responsible for all costs during the educational process and most of the time marginal costs end up being greater than the marginal benefits of such investments [Ray (1998)].

This problem could be even greater in countries where there is income inequality because of misguided educational policies. What usually happens is that governments spend most of their resources destined to education financing universities instead of primary and secondary education. The problem arises when students are selected to join some university. Students from higher-income households have a very good advantage compared to the others because they

went to private schools that are on average much better than their public counterparts. At the same time, the best students often choose to go to public universities because their quality is usually superior. The result is that public resources end up financing the rich while the poor are kept with fewer educational opportunities, a result that is clearly inefficient for society. A good example of a country where such phenomenon clearly exists is Brazil [Behrman, Birdsall & Székely (2000); Fonseca (1997); Ray (1998)].

It is worth mentioning that, according to Behrman, Birdsall & Székely (2000), there are some other implications regarding income distribution and education that could be inferred from the basic framework presented on the beginning of this section.

First, if children's intellectual endowments are correlated with their parents' endowments that are usually related to their human capital stocks and earnings, then children from higher-income households will increase their probability of being successful in their educational endeavors. Additionally, if their parents are better related (i.e., if they have good connections) then they would have more opportunities to find a good job after their schooling process is complete.

Finally, other important implication is related to informational issues. On average, better-educated parents often can assess with greater accuracy the risk involved in human capital investments because they are usually better prepared to deal with unpredicted events such as unexpected increase in the costs of education, for example. Therefore, those parents could afford to be less risk-averse than the others usually are.

So far, the basic ideas discussed here seem to indicate that income inequality heavily influences the accumulation of education. But, further analysis tends to indicate that the accumulation of education tend to increase inequality if there are unequal educational opportunities. This happens because, in general, better-educated people have greater ability to increase their income opportunities with time, which does not happen as often with people with low educational levels. Therefore, income inequality and the accumulation of formal education should be

treated as a process with joint causality that has profound impacts on the level of social mobility of countries and regions [Birdsall & Graham (2000)].

Thus, what can be done in order to guarantee that children provenient from poor families have access to basic educational opportunities that will make them able to minimally compete with more privileged students? The answer to this question probably resides on *quality*, i.e., students with fewer educational opportunities could only be able to compete with others if they were provided with better-quality educational opportunities.

In developing countries, high-quality basic education is not a pure public good (such as national defense, for example) because it is perfectly feasible to exclude the access of would be students to this good. Furthermore, high-quality education is costly and the market, if left alone, would not have incentives to provide this good in socially-efficient amounts. In fact, the market is willing to provide this good only to those that are able to afford it, since companies in the sector seek to maximize their profits [e.g., see Gradstein, Justman & Meier (2005), and Hoxby (2002)]. Another important characteristic of the private system of basic education is that it is supposedly able to regulate itself through competition. In fact, if higher-income households are usually better-educated, then they will be more prone to screen those schools that are more suitable for their children as they will be in a better position to assess if they are really receiving the expected value for what they are paying for. Hence, in the market system, schools should be intrinsically efficient or they would not be able to survive otherwise[8].

But, then, who would provide high-quality education to the least fortunate? This would supposedly be a role of the State, even though nongovernmental organizations (NGOs) could play an important part in this matter. Justification for a state intervention is found in the fact that education (especially basic education) generates important positive externalities that the market alone is not able to

[8] This is corroborated by the data available to Brazil and Ceara during the period 1998-2003. The analysis of several indicators for both primary and secondary education, such as approval and dropout rates, indicate that private schools are always in better shape than their public counterparts.

internalize, not to mention that, based on the previous discussion, education can be a very powerful instrument to reduce income inequality.

In fact, many authors in the specialized literature emphasizes the ability that education has to generate positive relevant spillover effects [e.g., see Carneiro & Heckman (2003), Grossman (2005), Gradstein, Justman & Meier (2005), etc.] as it is able to improve not only the life of the person that is being educated, but of society as a whole. It is argued that better-educated people are usually more productive and inventive in the labor market, are more likely to be law-abiding citizens, are more prone to better educate their children, are more likely to make better decisions about their diet and health-related issues, are less likely to commit crimes or adopt unethical behavior, can become more involved with community issues, are less likely to use drugs or to be infected by sexually-transmitted diseases; are more inclined to plan the number of children that they will have, can become more actively participants in politics, etc.

The state's intervention, however, can happen in many forms. The state can, for example, subsidize private schools in order to enroll those that are not able to pay. But, it is very common that this intervention is direct, i.e., the state provides education directly through public schools. Why it is the case? As Gradstein, Justman & Meier (2005, p. 8) point out,

> "*the state typically takes full responsibility for school building and maintenance, staffing of teachers, curriculum design, testing scholastic achievement and so on. (...) The prevalence of publicly provided schooling can be rationalized by several arguments, some of which are interrelated. The principle of specific egalitarianism charges the state with the moral responsibility of providing children with a minimal level of basic education. Arguably, a uniform public school system is more likely to achieve this objective than a publicly funded private education system. Publicly provided education has also been widely viewed as an important component in the process of state building*".

Additionally, these authors argue that "*ideological and cultural content are difficult to monitor at arm's length without the direct controls of public administration*" [Gradstein, Justman & Meier (2005, p. 9)].

The problem is that it is often the case, especially in developing countries, that public education is rarely able to achieve high-quality standards. This happens basically because the public system is almost always a natural monopoly when lower-income students are considered, and then the absence of competition ends up undermining efficiency. Furthermore, teachers and principals usually face very weak incentives to give high levels of effort, which can also negatively affect overall efficiency levels and student achievement [e.g., see Carneiro & Heckman (2003), and Hoxby (2001, 2002 and 2003)].

Thus, in order to provide good quality levels of education to the poor, the state has to create mechanisms to regulate attendance, curriculum, teaching staff, physical facilities, class size, and specially achievement standards in public schools. This mechanism would be similar to traditional regulatory systems used in electricity or water distribution[9].

In the context of the State of Ceara (Brazil), two public educational regulatory systems are compared: a public voucher system and a system based on teacher incentives. In the voucher system, competition would provide incentives to public schools to increase their levels of efficiency, penalizing the least efficient schools. The system based on teacher incentives, on the other hand, could be considered as a form of "positive regulation" in the sense that there will be no sanctions to the worst schools. The idea is to reward, through pecuniary benefits, teachers and principals of those schools considered the best in terms of existing levels and/or in terms of improvement in the quality of the education provided. The main argument is that a system such as the latter may induce a healthy competition among public schools that would end up improving teaching quality and achievement. These systems will be analyzed in further detail in the next section.

[9] For a thorough, yet brief, discussion about regulation see Pinho & Vasconcellos (2003).

III. ALTERNATIVE EDUCATIONAL REGULATORY SYSTEMS

The literature suggests many alternatives that a regulator may use in order to improve quality in schools. In this section, some of these alternatives will be analyzed giving special emphasis on those that are most attractive considering Ceara's reality.

Most of the alternatives found in the literature focus basically on two policy instruments: the creation of a voucher system and the creation of incentive schemes to teachers and/or principals. Those works about voucher systems (that are the most common in the literature) indicate that their main virtue would be to provide incentives to schools in order increase efficiency. Competition among schools would force them to compete with one another in order to attract a better pool of students and to improve the quality of education [e.g., see Hoxby (2001, 2002, and 2003); Lieberman (1986); and Millimet & Collier (2004)]. Those works about incentive schemes, on the other hand, focus their analysis on ways to improve schools' managerial capacity and/or to enhance the level of effort of teachers and/or principals [e.g., see Jacob & Lefgren (2005); and Glewwe, Ilias & Kremer (2003)].

In all cases, it is important to acknowledge that every alternative has its pros and cons, i.e., there is no system that can be considered perfect in every situation. Alternatives should be analyzed according to the specific environment where they ought to be implemented. That is exactly why two alternatives will be considered in Ceara's context: a public voucher system and a teacher incentive scheme based on school performance in standardized tests.

III.1 - A public voucher system

Considering Ceara's context, certain types of voucher systems proposed in the literature would be difficult to implement, especially those that include private schools, because of the following arguments:

[1] In poor regions or states, due to a tight budget constraint, the value of the voucher may not be large enough to cover the costs of attending a private school [see Lieberman (1986)];

[2] Private schools may not have capacity to include all the students provenient from public schools, and they would have few incentives to expand their capacity since there are no guarantees that the new system will last long enough so that they could return their investments [see Lieberman (1986)];

[3] If private schools are included, transfer of funds to those schools would mean less resources to their public counterparts and, therefore, the government would have to provide a very convincing argument to society in order to justify why these resources are not being used to improve the quality of public education; and

[4] This type of voucher system, which includes private schools, is more suitable to regions or countries where there are flexible labor markets and relationships. If teaching and non-teaching staff members of public schools have stability, for instance, they could not be fired if necessary (except in some special cases).

Thus, the conjunction of these factors indicate that it would be more realistic to consider in Ceara's case a system where only public schools compete with one another. This is not only the case of Ceara, though. Hoxby (2002, p.17), for example, acknowledges that "*this traditional form of choice is by far the most pervasive and important form of choice in American elementary and secondary schooling today*". This system, adapted to Ceara's reality, will be presented in more detail below.

The environment

Suppose that in a certain school district there are S public schools and N is the total number of students. Additionally, assume that every student has the minimum ability to learn and that ability depends on school environment. Students are assigned to the school that is located closest to their homes.

Furthermore, consider that total school costs (C_i) is given by the following

$$C_i = f\left(N_i, I_i, L_i^T, L_i^{NT}, w^T, w^{NT}, r, \theta_i\right),$$

where

N_i = number of students enrolled in the i[th] school;

I_i = physical infrastructure of the i[th] school;

L_i^T = number of teachers of the i[th] school;

L_i^{NT} = number of non-teaching staff members of the i[th] school;

w^T = average wage rate of teachers (*exogenous*);

w^{NT} = average wage rate of non-teaching staff members (*exogenous*);

r = price for other school inputs; and

θ_i = managerial capacity of the i[th] school;

In the function above, costs are increasing in all arguments with the exception of managerial capacity, i.e., keeping other things constant, the better the quality and commitment of both the headmaster and staff members, the lower its total costs will be.

For simplicity of notation, let us represent total costs as $C_i = f\left(N_i, \psi_i, \theta_i\right)$, where ψ_i is a vector that represents all variables other than the number of students enrolled in school "i" and its managerial capacity.

Resources necessary to cover operating costs are provided according to the number of pupils enrolled in a certain school and resources for investments in the school's infrastructure are defined by the government according to priority and availability of funds. Wages are determined according to governmental policies and are considered exogenous variables to schools.

The voucher system

Hence, the government decides to implement a voucher system in the district in order to increase learning. Now, students are free to choose the public school that best suits his/her interests subject to the school's capacity constraint. Students are selected in a "first come, first serve" basis. In this system, each school will receive exactly the same amount of money "v" per student enrolled and autonomously will decide how to allocate the resources received. In this new context, each school "i" can choose the number of students enrolled as well as how much it will spend improving its physical infrastructure. The other factors, such as wages of both teaching and non-teaching staff members, will be exogenously determined.

Assuming that the only source of revenues of each school is provenient from the vouchers, each school will have to earn revenues that should be greater or equal to its costs, i.e.,

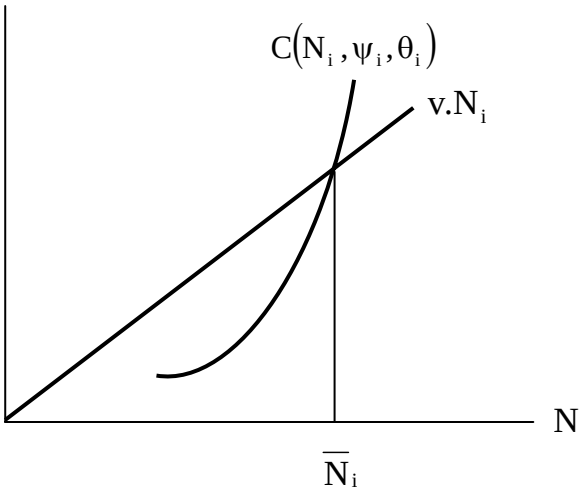
$$V_i = v.N_i - C(N_i, \psi_i, \theta_i) \geq 0 .$$

In this context, assuming that the school's capacity constraint is satisfied, the maximum number of students that it can enroll given ψ_i, $\overline{N}_i$, is the one that satisfies

$$V_i = v.\overline{N}_i - C(\overline{N}_i, \psi_i, \theta_i) = 0 .$$

If it is assumed that costs increase, at increasing rates, with the number of students[10], this condition above could be illustrated graphically as follows:

[10] This is reasonable to assume, at least from a certain scale of operation, since more students demand larger premises, additional administrative and teaching staff members, additional school equipment, stationary, food etc., and make procurement more expensive and the school more difficult to manage. This reflects the fact that there are usually more than one school in a district (and not only a very large school).



Therefore, as it is shown above, the value of "v" will be fundamental to determine how many students each school can enroll each year. And, the determination of its value will be influenced by two major constraints: (a) it should ensure that every student in the district is served and (b) it should satisfy the government's budget constraint, i.e., government's expenditures in education are bounded by the amount of resources available to this area.

Constraint (a) will imply that "v" cannot be set at a level lower than an amount $\underline{v}$ according to the costs of each school in order to assure that every student in the district that wants to study in a public school will be served. It is worth mentioning that, in this context, some schools may be closed if $\underline{v}$ is too low.

Furthermore, if "E" is the amount of financial resources available to fund education in the district, constraint (b) will imply that $E \geq \underline{v}.N$ is the condition that should be satisfied so that the voucher system can be implemented. And, in addition to this, the maximum value that "v" can assume will be given by

$$\bar{v} = \frac{E}{N}.$$

Therefore, constraints (a) and (b) together will imply that $v \in \left[\underline{v}, \bar{v}\right]$.

But, what should the optimal value of "v" under a voucher system be? This question is indeed extremely important at this point and, in order to provide an accurate answer to it, one should consider how the value of the voucher is linked to the main objective of the government in this case, which is to increase learning in the district.

Thus, in order to properly address the question above, define a per pupil learning function for the i^{th} school that is given by

$$y_i = A.q_i^{\alpha}.p_i^{\beta}.t_i^{1-\alpha-\beta} \qquad (1)$$

where $A \in \Re_+$ is a proportionality constant, $\alpha, \beta \in [0,1]$ with $\alpha + \beta < 1$, y_i represents per pupil learning, q_i denotes the quality of the i^{th} school's infrastructure, p_i is associated with the average peer quality in school "i", and t_i is related to the average teacher quality in school "i".

Thus, equation (1) denotes that per pupil learning results from a production process that uses as inputs the quality of the school's infrastructure, average peer quality, average teacher quality. In this case, for example, as $\alpha \to 1$ only the quality of the school's infrastructure tends to affect per pupil learning whereas when $\alpha \to 0$, only the other factors tend to matter.

In this context, one can assume that

$$q_i = f(z_i, \theta_i),$$

where z_i and θ_i represent, respectively, per pupil expenditure and managerial capacity in school "i", with $dq_i/dz_i > 0$ and $dq_i/d\theta_i > 0$.

Then, expression (1) can be re-written as follows:

$$y_i = A.[f(z_i, \theta_i)]^{\alpha}.p_i^{\beta}.t_i^{1-\alpha-\beta} \qquad (2)$$

In the voucher system proposed, $z_i = g(v)$, with $dz_i/dv > 0$. Hence, it should be the case that

$$q_i = f(g(v), \theta_i)$$

with $dq_i/dv > 0$.

Thus, expression (2) can be re-written as follows:

$$y_i = A.[f(g(v), \theta_i)]^{\alpha}.p_i^{\beta}.t_i^{1-\alpha-\beta}.$$

Therefore, per pupil learning in each school will basically be determined by the value of the voucher stipulated as well as by its average peer and teacher quality and managerial capacity.

Hence, if constraints (a) and (b), previously defined, are satisfied, and considering that θ_i, p_i ,and t_i are fixed (at least initially), then it would be optimal to set v as high as possible, i.e., it should be the case that $v = \bar{v}$, since this is the value that will maximize y_i for all "i", given p_i, t_i, and θ_i.

The appealing feature of this result is that as v is set above $\underline{v}$, more vacancies could be offered at better quality schools (that, on average, have higher per pupil costs) and, at the same time, a surplus would be generated at lower quality schools, and those resources could be used to improve their infrastructure, their teaching methods, and the quality of their teaching staff. Then, in this scenario, one could expect considerable positive impacts on learning.

At this point, a few critical remarks are necessary:

[1] Targets for per pupil learning should be compatible with the current expenditures per pupil, i.e., targets should be realistic given the existing budget constraint. Furthermore, the regulator must acknowledge that learning may be affected by a series of random effects associated with pupils' family backgrounds, pupils' commitment and efforts, pupils' future perspectives, school environment, pupils' health etc. [e.g., see Gradstein, Justman & Meier (2005)].

[2] There are decreasing returns on per pupil spending (keeping peer quality, teacher quality and managerial capacity unchanged). This implies that a cost-benefit analysis may reveal that in a certain point marginal costs may outweigh marginal benefits compared to other alternatives that the government has (e.g. investing in health and sanitation) [e.g., see Carneiro & Heckman (2003)].

[3] In poor regions $\bar{v}$ is not quite large because the government's budget constraint is usually very tight.

[4] In the context of a voucher system, the regulator must acquiesce to the fact that since students are free to move from one public school to the other (as long as vacancies are available and transportation costs are not too high), then peer quality may change after the system is implemented. In fact, the change of peers may have no effect at all, but there can be positive spillovers of knowledge across students, or negative externalities due to the incorporation of slow learners or disruptive students. On average, it should be expected that schools that are recognized by the students and their parents as the best will be able to attract a better pool of students and this could end up increasing the discrepancies among the schools in the district[11]. And, this becomes more likely to happen the larger $\bar{v}$ is because $\bar{N}$ will increase in all schools and more students may enroll on better schools (specially those who are more committed to their studies who, in general, will be the ones looking for better schools).

[5] Managerial capacity is fundamental to determine the efficiency on spending. In fact, as Millimet & Collier (2004) point out "*standard measures of school quality seem to have little impact on student achievement, unless one controls for the level of inefficiency*". In the voucher system, competition supposedly would force schools to increase efficiency levels. But, Peterson & Shattuck (2004) point out that there is a lot of inertia built into the process, and the change is very gradual. Furthermore, one should also take into consideration that the voucher system may end up punishing

[11] Hoxby (2001), for example, found empirical evidence that such a phenomenon did not occur on voucher systems implemented in Milwaukee, Michigan, and Arizona. Nevertheless, she aquiesces that such phenomenon is a theoretical possibility and may occur in certain contexts.

the least efficient schools, especially those that were already in disadvantage when the system was first implemented. In a worst case scenario, the worst schools could be shut down if its revenues are no longer enough to cover its operating costs. Therefore, the government may want to implement, in addition to the voucher system, an incentive program to boost efficiency in order to achieve better results with the same resources available.

[6] Teachers will face weak incentives to increase their levels of effort and, consequently, the quality of their teaching because, in the public voucher system described before, their wages are exogenously determined by the government and, therefore, an increase in their quality could not be compensated directly[12]. In fact, since schools do not seek profit in this case, as Hoxby (2002) argues, any surplus generated by the schools could be used to improve the working conditions of the teaching staff as well as to pursue social goals that they value such as experiments with teaching methods, the development of new curricula etc., even though the incentives generated in this case tend to be inefficient if compared to the distribution of cash.

Thus, one can realize that the voucher system can provide incentives to increase competition among schools may force them to compete in order to attract a better pool of students and to improve the quality of education. In order to accomplish this objective then they should enhance their managerial capacity and improve the quality of their teachers. At the same time, one must acknowledge that this system may originate some "centers of excellence" and weak incentives to teachers may undermine the expected results of the referred system.

[12] A similar argument is given by Kremer, Moulin, and Namunyu (2003) and Hoxby (2002).

III.2 - Teacher incentives and the quality of public education

Another body of work that proposed alternatives to improve learning in public schools is the one that suggests the use of incentive schemes. As it was mentioned before, these incentive schemes usually are designed to increase teacher effort.

The basic idea of such schemes is that the government regulator would like to hire teachers in order to provide good quality education to students in public schools. The problem is that the regulator will be expecting that the teachers will give a certain level of effort and commitment while performing their tasks. Since direct monitoring and the gathering of information are usually very costly, then the teachers could have their own agenda, i.e., they can provide students with a low level of effort, by preferring to teach in classrooms with a smaller number of students, summarizing too much the disciplines' contents, not observing the time that classes should take (they could arrive late and/or leave early), and, more importantly, they may not be willing to keep updated in terms of content and teaching methods of the disciplines that they teach.

Therefore, if teacher quality/effort is in fact one of the determinants of per pupil learning, as it was assumed before, then the principal would be facing an *agency problem*, which is one form of asymmetric information problem know in the literature as moral hazard [e.g., see Kreps (2003); Mas-Colell, Whinston & Green (1995); and Pindyck & Rubinfeld (1997)].

Pindyck & Rubinfeld (1997, p.632), for example, argue that "*an agency relationship exists whenever there is an arrangement in which one person's welfare depends on what another person does. The agent is the person who acts and the principal is the party whom the action affects*". Hence, in the case being discussed here, the principal-agent problem emerges from the fact that teachers (the agents) may pursue their own goals, even at the expense of obtaining lower per pupil learning levels, that is exactly the opposite of what the regulator (the principal) desires.

Thus, the regulator can design reward systems to teachers so that they can come as close as possible to meet his own goals. Kreps (2003) indicates that a variety of

motivators or incentives can work on individuals or groups of individuals. Among all possibilities, the ones that are more suitable in the present context would be the following:

- Intrinsic motivators, such as pride in a job well done.
- The desire to acquire and maintain a general reputation for good behavior, because such reputation provides future benefits.
- The desire not to be fired (in extreme cases).
- The prospect of a promotion or desirable assignments.
- Direct financial incentives based on measures of performance.

The most important factor that should be taken into consideration in the solution of this problem is that the regulator wants to determine a high-enough incentive in order to achieve the targeted level of effort, but just enough so this is true and no more. In other words, the regulator has to fine-tune the incentive scheme so that the teachers' utility in giving the targeted level of effort outweighs their next best option [see Kreps (2003)].

In problems where the agent is in reality a group of individuals, such as in this case, the same principles discussed here are still valid, but the principal should be aware that an additional problem may occur: the *free-rider* problem. More specifically, in the case considered here, the regulator must acknowledge that since every teacher accounts for just a small part of per pupil learning, then they will have less motivation to give a higher level of effort and then free-ride on others' effort. Despite this, group incentive schemes may still be used in the present context since the production process in consideration (per pupil learning, in this case) may not be measured by anything other than group output and tying compensation to the level of output of the group may promote helping efforts within the group [see Kreps (2003); Mas-Colell, Whinston & Green (1995) and Pindyck & Rubinfeld (1997)].

Furthermore, as Kreps (2003, p. 467) indicates,

> *"providing group-based incentive schemes, specially when the group is small, can be advantageous when three factors come together: good measures of the quality of the group are available, members of the group can monitor each other's individual effort*

levels easily and accurately, and groups have at their disposal the means and the inclination to enforce a healthy group norm for hard work The means can include the ability to punish slackers, either immediately or in future dealings, and the ability to enforce social sanctions on slackers. The inclination is trickier; one needs to watch out for groups that adopt a norm in which no one works hard, groups that have dysfunctional social relations, and groups that may scapegoat individual members".

As an example of this type of incentive scheme, Jacob and Lefgren (2005) propose that subjective principal assessments can be used in order to determine teacher compensations that will ultimately affect their performances and consequently learning. The most compelling argument of their analysis is that, according to the data analyzed[13], principals are most qualified to evaluate teachers according to their overall performance and that this could be used as a good predictor of student achievement. This may be so, but as the authors recognize, there will be a part in the middle of the performance distribution of teachers that principals will not be able to properly differentiate, i.e., principals are more likely to identify those teachers that produce the largest and smallest achievement gains in their schools. Furthermore, one must consider that this kind of assessment can be affected by personal biases of principles that will certainly affect their judgement[14]. In fact, if governments are supposed to propose and conduct policies that are transparent, it would be awkward, to say the least, to justify to society and to teachers that compensation should be based solely upon subjective criteria.

Another example of such mechanism is given by Glewwe, Ilias & Kremer (2003). These authors discuss Kenya's case where teacher incentive programs based on students' test scores were used in order to strengthen weak incentives. As the data analyzed seem to indicate, Kenya's experience cannot be considered successful, since students in treatment schools scored higher than their counterparts only during the life of the program. In fact, there is little evidence of increasing long-run learning, teacher attendance did not improve, homework assignment did not increase, and pedagogy did not change. The fundamental explanation for such results lies on the

[13] The data analyzed is provenient from a mid-size district located in the western United States. The district requested to remain anonymous.
[14] As an example, the authors in question present evidence that principals tend to discriminate against male and untenured faculty.

hypothesis that teachers change their levels of effort during the duration of the program to prepare the students to the test.

Levitt & Dubner (2005) explain that the American government established standardized tests as a mandatory part of the *No Child Left Behind* Act, sanctioned by President Bush in 2002. By that time, twenty American States already adopted such instrument. In Chicago, for example, these tests were incorporated in 1996 both in primary as in secondary schools. This mechanism was created aiming to stimulate students to study harder, since only students with merit were supposed to pass the tests. On the other hand, in this context, worse students and teachers would have strong incentives to cheat. In the specific case of teachers, this would happen because they could be reprehended (or lose a promotion) in case of a bad performance of his students. In fact, data from Chicago analyzed by these authors indicate that some teachers indeed cheated on the exams by changing some answers of the students who took the test. Teachers from the worst classes in terms of performance were exactly the ones with a greater disposition to cheat.

Therefore, given these indications provenient from past experiences, if a regulator ought to implement a mechanism based on incentives, a few very important points should be considered:

[1] Since these are incentives usually given to groups of individuals, the mechanism should account for the free-rider problem.

[2] The incentive scheme should have a long-run perspective, so that structural changes may occur during the process. In this case, other policy instruments may be introduced during the process so it can become more robust.

[3] If incentives are measured through the grades of standardized tests, then it would be preferable if teachers did not have direct contact with those tests, which should be elaborated and ministered by non-stakeholders.

Thus, considering the information discussed in this section, which type of mechanism is more suitable according to Ceara's reality? An answer to this question will be discussed below.

IV. THE CASE OF CEARA

In Ceara's context, the implementation of a voucher system as the one proposed before would mean a relevant change on the existing educational structure and, considering the possible set backs considered before, this option may end up being riskier than other options. Furthermore, this type of mechanism is based on the application of sanctions to those schools that are considered inefficient.

Incentive schemes, on the other hand, can be considered as a form of "positive regulation" in the sense that they aim to reward only those schools or teachers that present the best performances or the higher quality levels.

Considering the per pupil learning function defined previously in expression (2), in the case of incentive schemes, the objective is basically to affect teacher effort (t_i). However, broader incentive schemes can also affect managerial capacity, especially when school principals' efforts are also targeted.

Hence, as an attempt to deal with the problem of overall unsatisfactory results in standardized tests, in 2005, the Government of Ceara introduced an award to compensate some of its public schools for their good performances, according to the State Law n. 13,665 of September 20, 2005. This mechanism consists on the payment of an additional monthly wage to the teachers and principals of the schools which were relatively better than the others on annual standardized tests. Hence, it is expected that this pecuniary incentive would progressively enhance teacher dedication, improving future results of the teaching quality.

The mechanism of the award does not suppose that low teaching quality and low grades on the standardized tests are solely due to low teacher dedication, but

acquiesces that pecuniary incentives to teachers may generate *spillover effects* as they seek to improve their qualification and teaching skills. Furthermore, it may generate a healthy competition among public schools that can end up developing internal mechanisms in order to improve teaching quality and achievement.

During the conception of the award some specific questions where addressed. These can be summarized by the following arguments: (i) an award based only on higher grades would be simplistic and unfair because it does not take into consideration the initial differences on the distribution of infrastructure and peer and teacher quality in schools; (ii) some teachers may become *free riders* and, therefore, receive the award even though their levels of effort remained unchanged; and (iii) the number of schools awarded should be large enough in order to stimulate the participation of the largest number of schools possible and, at the same time, it should be compatible with the government's budget.

The first topic discussed above emerged from the fact that, in Ceara, schools located at the State capital are usually better equipped (in terms of libraries, computer labs, sport facilities, internet access, etc.) and their teachers are better qualified than in other regions of the State. Hence, if these differences were not acknowledged, other schools would be almost automatically excluded from the competition.

Additionally, public schools have different profiles according to the place that they are located and to the clients that they serve. In other words, there are schools specialized only in primary education, others only in secondary education, and those specialized in both. In the latter case, there could be important scale economies that can also be taken into consideration.

Furthermore, an award based solely on who gets the higher grades would not take into consideration the effort that a school in the lower end of the distribution had to make in order to improve its performance on the standardized tests and to enhance overall student achievement. On the other side, it would be acknowledging those experiences that seem to be working properly. Thus, one can notice that there are a

series of pros and cons that must be considered when such a system is being analyzed.

In order to properly address all the issues mentioned above, the type of award chosen was divided into to two categories and three subcategories. The two main categories were defined as “schools that achieved the highest grades in SPAECE of the year” and “schools with the best performances of the year”. And, the subcategories were defined according to the school’s teaching specialization: “primary education only”, “secondary education only”, and “both primary and secondary education”. The first award is intended to schools that define the quality standards in education that should be pursued by the others, while the second award is intended to give incentives for good performances so that schools can achieve the defined standards. In other words, the first award recompenses the best schools, while the second recompenses those schools with the best improvements.

After defining the categories eligible for the award, the next step was to define how to measure grades and performance. In this context, the option chosen was to build to indices, one for each category, and then classify schools according to their performances.

In order to classify the winners according to the highest grades, it was taken into consideration that there are two tests (Portuguese and Math) and different types of schools. Therefore, the classification index was built, as expression (3) details, the measures the average order of each school in the category that it is part of (the closer to 1 the better the school is).

$$IN_i = \frac{n_{F,i}}{n_i} \cdot \frac{ONP_{F,i} + ONM_{F,i}}{2} + \frac{n_{M,i}}{n_i} \cdot \frac{ONP_{M,i} + ONM_{M,i}}{2} \qquad (3)$$

where:

IN_i is the grade classification index of the i[th] school;

$n_{F,i}$ is the number of students in primary education;

n_i is the number of students of the i[th] school;

$ONP_{F,i}$ is the classification order of the i[th] school in the Portuguese test for primary education;

$ONM_{F,i}$ is the classification order of the i[th] school in the Math test for primary education;

$n_{M,i}$ is the number of students in secondary education;

$ONP_{M,i}$ is the classification order of the i[th] school in the Portuguese test for secondary education; and

$ONM_{M,i}$ is the classification order of the i[th] school in the Math test for secondary education.

Now, in order to classify the winners according to the best performances, it was taken into consideration the school order according to three indicators: the approval rate, the abandon rate, and SPAECE grades. Hence, a performance index was built, as expression (4) details, which will represent the average performance order of the school in its category (the closer to 1 the better the school is). This index is actually a weighted average of the three indices that will be detailed ahead.

$$IP_i = 0.15 \cdot OAp_i + 0.15 \cdot OAb_i + 0.70 \cdot ONP_i \qquad (4)$$

where:

IP_i is the performance classification index of the i[th] school;

OAp_i is the order in the approval rate performance of the i[th] school in relation to the other schools;

OAb_i is the order in the abandon rate performance of the i[th] school in relation to the other schools; and

ONP_i is the order in the SPAECE grades performance of the i[th] school in relation to the other schools.

The weights used in (4) are basically ad hoc, but were defined acknowledging that schools may manipulate their approval and abandon rates in order to improve their performances. On the other hand, since SPAECE tests are strictly out of the schools' control, its index would receive a greater weight in relation to the others.

The index in (4) that measures the schools' performance according to their approval rates is detailed in expression (5). More specifically, it consists in the determination of the relative orders of the average change in the schools' approval rate in primary and secondary education in relation to the previous year.

$$OAp_i = Order\left[\frac{\Delta Ap_{F,i} + \Delta Ap_{M,i}}{2}\right] \qquad (5)$$

where:

OAp_i is the order in the approval rate performance of the i^{th} school in relation to the other schools;

$\Delta Ap_{F,i}$ is the change in the approval rate in primary education of the i^{th} school in relation to the previous year;

$\Delta Ap_{M,i}$ is the change in the approval rate in secondary education of the i^{th} school in relation to the previous year.

The index in (4) that measures the schools' performances according to their abandon rates is detailed in expression (6). More specifically, it consists in determining the relative order of the average of the change in the abandon rate in primary and secondary education in relation to the previous year[15].

$$OAb_i = Order\left[-\frac{\Delta Ab_{F,i} + \Delta Ab_{M,i}}{2}\right] \qquad (6)$$

where:

OAb_i is the order in the abandon rate performance of the i^{th} school in relation to the other schools;

$\Delta Ab_{F,i}$ is the change in the abandon rate in primary education of the i^{th} school in relation to the previous year;

$\Delta Ab_{M,i}$ is the change in the abandon rate in secondary education of the i^{th} school in relation to the previous year.

[15] The multiplication by –1 is due to the fact that the smaller the abandon rate is the better is the school's performance.

And, the index in (4) that measures the schools' performances according to their SPAECE grades is more sophisticated than the others and is detailed in expression (7), below.

$$ONP_i = Order\left[\frac{n_{F,i}}{n_i}\cdot\Delta\left(\frac{NP_{F,i}}{\sigma_{NPF,i}}+\frac{NM_{F,i}}{\sigma_{NMF,i}}\right)+\frac{n_{M,i}}{n_i}\cdot\Delta\left(\frac{NP_{M,i}}{\sigma_{NPM,i}}+\frac{NM_{M,i}}{\sigma_{NMM,i}}\right)\right] \qquad (7)$$

where:

ONP_i is the order in the SPAECE grade performance of the i^{th} school in relation to other schools;

$n_{F,i}$ is the number of students in primary education;

n_i is the number of students of the i^{th} school;

$NP_{F,i}$ is the average grade of the i^{th} school in the Portuguese test for primary education;

$\sigma_{NPF,i}$ is the standard deviation of the grades of the students of the i^{th} school in the Portuguese test for primary education;

$NM_{F,i}$ is the average grade of the i^{th} school in the Math test for primary education;

$\sigma_{NMF,i}$ is the standard deviation of the grades of the students of the i^{th} school in the Math test for primary education;

$n_{M,i}$ is the number of students in primary education;

$NP_{M,i}$ is the average grade of the i^{th} school in the Portuguese test for secondary education;

$\sigma_{NPM,i}$ is the standard deviation of the grades of the students of the i^{th} school in the Portuguese test for secondary education;

$NM_{M,i}$ is the average grade of the i^{th} school in the Portuguese test for secondary education;

$\sigma_{NMM,i}$ is the standard deviation of the grades of the students of the i^{th} school in the Portuguese test for secondary education.

The sophistication of expression (7) is due to division of the average grade of the school by the standard deviation of their students' grades. The intuition behind this

procedure is that schools with very asymmetric distribution of grades, due to just a few students with natural abilities (despite teacher quality) or to just a few committed teachers, should be penalized. Therefore, there will be incentives for good teachers to monitor others and detect free-riders.

Regarding the third issue regarding the award mentioned before, it was defined that 50 schools should receive the award[16]. This represents approximately 7.5% of the 666 public schools managed by the state government[17]. In the category "schools that achieved the highest grades in SPAECE of the year" the best 3 schools according to teaching specialization (just primary, just secondary, and both primary and secondary education), totalizing 9 schools. And, in the category "schools with the best performances of the year" 7 schools with only primary education, 13 schools with only secondary education, and 21 schools with both primary and secondary education. The number of schools awarded was proportional to the relative number of schools of each type.

A very important analysis that can be done at this point is to investigate why these specific schools were awarded. Preliminary results indicate that certain factors indeed affect performance, such as: average qualification of teachers, the number of pupils per classroom, school participation in social projects, the amount of classes with laboratory assignments, etc.

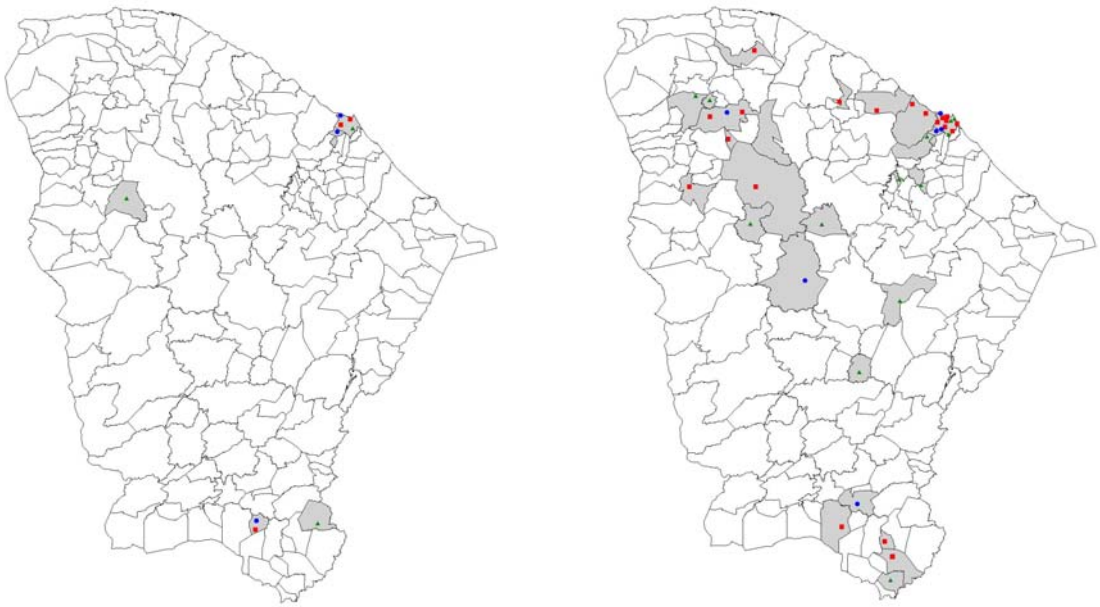
The following maps illustrate the geographical distribution of the winning schools both in terms of overall quality and performance levels.

On the map that indicates the best schools in terms of SPAECE grades, one can notice that the schools are concentrated in Fortaleza (the State's capital) and the cities that have or are close to universities. This could indicate that good grades on the exams are due to better qualification of teachers.

[16] Money rewards for teachers of awarded schools were estimated in approximately US$ 1,000,000.
[17] There was not only a single case where the same school should be awarded in both categories, but there is a rule that prevents a school to be awarded twice anyway.

Map of the schools awarded in each category – 2004

Highest grades in SPAECE **Best performances**



Municipalities with schools that received awards.

The second map illustrates the distribution of schools awarded according to their performances. The results show a great dispersion of schools supporting the idea that the award can be an instrument of better income distribution. On the other hand, considering that some schools awarded were located in poor municipalities and have poor infrastructure, then the results show that good teachers can make a difference in adverse conditions.

Thus, the implementation of the award represents a new regulation and public management paradigm in Ceara. The proposed system is simple since the basic instrument to regulate the quality of education is through the concession of pecuniary incentives, free of bureaucracy or complex rules.

In this sense, an imitation effect toward the best practices is expected, because when a group of schools are awarded in a certain year, the others will try to learn their practices so they could imitate them. But, there will always be schools that will be able to innovate in order to stay ahead of the others. And, parents will try to assess why the school of their children has not been awarded. Then, one should expect that these factors would end up inducing schools to increase their level of efficiency and teachers to give higher levels of effort that ultimately would lead to better quality of the education provided.

In this context, rational teachers will perceive that chances to improve the quality of student grades are better for those schools in the lower part of the grade scale and will be tempted to ask for transfers. Hence, this system may end up stimulating teacher mobility as they try transfer to other schools in order to increase their chances of being awarded. This contrasts with the voucher system discussed before, where the overall level of efficiency of schools is supposed to increase due to the mobility of schools across schools.

Thus, the future existence and regularity of the award proposed could ensure, in the long run, some kind of convergence in terms of school quality among the public schools maintained by the State's government. In other words, it is expected that the incentives provided by the award would lead the public school system to achieve satisfying levels of quality, in a relatively cheap and effective way.

V. CONCLUDING REMARKS

As it has been discussed in this paper, some countries have been experiencing decreasing quality levels in public education. On the other hand, quality of private education does not present the same trend. The explanation for this comes from the endogenous regulation that exists in private markets due to competition, i.e., when a private school lacks quality it will end up losing an expressive of its market share or, in an extreme case, will have to close its doors.

This phenomenon is a serious concern to society, basically because those with very few educational opportunities are exactly the ones that the clients of the public school system. Hence, due to the low quality of public education a vicious cycle is built: people who have lower levels income usually have less formal schooling and since they cannot afford it, they will not be able to acquire high-quality education. And, it goes on and on.

At the moment that a significant part of the population enters this vicious cycle, lower levels of schooling, and consequently of human capital, ends up negatively affecting the development process. In other words, a problem of inequality due to the absence of regulation will have impacts on social welfare.

In this context, since the public system lacks this endogenous regulation imposed by competition, then it is necessary that the government puts a regulatory system in place. Two types of systems, widely discussed in the specialized literature have been analyzed: i) a voucher system; and ii) a teacher incentive mechanism. In the case of Ceara, in particular, the latter system is supposedly more appropriate and easier to implement.

The final message of the paper is that regulation of the quality of education affects the distribution of income. And, if this instrument is well-designed, adequate to the specific conditions of the place where it is supposed to be implemented, and if it has continuity, then it can indeed become a very powerful public policy tool over time.

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