THE MARKET VALUE OF PUBLIC EDUCATION. A COMPARISON OF THREE VALUATION METHODS

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ABSTRACT

In this paper, I will compare three methods to value education services and their distributive impact. These methods are: the Cost of Provision approach, according to which public schooling is worth what it costs the state to produce it; the Labor Market approach, according to which a year of schooling is worth the present value of the additional lifetime income it brings; and the Private Educational Market approach, according to which a year in a public school is worth what it would cost in an equivalent private school. For each method, I will calculate the total value of public educational services by level as well as their impact upon income inequality, as measured by the Gini Coefficient of *per capita* household income. I will apply each method to Brazil, a country for which educational, expenditure, and income distribution data are both good quality and easily available. The results are surprisingly invariant across methods: (i) the value of all public schooling varies from 6% to 7% of incomes with the Cost of Provision providing the lowest estimates and the Labor Market Method the highest; and (ii) with the exception of higher education, public schooling is highly distributive and all public educational services reduce the Gini Coefficient by about 3 to 4 Gini points.

JEL Codes: I24 (Education and Inequality – principal); I26 (Returns to Education); I22 (Educational Finance • Financial Aid).

Keywords: valuation of educational services, value of public education, distributional aspect of public education, hedonic prices, educational rates of return, costs of education.

The Market Value of Public Education – A Comparison of Three Valuation Methods

Sergei Soares

1. Introduction

Public education has become widespread in human societies. Apart from failed states or nations in throes of civil war, almost everywhere else schooling is provided by the state to children. This service is also provided free of cost to families. According to Unesco, 80% of the world's 184 nations (at least those for which Unesco has education statistics) have laws which require the state to provide eight or more years of free education to their children. It is not, however, free of cost to the state. Again, according to Unesco, the median public education expenditure on this planet is close to 5% of GDP. Worldwide school attendance is about 91% for primary and 83% for secondary education. All this means that publicly provided education is both an important public expenditure and a relevant in-kind transfer, often to the poorest households. It is important to value this public effort adequately.

In this paper, I will compare three methods to value education services and their distributive impact. For each method, I will calculate the total value of public educational services by level as well as their impact upon income inequality, as measured by the Gini and Concentration Coefficients. I will apply each method to Brazil, a country for which educational, expenditure, and income distribution data are both good quality and easily available.

By far the most common approach in recent times has been their valuation according to their cost to the public sector. An OECD (2008) report on income distribution leaves this clear:

> "Imputation of public educational expenditures to individuals based on actual use requires, first, determining whether or not an individual is participating in different levels of the educational system; and second, increasing the income of the household where they live by the average public spending per student at the relevant educational level."

The majority of the recent literature, such Atkinson (2005), follows this approach, which is to take how much it cost the state to provide the educational services and split it up evenly among the families with children in the public education system.

The second method I will use is to value educational services using the labor market as the measure of their worth. The value of an additional year of education is calculated based upon how much more individuals will earn if they study an additional year. This approach is based upon an as yet unpublished paper by Sergio Urzua (2017).

The third method is to use the market for private educational services to measure the value of public education services. This involves matching private educational expenditures, access to public education, and test score data (this approach presupposes that test score data are a proxy for schooling quality).

Neither approach is perfect and all three suffer from serious conceptual problems, to be detailed below. However, I believe that the conceptual problems are somewhat complementary, so that looking at the results from all three may allow a reasonably complete picture of the distributive and welfare impacts of education.

2. *First Method: Schooling is worth what it costs the State to provide it.*

This Cost of Provision approach has several advantages.

First, it is easy. To calculate the value of schooling and monetize it, take the cost per student at the lowest level of aggregation possible and divide it up equally between the families whose children are enrolled in public education, weighted by the number of children enrolled by family, of course. This value can then be added to the per capita finally income and all the distributive statistics can then be calculated. This is easy to do and easy to understand.

Second, the data requirements are modest. All that is needed is per student expenditures by level, hopefully at a low level of aggregation. In many countries with centralized systems, this level of aggregation will be the whole county. In some it might be the municipality (or even the school, maybe). In the United States, it would be the school district. For Brazil, I will use states, since all municipalities in each state receive in principle the same per student financing.

Finally, the cost of provision approach does not change the size of the welfare cake. The benefits of public education will be equal to the taxes used to finance it. I am not sure this is really an advantage but it does keep things simple. Education is nothing more than a redistribution from those who pay to those who benefit, neither creating nor destroying wealth.

On the other hand, the Cost approach also suffers from various shortcomings.

First, it assumes that all students are receiving the same public education. This is clearly not the case even if the state spends the same on each student, which is usually not the case. Even in a highly centralized system such as France, in which all students study the same subject matter on the same day, the differences in teaching quality between a school in a poor *banlieue* and a school in Paris' fifth district are quite evident. These differences will be even higher for countries in which schools or municipalities are allowed to raise money for themselves.

Secondly, it flies in the face of the theory of provision of public goods (Samuelson (1955)), according to which the welfare value of a public good is the sum of the marginal utilities of all its users (as opposed to the simple marginal utility in the case of private goods). While schools are not really pure public goods since one can only fit so many children into a classroom, for a wide range of class sizes an additional student will not reduce the quality of teaching to the other students (or will reduce it far less than the benefit accrued by the student).

Finally, the third advantage can also be seen as a shortcoming. The cost approach allows neither for the creation of welfare nor its destruction through the public provision of educational services. If the state is highly efficient or woefully inefficient in translating educational expenditure into schooling will make no difference in the Cost method.

3. *Second Method: Schooling is worth what the labor market says it is worth.*

The Labor Market method is a little more complicated than the Cost of Provision method, but not much. The idea is to take the difference in present values of lifetime earnings of men and women with and without an additional year of schooling as the value of that year of schooling. In symbols:

$$value_s = lifetime\ y_s - lifetime\ y_{s-1} = \sum_{t=16}^{70} d^{(t-16)} y_{s,t} - \sum_{t=16}^{70} d^{(t-16)} y_{s-1,t}$$

where $y_{s,t}$ represents the average earnings of someone with schooling level *s* at age *t* and *d* is a discount factor. The age range we consider goes from the legal working age of 16 to maximum retirement age of 70. Note that $y_{s,t}$ is the product of the probability of employment by the average wage if employed. $y_{s,t}$ must also be calculated at some level of aggregation since individual future wages cannot be observed for people in school today. My objective was to use individuals of a given race and sex born in the same state, but sampling noise forced me to settle for individuals of a given race and sex born in the same region of the country (North, Northeast, Southeast, South and Center-West).

But what if there is more than one schooling level? The calculation becomes a little more complicated. A child or young adult overcoming a given year of schooling opens to its future self not only the doors of higher earnings accruing to that year of schooling, but also the possibility of going even further in his or her education and accessing the higher wages of even higher schooling levels. This means that in addition to the future salary already contracted with an additional year of education *s*, the child or young adult has also added the option value of going to level *s*+1 to his menu. In symbols:

$$value_s = (lifetime\ y_s - lifetime\ y_{s-1}) + p_{s+1} value_{s+1}$$

where p_{s+1} is the probability of completing schooling level *s*+1, given that schooling level *s* has been completed.

The calculation is simple. Begin with the highest schooling level in the household survey and calculate $value_s$ for that level. The work backwards using the option value for $value_{s+1}$ for calculating each new $value_s$.

The incomes and probabilities of working can be found in any household survey. For Brazil, used the 2015 PNAD. The transition probabilities can be calculated either using educational statistics or else just a cross-section of individuals aged about 25, which is definitely easier. This leaves only the discount rate *d* to be decided upon arbitrarily. I used three values: 5%, 10%, and 15%. They are somewhat arbitrary but 5% is close to the long run real prime rate for Brazil and 15% is close to the lowest interest rate for a personal loan in Brazil. I consider the 15% annual discount rate as the most adequate for individual decisions.

The Labor Market approach, which uses the net present value of income, also has advantages and disadvantages.

Perhaps its main advantage is that it ties the value of schooling to its real world impacts. This allows for welfare enhancing public schooling, particularly if labor market returns are elevated as they still are in Brazil. This is a huge advantage over the Cost approach.

I can think of three main disadvantages.

The first is that the results depend crucially upon an arbitrary parameter, the discount rate *d*. Given that there is no consensual way to calculate what should be the discount rate for a given country or person, this is indeed a problem.

The second is that it reduces the impacts of education to its future income component. Education also has been shown to enhance health (independently of income), to reduce the probability of being murdered (also conditional on income), and to increase the educational level of future generations. These are certainly important dimensions of welfare that are not included in the Labor Market approach.

A variation on this theme is that many educators maintain that education has intrinsic value, independent of its effect on desirable outcomes. In other words, knowing about the world is a source of satisfaction in and of itself (this is certainly true for me).

A calculation problem is that the future labor market will almost certainly different from today´s labor market, which means that the values will be calculated with bias. In a country with an expanding education system, it is likely that this bias will be upwards since more education will drive down educational premiums. This is what happened in Brazil over the last two decades.

Finally, this method cannot be used to value pre-school education with present data. Since household surveys contain only the highest educational level completed, we do not know how much additional income is brought from having attended pre-school.

The net present value of income Labor Market approach ignores all these issues.

4. *Third Method: Schooling is worth what the private education market says it is worth.*

The third method is to use the private education market to attribute a value to public education. One possibility would be simply to attribute the value of private education of the same level and in the same area to public schooling. The problem is that private schools are usually considered better than public ones – which is why people put their hard-earned money into paying tuition instead of enjoying free public education. A way to take this into consideration is to attribute to public education at a given level and in a given geographical area the same value as private education of the same quality. I will consider quality as being measured solely by the score on a standardized test.

How does the cost of equivalent private education method work? Three pieces of information are necessary: tuitions, test scores, and of course incomes. In Brazil, tuition can be found only in the POF Expenditure Survey (the Ministry of Education collects data on tuition by school but they are not made public). Test scores can be found in the main tests: Prova Brasil / SAEB for elementary and middle school, ENEM for high school, and ENADE for higher education. Finally, I will use the PNAD for incomes.

With five databases and no identifiers, the biggest challenge in this method is merging data. Luckily, all the school tests (Prova Brasil/SAEB, ENEM, ENADE) have good socioeconomic questionnaires with plenty of variables that allow for matching keys to be made.

The steps I followed are as follows.

First, tuition income from the 2099 POF was matched to test scores data from the same year from SAEB, ENEM and ENADE. Only private schools were chosen and the matching codes on Table 1 were used.

Second, for each educational level (bar pre-school, for which there are no test scores), a regression linking test scores to tuition was estimated. Unfortunately, the POF has few observations for private tuition and the numbers were typically in the low hundreds (also on Table 1).

Table 1 Matching codes and Regression Statistics.

Schooling Level	Match Code	Number Matched	R^2
Pre-school	no regression		
Lower Primary	State; Sex; Year Born; Mother´s Education; Father´s Education; Household size; Microcomputer; Car; DVD	195+9	0.2792
Upper Primary	State; Sex; Year Born; Mother´s Education; Father´s Education; Household size; Microcomputer; Car; DVD	122+26	0.2556
Secondary	State; Sex; Year Born; Income Category; Mother´s Education; Father´s Education; Microcomputer	151+11	0.2784
Higher	State; Sex; Year Born; Income Category; Household size; Mother´s Education; Father´s Education	1637+270	0.0534

Source: 2009 POF Consumption survey; 2011 SAEB, 2009 ENEM, 2009 ENADE.

The "Number Matched" column in Table 1 is expressed as the sum of two numbers. The first number are the observations that were directly matched between the test scores and consumption survey. The second number represents observations for which there are tuition data in the consumption survey but no match with test score data. In order to use these observations, they were matched to the nearest observation in the test score data. The distance measure used is the predicted value of a regression in which test scores are the dependent variable and the match code variables above make up the independent variables.

The regression results in which test scores explain tuition can be found in the Annex.

Then we turned back to the test scores and matched test score data to the PNAD using the same match codes as before. The data were different since 2015 data were used both for incomes and test scores. Only test results for public schools were used. In this case, the number of observation were much higher – typically in the low thousands – and the merges were almost perfect. With the match made, the coefficients from step two were used to predict the tuition that would have been paid by families for the same quality of education they obtained for free from the state. Since I used the 2015 PNAD household survey, the predicted values for tuitions had to be multiplied by 1.51067, which represents the inflation from 2009 to 2015.

Finally, this value was added to family income and the same standard distributional analysis undertaken for methods one and two were repeated.

5. Comparison of Results.

The first question each method must answer is how much public education is worth. The answer varies according to the method used. The estimates go from R$ 60.80 for every man, woman, and child in Brazil for the Cost method to R$ 474.59 using the Labor Market method with a discount factor of 5%. As I said before, I do not believe a discount factor of 5% or 10% is adequate for Brazilian individuals since they are willing to pay far more than that for credit.

If we use the 15% discount factor for the labor market method, all three methods provide reasonably close estimates of the total value of public education to the public. They vary from R$ 60.80 to R$ 74.09, increasing incomes for the population as a whole by about 6% or 7%. All three methods provide estimates that are quite close to each other. Remember, though, the Labor Market method does not value pre-school.

Table 2 – Impacts of Public Education Services on Global Income Distribution

Distribution	Income	∆ Income	Gini	∆ Gini
Income	1,056		0.514	
Cost	**1,117**	**61**	**0.477**	**-0.037**
Labor Market (5%)	1,531	475	0.446	-0.068
Labor Market (10%)	1,220	164	0.455	-0.059
Labor Market (15%)	**1,130**	**74**	**0.477**	**-0.037**
Education Market	**1,118**	**62**	**0.479**	**-0.035**

Source: 2009 POF Consumption survey; 2015 PNAD household survey; 2011 and 2015 SAEB; 2009 and 2015 ENEM; 2009 and 2015 ENADE.

In addition, the reduction in Gini points is about the same for all three methods. The Gini Coefficient falls by about three and a half Gini points with the addition of the value of public educational services to family incomes.

How is the breakdown by education level?

Table 3 shows that the Labor Market approach provides much higher estimates of educational value than the Education Market and the Cost approaches. This was not clear in Table 2 because the Labor Market approach cannot value pre-school education. The Labor Market approach provides estimates that are 40% higher for primary and 67% higher for secondary than the Cost approach.

Table 3 – Value of Public Education by Level

Educational Level	Number of Students (millions)	Cost	Labor Market (15%)	Education Market
Pre-School	5.19	248	none	296
Lower Primary	14.09	250	352	233
Upper Primary	11.32	272		291
Secondary	8.08	302	504	414
Higher	1.87	917	883	502
All Levels	40.55	297	415	305

Source: 2009 POF Consumption survey; 2015 PNAD household survey; 2011 and 2015 SAEB; 2009 and 2015 ENEM; 2009 and 2015 ENADE.

The Cost approach and the Education Market approach, on the other hand, provide estimates that are quite close for all schooling levels but higher education. An argument can be made, however, that included in public higher education cost are items that are really not education, particularly research. While specific research budgets, such as laboratories and research grants,

have not been included in education costs, the salaries of many higher education teachers also pay their time as researchers.

Finally, Table 4 shows that distributive impacts of public schooling by level. The Table shows both the Ex-ante impacts (Concentration Coefficients calculated with no imputation of public schooling value into incomes) and Ex-post impacts (Concentration Coefficients calculated with educational values included in incomes). Once again, there are no pre-school impacts for the Labor Market approach because the method cannot estimate them with the data available.

Table 4 – Concentration Coefficients of Public Education by Level, Ex Ante and Ex Post

	Ex Ante			Ex Post		
Level	Cost	Labor Market	Education Market	Cost	Labor Market	Education Market
Pre-School	-0.302	none	-0.257	-0.240	none	-0.150
Lower Primary	-0.388	-0.290	-0.279	-0.319	-0.048	-0.162
Upper Primary	-0.332		-0.257	-0.251		-0.116
Secondary	-0.181	-0.139	-0.141	-0.093	0.071	0.018
Higher	0.321	0.378	0.350	0.532	0.592	0.459
All Levels	-0.216	-0.173	-0.188	-0.122	0.057	-0.055

Source: 2009 POF Consumption survey; 2015 PNAD household survey; 2011 and 2015 SAEB; 2009 and 2015 ENEM; 2009 and 2015 ENADE.

The distributive results are more varied than the averages. The Cost approach yields Ex-Ante Concentration Coefficient in negative thirties – highly distributive – for pre-school and primary education. The Labor Market and Education Market approaches yield Concentration Coefficients in the negative twenties – still quite distributive but less so than the Labor Market approach. The same relation holds true for secondary education. For higher education, Concentration Coefficients from all three approaches are in the positive thirties.

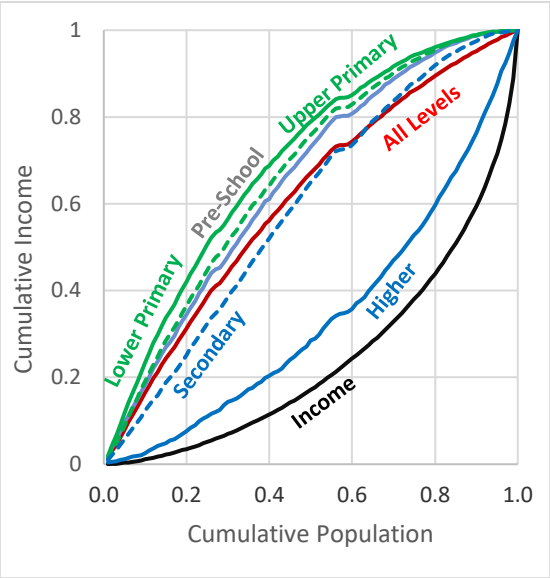
This discrepancy is probably due to heterogeneity among schools. While the Cost approach assigns to all schools in a given state the same expenditures, the Education Market approach assigns higher value to better public schools, thus negating some of its distributive impacts.

The Ex-Post results are always less distributive because the recipients of education spending all move up the income distribution once educational spending is imputed into their incomes. Additional spending on higher education is regressive as shown by Ex Post Concentration Coefficients which are higher than the Ex Post Gini Coefficient.

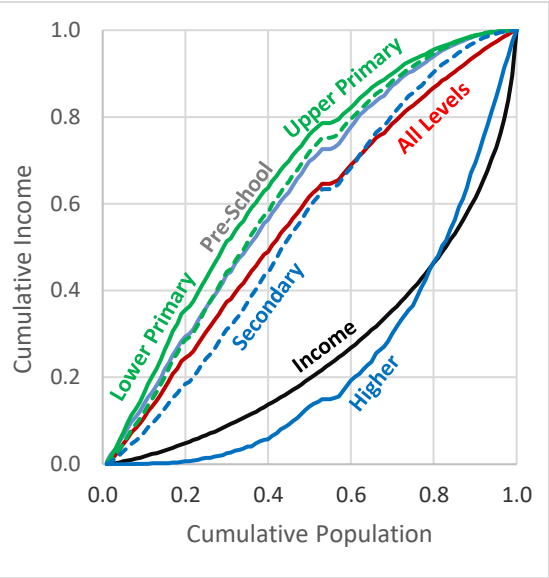
Finally, the six panels of Figure 1 shows the Ex-Ante and Ex-Post Concentration Curves for all educational levels for all three methods.

Figure 1 – Concentration Curves

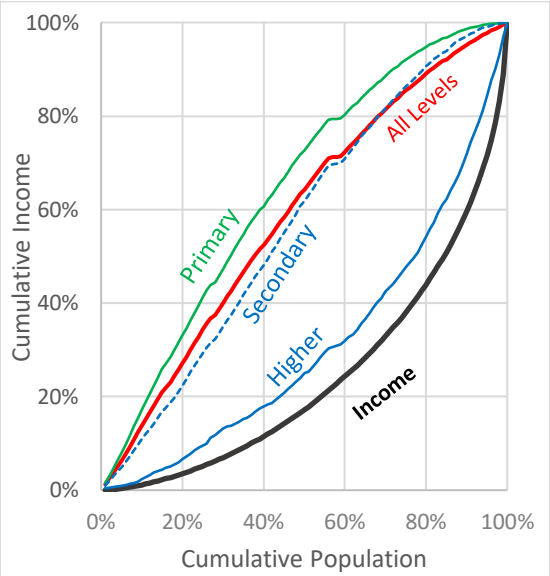
Cost Approach Ex Ante



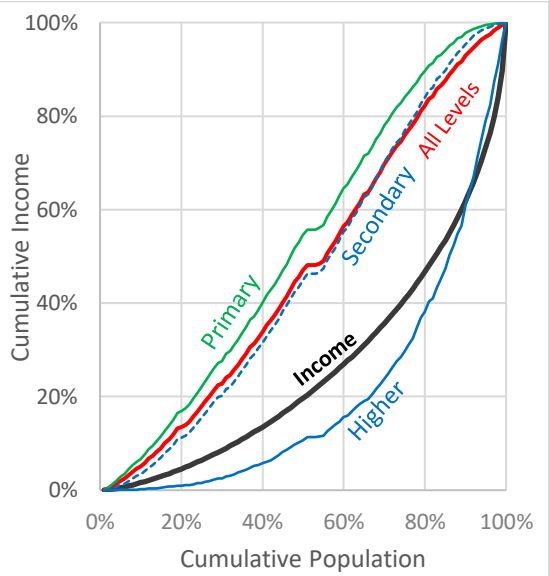
Cost Approach Ex Post



Labor Market Approach Ex Ante

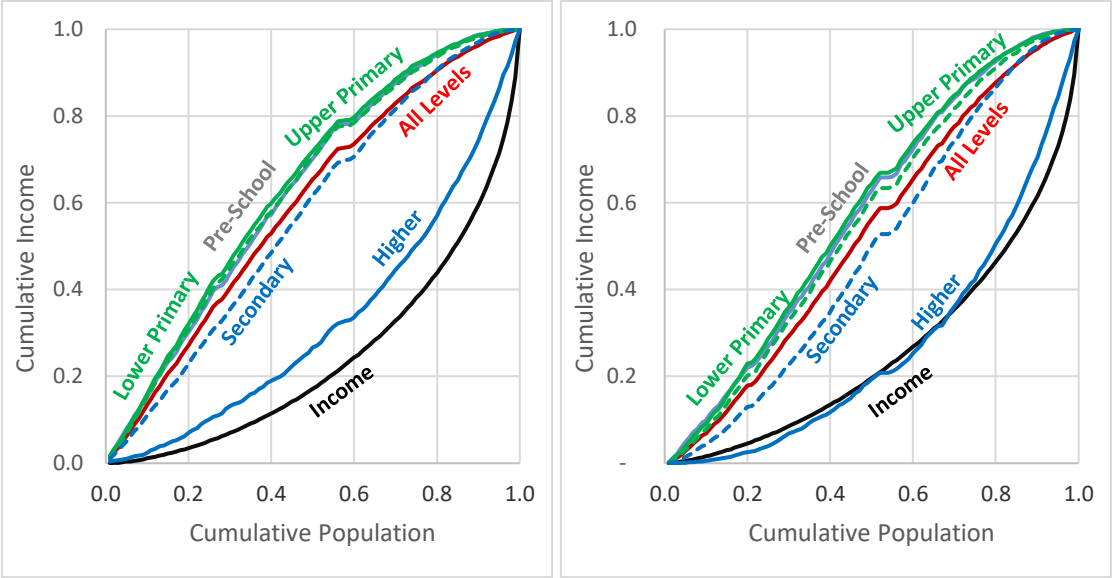


Labor Market Approach Ex Post



Education Market Approach Ex Ante

Education Market Approach Ex Post



Source: 2009 POF Consumption survey; 2015 PNAD household survey; 2011 and 2015 SAEB; 2009 and 2015 ENEM; 2009 and 2015 ENADE.

6. Conclusions.

In this paper, I compare different methods for providing an estimate of how much public education is worth to those who benefit from it. Apart from the tried and true Cost method, I also applied two other methods, the Labor Market method invented by Sergio Urzua (2017) and the Education Market method pioneered by myself (Soares, 2017). I find that the results from the three methods do not fall far from each other.

That Cost and Education Market methods yield similar estimates of value should not be a surprise. The private system is heavily influenced by the public schooling supply. The Labor Market valuation of public education, however, depends a lot on the discount rate chosen.

All methods provide similar distributive results Ex Ante because the children who benefit from them are more or less in the same position in the income distribution. Furthermore, if the value each assigns to public education is not too different, then the Ex Post distributive results will not fall too far from each other either.

My conclusion is that the value of public education in Brazil is close to 6% of household income and it is highly distributive, whatever the valuation method used.

7. References.

Andridge, Rebecca R and Little, Roderick J. A. 2010. "A Review of Hot Deck Imputation for Survey Non-response" *International Statistical Review*, Volume 78, Number 1, pp 40–64.

Atkinson, Anthony B. 2005. *Measurement of Government Output and Productivity for the National Accounts. Atkinson Review: Final Report*. Palgrave MacMillan.

OECD. 2008. *Growing Unequal? Income Distribution and Poverty in OECD Countries*.

Soares, Sergei. O Valor de Mercado da Educação Pública. IPEA Discussion Text no 2324. August 2017.

Urzua, Sergio. Estimating the Value of Education Services: A Comparison of the Average-cost versus Private Rate of Returns to Education. Presentation at CEQ Workshop. 2017.

Annex – School Tuition Regressions

Variable	Lower Primary		Upper Primary		Secondary		Higher Education	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Test Score	**18.31**	**0%**	**9.88**	**10%**	**9.21**	**5%**	**18.89**	**1%**
Acre	548	82%	1692	63%	-918	66%	2135	4%
Amazonas	-2459	14%	-782	84%	-2624	39%	642	52%
Roraima	0		0		0		-113	97%
Pará	417	76%	849	80%	-1069	58%	624	47%
Amapá	836	65%	1528	65%	-23	99%	1	100%
Tocantins	-1276	36%	0		-1131	63%	176	83%
Maranhão	-1359	33%	771	79%	155	92%	1710	4%
Piauí	-593	63%	1256	67%	-209	90%	747	36%
Ceará	-958	47%	-2	100%	-1159	53%	-414	63%
Rio Grande do Norte	-551	65%	148	96%	-1032	57%	-344	70%
Paraíba	817	53%	3761	21%	759	68%	-35	97%
Pernambuco	-505	69%	1817	56%	-718	68%	655	39%
Alagoas	-925	46%	848	77%	-480	78%	-277	72%
Sergipe	-105	93%	1362	64%	3003	7%	587	45%
Bahia	-1411	30%	-231	94%	3016	10%	845	25%
Minas Gerais	-118	93%	608	84%	-191	90%	1601	2%
Espírito Santo	-1909	13%	2343	43%	-1553	35%	348	64%
Rio de Janeiro	1250	36%	2160	49%	-1125	49%	2137	1%
São Paulo	1091	40%	2541	41%	1964	19%	1932	1%
Paraná	-360	80%	928	76%	867	65%	629	39%
Santa Catarina	-311	82%	6476	7%	1240	47%	153	83%
Rio Grande do Sul	-908	53%	632	85%	-365	84%	1872	1%
Mato Grosso do Sul	-1578	25%	209	95%	711	71%	325	66%
Mato Grosso	-1378	34%	-451	88%	3123	19%	-166	83%
Goiás	293	83%	47	99%	-155	92%	876	22%
Distrito Federal	-557	69%	6292	5%	5473	8%	2325	0%
Constant	-5544	1%	-3794	32%	-1763	55%	1777	2%

Source: POF Consumption survey, SAEB, ENEM, ENADE.