Do Teachers' Wages Matter for Proficiency? Evidence from a Funding Reform in Brazil*

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Abstract

In the Brazilian public education system, teachers' wages are determined by the state or municipality legislation and are unrelated to performance. A first examination of our data set reveals that wages are unrelated to the proficiency of public schools pupils in test scores, conditional on other teachers' observed characteristics, whereas a positive correlation exists in the private sector. This could be due to the fact that wages do not matter for proficiency in the public sector or that there is a spurious correlation between wages and proficiency. In this paper we use the 1998 reform in the funding of fundamental education in Brazil (FUNDEF) to identify the effects of teachers' wages on the proficiency of public school pupils. This reform established a floor on the percentage of public spending in teachers' wages out of total resources of 60% and redistributed resources among states and municipalities, depending on the size of each system. The evidence suggests that FUNDEF raised the relative wages of public school teachers and that this effect improved the proficiency of public school students. Further experiments suggest that this effect was due to the attraction of better new teachers.

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1) Introduction

In terms of income distribution, Brazil is one the most unequal countries in the world.[1] Education plays an import role in explaining this fact, as about 50% of the income distribution in Brazil can be associated with education. This happens because returns to education are very high in Brazil and only a small proportion of the population has access to higher levels of education.[2] Despite the fact that access to the first schooling year is almost universal in Brazil, children from a poor background tend to drop out of the school system quite early on.[3] One the reasons behind this high drop-out rate may be the quality of the education they receive in the public system.

In 1998, a reform in the funding of the public fundamental education system was introduced in Brazil, with the creation of **FUNDEF** (Fundo para Manutenção e Desenvolvimento do Ensino Fundamental e Valorização do Magistério – Fund for Maintenance and Development of the Fundamental Education and Valorization of Teaching). FUNDEF's main aim is redistribute resources from richer to poorer regions and to increase public teachers´ wages. The aim of this paper is to examine whether the introduction of FUNDEF has in fact increased the earnings of the public school teachers, relative to their private schools counterparts, and the relative performance of public school pupils in test scores.

The Brazilian education system is divided in cycles. The first cycle (primary education) consists of four years, the second (secondary) also has four years, the third (high school) lasts three years and the fourth (college) usually lasts between four and five years.

[1] The 10% in the top of the income distribution appropriate 50% of all income in Brazil.
[2] See Menezes-Filho et al (2002). A college graduate earns about three times more than a high school graduate and only about 10% of the population has a college degree.
[3] See Filmer, D and Prichett, L. (1998)

The primary and secondary cycles together form what is called the fundamental education, which was affected by the introduction of FUNDEF.

The system has both private (paid) and public (free) schools. Figure 1 presents the share of pupils studying in private schools and the share of schools that are privately owned in selected grades. One can notice that the share of students in private schools rises with the level of education, which can be explained by the high drop-out rate among kids from a poor background, which tend to study in public schools. Moreover, the share of private schools is higher than the share of students in private schools, especially from the 8th grade onwards, which means that private schools tend to have fewer students than the public ones after that grade.

In terms of college education, the situation is radically different, since students from public colleges perform much better on average in evaluation tests than do the students from private institutions. As such, there is a very competitive exam to gain admission into each of the public colleges, and students from private high schools generally do much better in these admissions exams than do pupils from the public school system that managed to conclude high school. Therefore, most of the students from a poor background, which went through the public high school system, have to go to private colleges or try their luck in the labor market and inequality tends to self-perpetuate.

For all these reasons, it is important to evaluate an education reform that aimed at changing the funding structure of the public school system, in order to redistribute resources to the poorest regions, such as FUNDEF. Barros *et al* (2001), using household level data, found that the wages of public school teachers rose by about 8% with respect to those in the private sector in the southeast of Brazil. Anuatti Neto *et al* (2003) also found that the relative wages of public school teachers increased between 1997 and 1999,

particularly in the municipal system in the Northeast of Brazil, which they attribute to FUNDEF. However, there is no study evaluating the impact of FUNDEF using school level data and examining its effects on the relative proficiency of public school pupils. We think that this paper also relates to a broader literature the tries to evaluate the impact of resources spent on education and on teacher labor market (see Hanushek, 2004, for example).

The structure of the paper is as follows. In section 2 we describe the FUNDEF program and section 3 describes the data. Section 4 presents the econometric methodology, while the results are presented in section 5 and the conclusions in section 6.

2) The FUNDEF Program

In each Brazilian municipality, the public schools may belong to the State system or to the municipality system. The new Brazilian constitution, which took effect in 1988, stated that all States, Municipalities and the Federal Government had to spend a fixed share of their tax and transfer revenues in their public education system. This share was equal to 25% in the cases of states and municipalities and 18% in the case of the federal government. With this new legislation, the amount of resources allocated to education increased, but the so did heterogeneity of the public schools, since richer states with a small share of students in their system were spending much more per pupil than were poor municipalities with a large share of students. Moreover, there was no mechanism to enforce that the education

resources were effectively being spent on the educational system itself and not on other activities that could be remotely linked to education. [4]

The introduction of FUNDEF aimed at changing the structure of funding in fundamental education. Since its implementation (January 1st 1998) and for a period of 10 years, all municipalities and states had to spend 60% of their education resources (that is, 15% of their revenues) exclusively with the maintenance and development of its fundamental education. However, instead of being directly applied by the government unit, all resources were firstly directed to a common fund. In a second moment, the resources were redistributed to the states and municipalities, in direct proportion to the number of students enrolled in each state and municipality fundamental school system. Moreover, 60% of the resources received through this fund had to be spent with teachers´ wages. Finally, a minimum amount of spending per pupil was established, and in the cases where this amount could not be achieved with the fund resources alone, the federal government would complement it.

Hence, FUNDEF affected the education system in several ways. Suppose that a municipality had revenues (from tax and transfers) that amounted to R$100. With the 1988 constitution, it had to destine R$25 to education in any way it preferred. After FUNDEF, it had to donate R$15 to the fund, whereas the amount if received back depended on the number of pupils enrolled in the fundamental education. If its share of pupils was equal to its share of resources to the fund, it would receive the same R$15 back. Moreover, at least R$9 had to be spent in teachers´ wages.

[4] Rich municipalities with a small number of public schools, for example, spent the resources in activities remotely related to the education, like street pavements near the school, sports gymnasium, etc..

Therefore, the impact of FUNDEF on the schools and on teachers' wages in a municipality or state depended on the amount of resources initially allocated to the fundamental education system out of its education budget; on the initial share of wages out of this amount and on its share of enrollments as compared to its share of revenues within the State.

Table 1 reports the financial redistribution that took place between the each state and its municipalities in 1998 for the different regions. The transfers within a State would sum zero, were it not for the federal government transfers that complement the budget if the expenditures per student do not reach the minimum amount. It is clear that in all regions, with the exception of the south-east (SE), the transfer favored the municipalities. This happened because their proportion of enrolments was high relative to the proportion of their revenues.

Figure 2 shows the behavior the expenditures on education in each state as a proportion of the GDP over time. Since the proportion of the revenues spent on education in each unit should be constant over time (determined by the Constitution), the changes in the share of education expenditures should correspond to changes in the revenues/GDP ration. It is clear that there was a rise in the share of education expenditures in the country as a whole between 1997 and 1998, with the main responsible being the states and municipalities of the Northeast, where the rise actually starting in 1997. Therefore, a higher share of resources was being spent on education over the period under analysis.

FUNDEF established that 60% of all education resources should be spent on fundamental education. Figure 3 shows that the states were, on average, already spending more than 60% of its education resources on fundamental education in 1997. This is also true for each state and municipal system separately, except for the state system in Sao

Paulo, Rio de Janeiro and Paraná (figure not shown). Between 1998 and 1999, one can notice a decline in share of resources accruing to fundamental education and a rise in the high school share of education expenditures.

Figure 4 shows that the Municipal system as a whole was already spending about 70% of its education resources on the fundamental cycle. The São Paulo municipalities were the only ones spending less than the minimum required, on average (figure not shown). However, the share of resources spent on the fundamental education rose by about 8% between 1997 and 1998, with a similar decline in the amount destined to the pre-school system. This could be the result of the effort made by municipalities that were not previously spending the minimum required and had to substitute resources away from the pre-school to the fundamental education.

Figure 5 presents the evolution of the total number of students in the fundamental education in each system (state, municipality and private schools) between 1997 and 1999. It is clear that the total number of students rose over time, with a rise in the number of students in the municipal system more than compensating for the decline in the number of students in the state system. It seems therefore that students are being transferred fron the state to the municipal system, which could perhaps be associated with the shifts in the allocation of the education resources from the states to the municipalities. It is interesting to note however, that these movements to the municipal system and away from the State system occurred even in the states which experienced a shift in resources in the opposite direction, like São Paulo and Minas Gerais, which means that it could actually reflect a trend that pre-dates the introduction of Fundef.

In Figure 6 we present the evolution of the real expenditures per pupil in the fundamental education in the state and municipal systems and in Brazil as a whole. It is

clear that there was a rise in real expenditures between 1997 and 1998, in both the state and the municipal systems, despite the rise in the number of students, followed by a decline in the level of expenditures in the state system between 1998 and 1999.

Figures 7 and 8 present the equivalent numbers for the Northeast and Southeast regions separately. One can notice from figure 7 that in the northeast the pattern is very similar to the one observed for the country as a whole. The stabilization of real expenditures between 1998 and 1999 despite falling expenditures in both the municipal and state systems can be explained by the rise in the federal transfer to the units that did not reach the stipulated minimum amount of expenditures per pupil. Figure 8 shows that in the Southeast region, where the state system was a net beneficiary of the FUNDEF program, real expenditures in the municipal system fell continuously between 1997 and 1999.

Figure 9 shows that the number of schools offering fundamental education fell between 1997 and 1999 especially due to the fall in the number of State schools, although there was a slight fall in the number of municipal schools as well. This happened both in the Northeast ad in the Southeast (figures not shown), with the exception of the number of municipal schools in the southeast, which rose between 1997 and 1998, despite the fall in real expenditures documented in the previous figure.

Despite the fall in the number of schools, Figure 10 shows that the total number of teachers actually rose between 1997 and 1999, mainly due to the rise in the municipal system, which out-weighted the fall in the state system. It seems therefore that teachers also moved from the municipal to the state system, following their students. This was true both in the Northeast and in the Southeast regions as well (figures not shown). It is important to note that the number of private schools and of their teachers has remained constant over this time frame, since they will form our control group.

Finally, Figure 11 shows that average class sizes remained basically constant between 1997 and 1999 in the system as a whole, but there was a rise in the average class size in the municipal system, which was compensated by a fall in the private schools. This was especially true in the Northeast (figures not shown).

3) Econometric Methodology

The empirical strategy we will follow to evaluate the impact of the FUNDEF program on proficiency is based on the differences-in-differences methodology, used in Card (1990) and generalized by Blundell et al (1998). The aim is to investigate whether the changes in wages, implemented by the FUNDEF program impacted the proficiency of public schools pupils.

More formally, we specify an equation that relates students' proficiency (y) with teachers' wages (w), controlling for the characteristics of students (x), teachers (t) and schools (s):

$$y_{ijkt} = \alpha + \delta w_{jt} + \gamma x_{it} + \gamma p_{jt} + \theta s_{kt} + \varepsilon_{it} \qquad (1)$$

The problem with estimating (1) is that the error term in general will be correlated with the explanatory variables, in particular with teachers' wages.

$$\varepsilon_{ijkt} = \varepsilon_{it} + \varepsilon_{jt} + \varepsilon_{kt} + u_{ijkt}$$

This will happen, for example, if good teachers allocate themselves into good schools, which have the best students. Moreover, in Brazil teachers' wages in the public schools are defined by the state (if the school is in the state system) or by the municipality (if it is in the municipal system), depending only on the teachers' observable characteristics, whereas in the private sector wages can vary according to teachers' ability, for example. Therefore, it

is expected that teachers with preferences for a "quiet life" will prefer the public schools, which could be reflected in the proficiency of the students. Finally variance in wages across municipalities and states systems can also be endogenous, since better systems will have both better teachers and better outcomes.

We therefore need an exogenous variation in wages to identify delta in (1). The FUNDEF reform provides such an opportunity, as the change in the legislation was defined at the federal level, unrelated to state and municipalities' wishes. In order to identify equation (1) we assume that:

$$E[u_{ijkt} / w] = \beta_t + \gamma_s + \eta_m + \beta_{tm} + \gamma_{sm} + \beta_{ts} \qquad (2)$$

This means that unobserved differences in proficiency can be captured by a time effect (β_t), a system effect (γ_s municipal, state or private), a municipality effect (η_m), an interaction between time and municipality (β_{tm}), an interaction between municipality and system (β_{ms}) and an interaction between time and system (β_{ts}). In other words, this assumption allows for unobserved differences in average proficiency across municipalities and across systems to change over time. It only requires that unobserved differences in proficiency across systems within municipalities are constant over time.

One possible problem with the identification strategy is that FUNDEF also changed the amount of resources available to different systems within the same municipalities over time, through the special fund. Therefore we will also condition the expectation above on the net transfer of resources across systems ($):

$$E[u_{ijkt} / w, x, t, s, \$] = \beta_t + \gamma_s + \eta_m + \beta_{tm} + \gamma_{sm} + \beta_{ts} \qquad (3)$$

In order to complete identification, we also need that teachers' wages grow differentially across systems within municipalities over time. Defining:

$$D_w = E[w_i / m,t,s] - E[w_i / t,s] - E[w_i / m,t] - E[w_i / m,s] \quad (3)$$

We need that $E[D_w]^2 \neq 0$. This is exactly what the FUNDEF reform provokes, since some states/municipal systems were already spending more than 60% of education resources with teachers, while other were not, within the same municipality.

In order to implement this result we will use the student level data to regress teachers' wages on the students, teacher and school controls and on a set of dummies for: time, municipality, system, time/system, municipality/system, time/municipality and time/municipality/system and compute the residuals from this regression. Then we use the same data to regress test scores on teachers' wages, the students, teacher and school controls and all the dummies, apart from the interactions between time/municipality/system, and the wage residual. The t-value on the coefficient of the residual is a test of exogeneity, once the standard errors have been corrected for generated regresor bias and intra-group dependence.

3) Data

The data we use in this part of the project come from SAEB (Sistema de Avaliação do Ensino Básico) a survey carried out by the Ministry of Education. This data set has information on the test scores of a sample of students in both public and private schools in 1995, 1997, 1999 and 2001. As FUNDEF was introduced in 1999 (see above) we will only use the 1997 and 1999 waves. Each student in each school was tested for his/her proficiency in one out of two possible subjects: Portuguese and Mathematics. The information on the teacher responsible for this subject and the school characteristics were matched to each student to form the final data set. In this version of the paper, we will use

only the test scores of the students that were in the 8th grade, the last grade of the fundamental education.

The SAEB data are repeated cross-sections of a representative sample of schools, so that the schools and even the municipalities are not necessarily the same across surveys (although they might be). Since we are interested in the effect of the change in resources in the states and municipalities between 1997 and 1999, and we want to control for municipality fixed effects, we restrict the sample to the schools that are located in municipalities that appear both in 1997 and in 1999. Table 2 presents the balance of the panel.

The data set contains a very detailed set of characteristics of each student, school, teacher and director for all schools in the sample. Table 3 presents the summary statistics of the students' characteristics. The percentage of boys is slightly higher in the private schools, although girls form the majority of students in both systems. It is interesting to note that the mean age in the private schools is much lower than in the public ones, with may reflect late start or higher grade repetition. The differences in the family background are quite striking, as about 48% of the mothers of private school students have a college degree as compared to 9% in the public schools! This difference remained basically the same in 1999. The percentage of pupils that have failed the grade exams in the past is very high, reaching 27% in the private and 59% in the public system in 1997, declining in both systems by about 5 percentage points between 1997 and 1999.

Table 4 presents a summary of the teachers' characteristics. The first thing to notice is that sample sizes increased between the 97 and 99 sample. This may bias our estimation results if it affected the composition of the public and private school teachers differently in

terms of unobservable characteristics.[5] One can notice that about 93% of private school teachers were college educated in 1997, as compared to 80% in the public schools, a difference of about 13 percentage points. In 1999 the difference in terms of college education was in the range of 10 percentage points. In terms of experience and age, there were no marked differences between the 1999 and the 1997 sample means. In terms of average wages however, we can see that the difference between the private and public schools that was R$512 in 1997, declined to about R$290 in 1999, a reduction of about 43%![6]

Table 5 presents the description of some school characteristics. This is the most problematic part of the data, since there are not many school characteristics in the 1999 survey, and there are differences in the way that the questions were formulated between the 1997 and the 1999 surveys. Therefore, a comparison between the 1997 and 1999 data is problematic, and we should concentrate on the comparison between public and private schools in each year.[7] One can notice that in 1997 about 97% of the private school had computers, whereas only 37% of the public schools had at least one. In 1999 the question asked about the number of computers *used by students*, and so the proportion decreased to 66% in the private schools and 17% in the public system. It is interesting to note that the difference in terms of the director's wage between the private and public schools has also declined between 1997 and 1999, from approximately R$900 to about R$490, a change of about 45%, in line with the teachers' wages.

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[5] Both the 1997 and the 1999 samples are representative at the level of each State. It is not clear why the sample sizes increased in the period.

[6] The original information on teachers' wages was in the form of intervals, so we used the midpoints of each interval to construct the means, and converted into real wages, using the average inflation rate in the period.

[7] We recently noticed that the 1999 teacher survey does contain information on several school characteristics that could be used and compared to the ones present in the 1997 survey. The next version of the paper will include these variables.

4) Results

Table 6 below presents the basic correlation between pupils' proficiency and teachers' wages in our data. It can be seen that when we pool the data from public and private sector an OLS regression coefficient of 20.53 is obtained and very precisely estimated. When we separate students from public and private schools, however, a radically different pattern emerges between the two groups. In the public sector the estimated coefficient is 2.98, marginally significant at 5%, whereas in the private sector the coefficient is about 6 times higher and very significant. These results could be due to the fact that teachers in the private sector have better observed and unobserved characteristics than teachers in the public sector, which would drive up wages and proficiency in first sector. Alternatively, it could be due the fact that wages actually improve performance in the private sector, due to some efficiency wage considerations.

Table 7 presents the results of and OLS regression that looks at the determinants of teachers' wages and students' proficiency for the pooled 1997 and 1999 sample. The first three columns examine the determinants of wages at the state, municipal and private systems, while the last three investigate the determinants of proficiency in these three systems. The dummy for 1999 shows that real wages increased in 1999 in state and municipal systems, but not in the private system, which is evidence that FUNDEF in effect raised wages in the public sector. Interestingly, the last three columns show that proficiency declined in 1999 in the three systems, most notably in the municipal system. The dummies for the different disciplines reveal that mathematics teachers in the private schools earn more than the Science teachers (omitted category) and that the pupils tend to fare worse in Portuguese do better in mathematics in the private sector.

Inspection of the personal and family background estimated coefficients also reveal interesting patterns. Teaches tend to earn more when their pupils are white, younger and have more educated mothers, both in municipal and in the private schools. These variables are also associated with a better performance in the test scores, as the last three columns reveal. It is interesting that wages depend on these characteristics in the public system, since wages are defined at the system level and are not related to pupils' performance. One possible explanation is that the municipalities that have kids with a better background are richer and therefore able to pay higher wages.

In terms of the teachers' characteristics, it is important to notice that wages are negatively related to proficiency in the state schools, conditional on the other teachers, students and schools' characteristics. In the municipal schools the relationship is insignificantly different from zero, while in the private schools it is positive and very significant. One possible explanation for these results is that wages in the public system are completely determined by observable characteristics, while in the private sector it is partly determined by performance. But the level of wages (and its relationship to unobservable characteristics) could vary across municipalities, and it is interesting to see that even in this dimension the correlation is negative or zero in the public schools.

With respect to the other characteristics, full-time teachers (dedication) earn more than part time ones, but their performance, as measured by their students' test scores, is lower. Experience is strongly associated with higher wages, both in the public and in the private schools, but is only associated with better performance in the private system. Teachers' education is only associated with higher wages in the public system and bears no relationship with the students' test scores. Age is also strongly associated with higher wages, but only in the public system, and has no relationship with performance.

In terms of school characteristics, the director's wage is positively associated with the teachers' wage, which could reflect a municipality fixed effect, and is also associated with performance in the municipal and in the private sector, but not in the state system. The presence of a laboratory raises wages in the private system and improves test scores in all three systems. The presence of computers raises wages in the state system and raises performance only in this system. Finally, the presence of a photocopying machine is associated with higher wages in the municipal and in the private sector and raises performance in all three sectors.

Table 8 presents the main results of the paper, using the instrumenting strategy described in section 3 above. In this section we are only comparing municipal and state schools, because wages in the private schools may vary over time due to sample composition, since wages are defined at the school level and the schools are different between 1997 and 1999). Column (1) combine the results of columns (4) and (5) of the previous table, by pooling together state and municipal public schools. It is interesting to note that only the Portuguese dummy, the students' and the schools' characteristics are statistically significant in the regression. In particular, no teachers' characteristic enters significantly in this specification, including teachers' wages. This is interesting because it means that in the cross-section wages do not matter either directly or indirectly for proficiency, since wages are determined in part by the teachers' characteristics.

Column (2) includes municipalities fixed-effects and, interestingly enough, the results do not change much, apart form a decline in the magnitude of the effect of the school characteristics. Column (3) includes the interactions between the dummies for municipalities and systems, to control for the fact that the state system might be better in some municipalities than in others, for example. Again the results do not change much,

apart from a further decline in the effect of the school characteristics. Column (4) includes the interactions between the municipalities and the time dummies, to control for the fact that unobserved characteristics may have changed different in different municipalities over time. Needless to say, the results do not change significantly.

In the final column, we instrument teachers' wages with the municipalities-time-system interactions, that is, we use only the variation of wages between the municipal and the state system within municipalities over time to identify the effect of wages on proficiency. Interestingly, the wage effect is now statistically and economically significant. Moreover, the residual of the wage regression, that captured the variation of wages not explained by the model, is negative and statistically significant, meaning the unobserved characteristics were driving the negative correlation between wages and proficiency observed in columns (1) to (4) in this table. When we included the FUNDEF net transfers, the results did not change qualitatively (not shown).

But if wages are not related to performance in the public sector, then why should an exogenous rise in wages improve performance of pupils' performance? Table 9 starts answering this question. In this table we split the sample in two sub-samples, according to the tenure of the teacher *in the school*. According to our definition, a new teacher is one that has been in the school for less than two years, that is, arrived in the school after the reform has taken place. The results of the table show that when we control for the endogeneity the effect of wages on performance only occur in the sample of new teachers. This means that the rise in wages was effective in raising performance because of the better quality of the new teachers attracted by the better salary.

5) Conclusions

In the Brazilian public education system, teachers' wages are determined by the state or municipality legislation and are unrelated to performance. A first examination of our data set reveals that wages are unrelated to the proficiency of public schools pupils in test scores, conditional on other teachers' observed characteristics, whereas a positive correlation exists in the private sector. This could be due to the fact that wages do not matter for proficiency in the public sector or that there is a spurious correlation between wages and proficiency. In this paper we use the 1998 reform in the funding of fundamental education in Brazil (FUNDEF) to identify the effects of teachers' wages on the proficiency of public school pupils. This reform established a floor on the percentage of public spending in teachers' wages out of total resources of 60% and redistributed resources among states and municipalities, depending on the size of each system. The evidence suggests that FUNDEF raised the relative wages of public school teachers and that this effect improved the proficiency of public school students. Further experiments suggest that this effect was due to the attraction of better new teachers.

7 -References

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Tabela 1: FUNDEF Financial Impact by Brazilian Regions- 1998

Region	State Government				B – A	Municipal Government				B - A
	Contribution to FUNDEF (A)	Revenues from FUNDEF				Contribution to FUNDEF (A)	Revenues from FUNDEF			
		Principal	Federal Compl.	Total (B)			Principal	Federal Compl.	Total (B)	
N	731,7	655,6	66	721,6	(10)	262,5	338,5	46,6	385,1	122,6
NE	1810,6	1203,2	157,9	1361,3	(449,5)	966,1	1573,8	216,1	1789,9	823,8
SE	4327,7	4500,2	-	4500,2	173,2	1973,3	1799,9	-	1799,9	(173,4)
S	1283,4	1152,5	-	1152,5	(130,9)	717,2	848,1		848,1	130,9
CO	452,0	446,3	-	446,3	(5,7)	247,0	252,5	-	252,5	5,5
Brazil	8604,7	7957,8	223,9	8181,7	(423,0)	4166,1	4818,8	262,7	5075,5	909,4

Source – Education Secretary – MEC **R$ Millions**

Table 2: Panel Description

Panel 97-99	State Schools		Municipal Schools		Private Schools	
	1997	**1999**	**1997**	**1999**	**1997**	**1999**
Students	7.321	3.306	3.790	3.435	7.702	5.836
Schools	171	236	118	280	144	443
Municipals	53	53	44	44	58	58
States	26	26	23	23	26	26

Table 3: Descriptive Statistics – Student's Characteristics

Students	**1997**		**1999**	
	Public	**Private**	**Public**	**Private**
Boy	42,16%	45,85%	44,36%	48,54%
White	49,88%	70,40%	45,68%	65,25%
Age - 7	8,98 (2,27)	7,38 (1,20)	8,66 (1,75)	7,37 (1,08)
Mother's Education = Secondary	60,75%	17,48%	63,21%	16,16%
Mother's Education = High School	21,27%	28,72%	19,70%	34,32%
Mother's Education = College	10,46%	52,71%	6,78%	47,76%
Failed before	58,73%	25,07%	55,45%	25,55%
Portuguese	242,35 (45,40)	283,57 (46,20)	229,45 (41,59)	268,74 (47,60)
Mathematics	238,95 (42,75)	296,88 (49,28)	239,62 (42,76)	290,52 (51,11)
Number of observation	11.111	7.702	6.741	5.836

Table 4: Descriptive Statistics – Teacher's Characteristics

Teachers' Characteristics	**1997**		**1999**	
	Public	**Private**	**Public**	**Private**
High School	11,37%	5,67%	10,68%	9,03%
College	88,17%	94,33%	89,09%	90,87%
Experience >=6 & <=15	41,17%	44,62%	41,10%	49,44%
Experience >=16 & <= 20	18,27%	15,55%	17,96%	12,00%
Experience >= 21	19,79%	25,00%	22,37%	19,08%
Age >=25 & <= 29	11,30%	15,26%	14,09%	21,33%
Age >=30 & <= 34	17,29%	22,24%	18,50%	22,87%
Age >=35 & <= 39	20,92%	17,59%	18,19%	17,54%
Age >=40 & <= 44	20,77%	17,44%	19,50%	12,10%
Age >=45 & <= 49	13,72%	13,95%	14,94%	10,05%
Age >=50	7,13%	7,12%	7,97%	6,56%
Men	36,92%	39,53%	36,38%	46,67%
Wage	732,59 (424,57)	1310,52 (726,52)	1017,58 (586,36)	1301,54 (768,19)
Number of Observation	1.319	688	1.292	975

Table 5: Descriptive Statistics - Schools Characteristics

Schools Characteristics	**1997**				**1999**			
	Private		**Public**		**Private**		**Public**	
Computer	107	92,2%	176	37,5%	488	65,9%	226	17,0%
Clean classroom	97	83,6%	217	46,3%	509	68,7%	631	47,5%
Clean bathroom	93	80,2%	105	22,4%	602	81,2%	701	52,8%
Director's Wage	1.981,01 (845,29)		1.070,03 (644,92)		1.497,31 (872,47)		1.009,64 (553,26)	
Number of Observation	116		469		741		1328	

Table 6- Correlation Between Wages and Proficiency

Proficiency	**Pooled**	**Public Sector**	**Private Sector**
Ln(Wages)	20,53	2,98	17,43
	(2,52)	(1,49)	(2,56)
Constant	124.65	220,74	166,62
	(9,67)	(9,52)	(17,99)
R2	0,074	0,001	0,053
N	34625	20194	14431

Results of OLS regression. Standard errors (robust) in brackets

Table 7- Correlates of Wages and Proficiency

	Ln Wage			Proficiency		
	State	**Municipal**	**Private**	**State**	**Municipal**	**Private**
Year 99	0,278	0,201	0,055	-5,514	-8,254	-4,939
	(0,060)	(0,053)	(0,056)	(2,229)	(1,555)	(2,848)
Portuguese	0,064	0,076	0,007	-1,505	-3,968	-10,320
	(0,057)	(0,043)	(0,039)	(1,578)	(1,663)	(1,628)
Mathematic	0,068	-0,002	0,137	0,322	-1,009	4,759
	(0,052)	(0,035)	(0,032)	(1,536)	(1,556)	(1,559)
Student's Characteristics						
Boy	-0,004	0,011	-0,007	8,404	8,735	3,915
	(0,013)	(0,015)	(0,015)	(1,220)	(1,214)	(1,078)
White	-0,010	0,034	0,074	3,961	3,576	4,245
	(0,021)	(0,017)	(0,023)	(1,189)	(0,918)	(1,183)
Age	0,068	-0,043	-0,021	-11,061	-9,144	3,791
	(0,039)	(0,030)	(0,040)	(1,642)	(1,712)	(2,884)
Age^2	-0,003	0,001	0,000	0,319	0,252	-0,476
	(0,002)	(0,001)	(0,003)	(0,075)	(0,083)	(0,145)
Mother's education =Middle school	0,010	0,051	0,010	3,975	5,868	6,403
	(0,028)	(0,026)	(0,056)	(1,220)	(2,237)	(4,705)
Mother's education =High school	0,063	0,073	0,064	10,626	11,982	13,627
	(0,028)	(0,031)	(0,052)	(1,676)	(3,203)	(4,623)
Mother's education =College school	0,061	0,083	0,154	10,008	11,748	18,059
	(0,027)	(0,033)	(0,045)	(2,030)	(3,137)	(4,547)
Failed before	0,019	0,000	-0,019	-7,074	-10,247	-22,109
	(0,018)	(0,018)	(0,028)	(1,245)	(1,479)	(2,036)
Teacher's Characteristics						
Ln wage				-4,242	2,236	9,092
				(1,222)	(1,583)	(2,536)
Dedication	0,262	0,301	0,169	2,265	-0,382	-7,256
	(0,073)	(0,055)	(0,049)	(2,027)	(1,549)	(1,862)
Years of experience >= 6 and <= 10	0,191	0,079	0,178	-2,097	0,121	4,287
	(0,067)	(0,070)	(0,057)	(2,938)	(2,508)	(2,728)
Years of experience >= 11 and <= 15	0,296	0,154	0,346	-0,700	-1,461	5,546
	(0,084)	(0,073)	(0,067)	(2,497)	(2,828)	(3,204)
Years of experience >= 16 and <= 20	0,268	0,118	0,292	-0,373	-4,376	11,977
	(0,080)	(0,105)	(0,082)	(2,708)	(3,118)	(5,274)
Years of experience >= 21	0,419	0,364	0,579	2,789	-2,720	4,567
	(0,087)	(0,104)	(0,085)	(2,768)	(3,903)	(3,538)
Men	0,064	0,140	0,040	-1,686	-1,547	0,385
	(0,057)	(0,046)	(0,050)	(1,269)	(1,699)	(2,044)
High School	0,178	-0,015	-0,410	-6,321	-6,941	-2,788
	(0,307)	(0,340)	(0,131)	(7,742)	(6,897)	(5,438)

College	0,573	0,508	-0,080	2,996	-3,730	-13,956
	(0,255)	(0,302)	(0,110)	(7,461)	(6,249)	(4,098)
Fez pós-graduação	0,070	0,134	0,020	3,606	-0,038	1,390
	(0,068)	(0,057)	(0,045)	(2,718)	(1,843)	(1,904)
Age>=21 & <=25	0,126	0,256	-0,007	-2,142	-7,867	7,345
	(0,199)	(0,191)	(0,263)	(4,416)	(6,974)	(9,526)
Age>=26 & <=30	0,426	0,454	0,011	-4,476	-2,640	3,135
	(0,215)	(0,195)	(0,282)	(5,442)	(5,456)	(9,801)
Age>=31 & <=35	0,360	0,558	-0,019	-2,706	-4,649	-0,035
	(0,182)	(0,199)	(0,309)	(5,720)	(5,757)	(9,902)
Age>=36 & <=40	0,456	0,590	-0,058	0,752	-0,031	0,967
	(0,189)	(0,199)	(0,291)	(5,180)	(6,640)	(8,659)
Age>=41 & <=45	0,512	0,661	-0,006	1,899	-1,451	3,087
	(0,188)	(0,209)	(0,281)	(5,220)	(6,535)	(9,152)
Age>=46 & <=50	0,441	0,685	-0,221	-0,428	-0,567	3,588
	(0,193)	(0,205)	(0,286)	(5,781)	(6,135)	(8,425)
Age>=51	0,417	0,605	-0,203	-7,375	-3,503	3,958
	(0,332)	(0,212)	(0,295)	(5,003)	(5,983)	(9,547)
School's Characteristics						
Director's Ln wage	0,123	0,196	0,340	-0,343	3,253	4,801
	(0,050)	(0,079)	(0,071)	(2,444)	(1,686)	(1,957)
Science Laboratory	-0,043	0,093	0,117	6,316	10,789	3,897
	(0,055)	(0,058)	(0,056)	(2,296)	(2,528)	(2,190)
Computer	0,121	0,056	0,139	6,860	-0,229	4,750
	(0,065)	(0,075)	(0,088)	(2,232)	(2,445)	(3,628)
Xerox	-0,091	0,208	0,314	5,786	6,572	12,023
	(0,060)	(0,061)	(0,126)	(2,228)	(2,086)	(4,451)
Constant	3,560	3,676	3,526	324,932	262,908	164,818
	(0,508)	(0,603)	(0,548)	(19,310)	(20,398)	(19,697)
R-Squared	0,360	0,439	0,401	0,175	0,163	0,227
Nº Municipal	32	32	32	32	32	32
Nº Observation	7.627	6.535	9.181	7.627	6.535	9.181

Table 8: Determinants of Proficiency – Instrumental Variables

Dependent variable: Proficiency	Model 1	Model 2	Model 3	Model 4	Model 5
Year 99	-6,971	-7,424	-6,921	0,168	-8,131
	(1,694)	(1,570)	(1,739)	(1,390)	(3,697)
State	-0,685	1,395	6,326	9,090	10,848
	(2,107)	(1,977)	(1,840)	(1,655)	(1,436)
Year 99 * State	0,060	0,697	0,718	-1,127	-1,009
	(2,824)	(2,964)	(3,410)	(3,819)	(3,473)
Portuguese	-2,707	-1,697	-1,489	-1,549	-3,027
	(1,381)	(1,349)	(1,378)	(1,374)	(1,396)
Mathematic	-0,609	-0,324	-0,298	-0,214	-1,116
	(1,200)	(1,138)	(1,123)	(1,144)	(1,100)
Dummies of Municipals		Yes	Yes	Yes	Yes
Municipal * State			Yes	Yes	Yes
Municipal * Year 99				Yes	Yes
Student's Characteristics					
Boy	8,638	8,487	8,552	8,572	8,552
	(0,897)	(0,875)	(0,880)	(0,871)	(0,869)
White	3,995	2,405	2,337	2,295	1,868
	(0,863)	(0,829)	(0,837)	(0,831)	(0,787)
Age	-10,382	-9,765	-9,501	-9,694	-9,689
	(1,293)	(1,249)	(1,286)	(1,263)	(1,251)
Age^2	0,296	0,273	0,265	0,276	0,282
	(0,062)	(0,060)	(0,061)	(0,060)	(0,060)
Mother's education =Middle school	5,313	4,055	4,109	4,156	3,687
	(1,384)	(1,353)	(1,332)	(1,332)	(1,263)
Mother's education =High school	11,699	10,446	10,197	10,074	9,294
	(1,910)	(1,761)	(1,798)	(1,787)	(1,706)
Mother's education =College school	11,360	9,085	8,734	8,561	7,724
	(2,335)	(2,161)	(2,171)	(2,151)	(2,052)
Failed before	-8,650	-8,587	-8,646	-8,607	-8,895
	(1,049)	(0,999)	(1,008)	(1,022)	(1,014)
Teacher's Characteristics					
Ln Wage (observed)	-1,107	-0,706	-0,970	-1,335	18,228
	(1,306)	(0,884)	(0,875)	(0,969)	(7,989)
Ln Wage (Residual)					-20,132
					(7,783)
Dedication	0,983	1,457	1,446	1,884	-3,713
	(1,598)	(1,114)	(1,035)	(1,007)	(2,280)
Years of experience >= 6 and <= 10	-0,819	0,076	0,422	0,507	-1,434
	(1,959)	(1,321)	(1,492)	(1,470)	(1,756)

Years of experience >= 11 and <= 15	-1,112 (2,112)	-0,476 (1,547)	-0,361 (1,481)	-0,353 (1,503)	-5,104 (2,539)
Years of experience >= 16 and <= 20	-2,203 (2,204)	-1,437 (1,590)	-0,902 (1,564)	-0,867 (1,583)	-5,731 (2,583)
Years of experience >= 21	0,798 (2,761)	0,301 (2,001)	0,997 (1,988)	1,274 (2,046)	-6,536 (3,649)
Men	-1,392 (1,195)	-1,323 (1,075)	-1,182 (1,103)	-1,053 (1,126)	-2,535 (1,239)
High School	-6,651 (5,637)	-2,248 (4,976)	-0,061 (5,403)	-0,765 (5,817)	-1,871 (5,578)
College	0,237 (4,760)	1,372 (4,434)	3,292 (4,914)	2,202 (5,342)	-4,216 (5,159)
Fez pós-graduação	2,062 (1,749)	0,763 (1,175)	0,643 (1,283)	0,498 (1,282)	-1,564 (1,511)
Age>=21 & <=25	-4,155 (4,658)	-1,560 (3,304)	-2,153 (3,324)	-0,835 (3,585)	1,159 (3,122)
Age>=26 & <=30	-3,331 (4,879)	-1,995 (3,371)	-3,648 (3,243)	-2,748 (3,524)	-5,997 (3,939)
Age>=31 & <=35	-3,371 (5,082)	-1,381 (3,512)	-2,661 (3,428)	-1,410 (3,724)	-5,661 (4,442)
Age>=36 & <=40	0,205 (5,038)	1,031 (3,668)	-0,673 (3,632)	0,510 (3,898)	-3,506 (4,573)
Age>=41 & <=45	0,746 (4,878)	2,297 (3,579)	0,624 (3,671)	2,038 (3,938)	-3,592 (4,812)
Age>=46 & <=50	-0,359 (5,145)	0,885 (3,672)	-1,005 (3,717)	-0,029 (4,040)	-4,699 (4,732)
Age>=51	-4,937 (5,090)	-2,222 (3,653)	-3,536 (3,769)	-1,952 (4,030)	-6,972 (4,832)
School's Characteristics					
Director's Ln wage	1,639 (1,723)	0,637 (1,147)	-0,045 (1,006)	-0,891 (0,986)	-0,294 (0,886)
Science Laboratory	8,230 (2,182)	3,675 (1,551)	1,600 (1,674)	1,558 (1,820)	1,898 (1,795)
Computer	3,388 (1,734)	1,273 (1,289)	2,207 (1,440)	2,290 (1,652)	2,364 (1,621)
Xerox	6,591 (1,900)	2,597 (1,572)	2,616 (1,774)	2,916 (1,869)	2,826 (1,793)
Constant	294,217 (15,092)	312,096 (11,096)	313,052 (10,069)	318,066 (10,777)	223,270 (40,157)
R-Square	0,1650	0,2011	0,2058	0,2099	0,2108
Nº Municipals	32	32	32	32	32
Nº Observation	14.162	14.162	14.162	14.162	14.162

Table 9: Determinants of Proficiency – New and Old Teachers

	New Teachers		Old Teachers	
Ln (wage) Observed	-2,858	10,085	0,594	7,714
	(1,286)	(4,457)	(1,269)	(6,682)
Ln (wage) Residual	-	13,410	-	7,285
		(5,109)		(6,878)

Figure 1 - Share of Private Schools - 2002

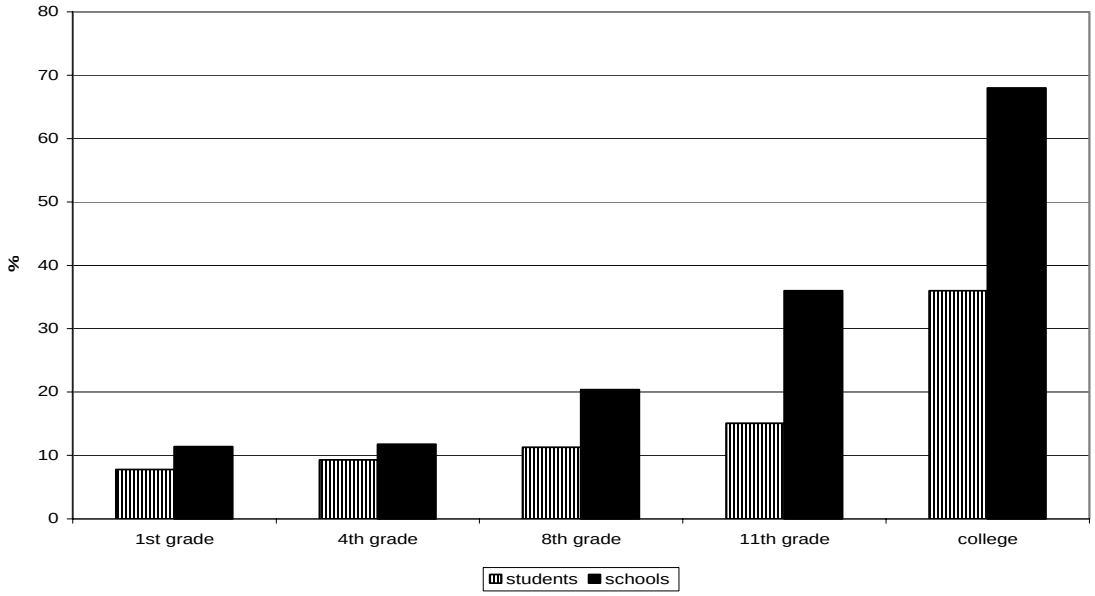

Figure 2 - Expenditures on Education per GDP by Region

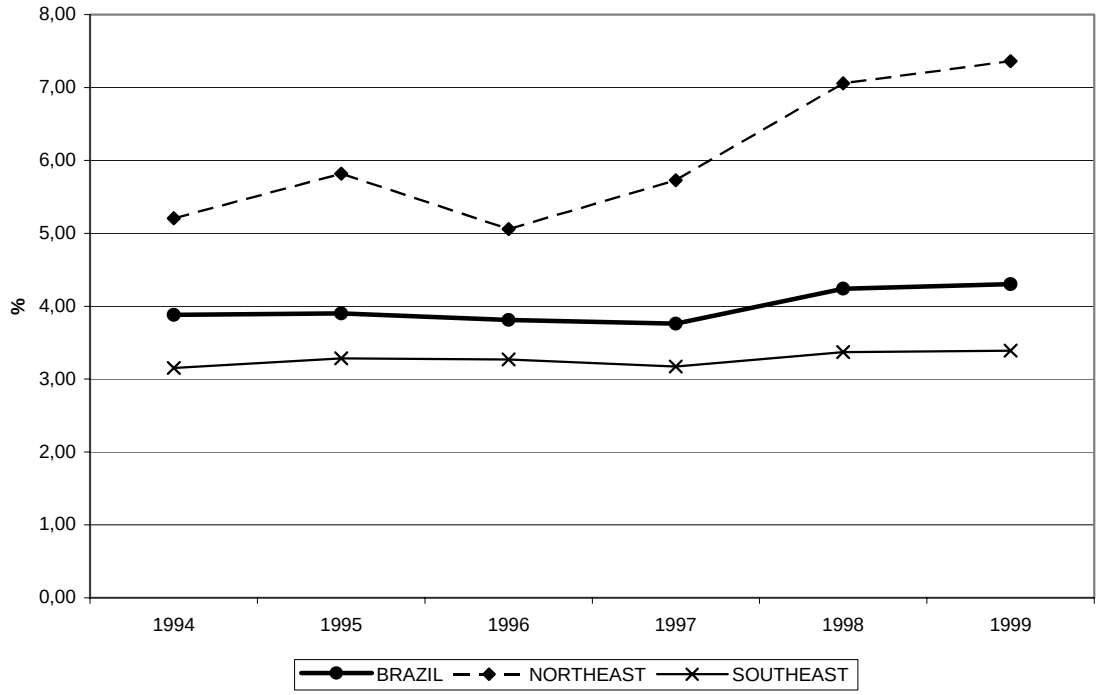

Figure 3 - Expenditure Share in Each Cycle - State System

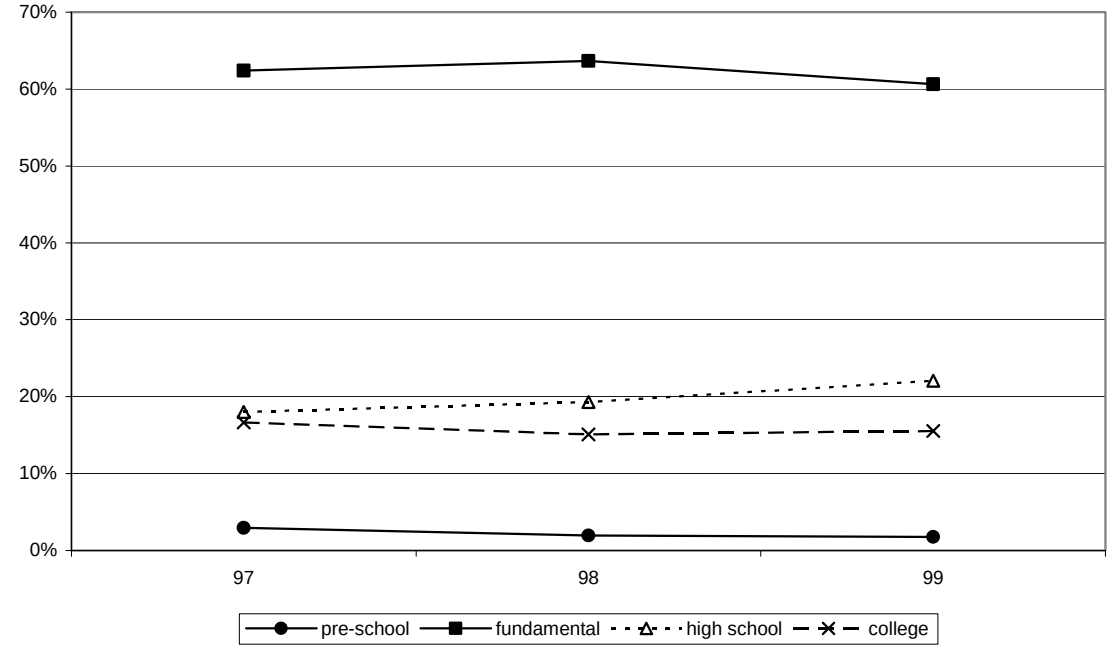

Figure 4- Expenditure Share in Each Cycle - Municipal System

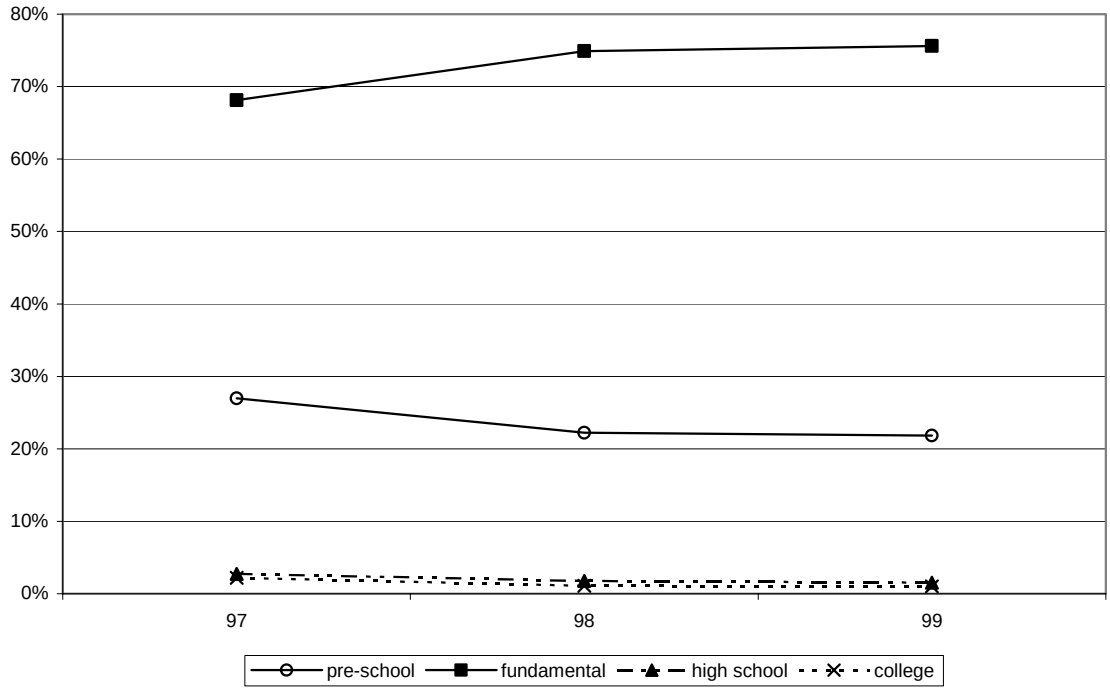

Figure 5- Number of Students in Fundamental Education - Brasil

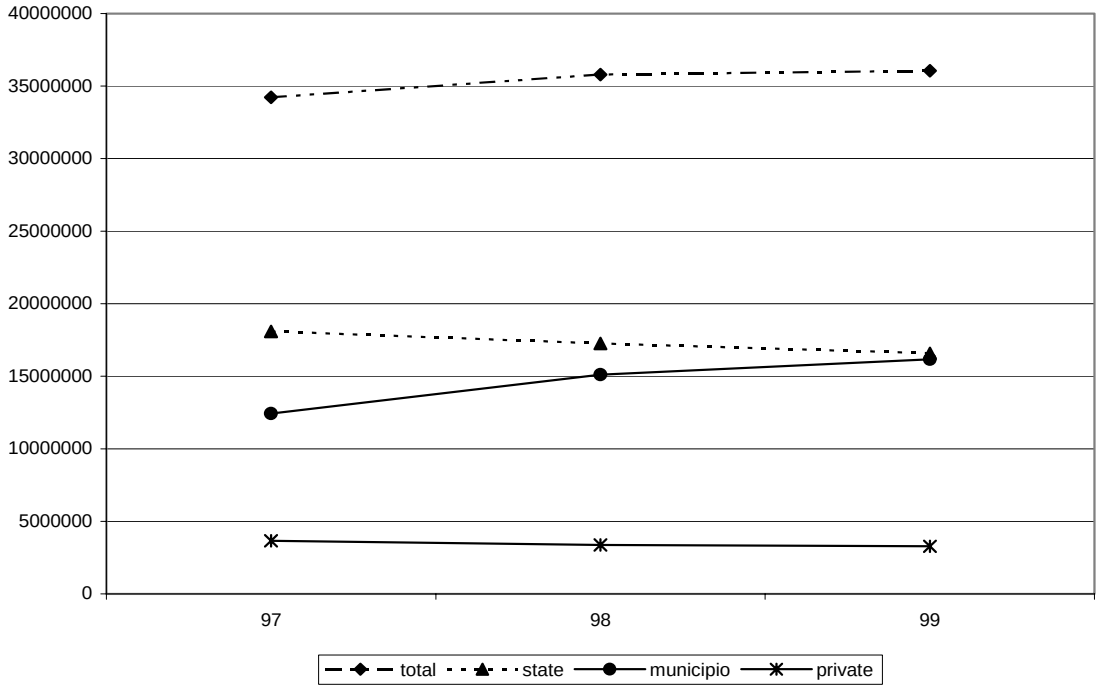

Figure 6- Real Expenditures per Pupil - Fundamental Education - BRAZIL

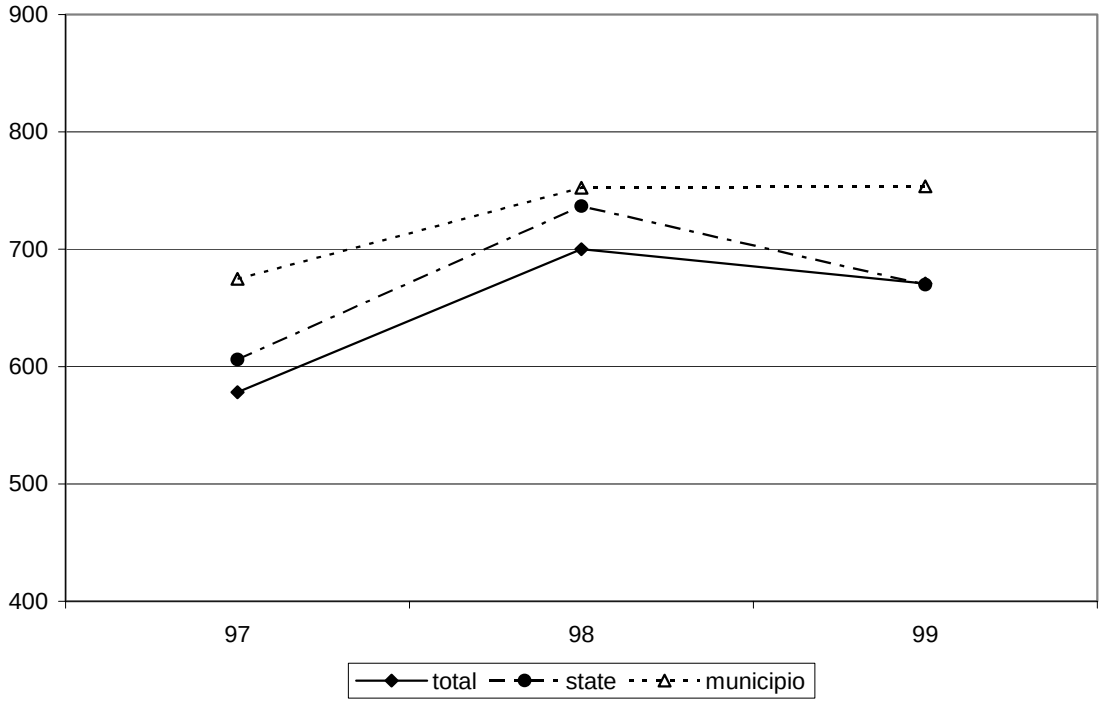

Figure 7- Real Expenditures per Pupil in Fundamental Education - NE

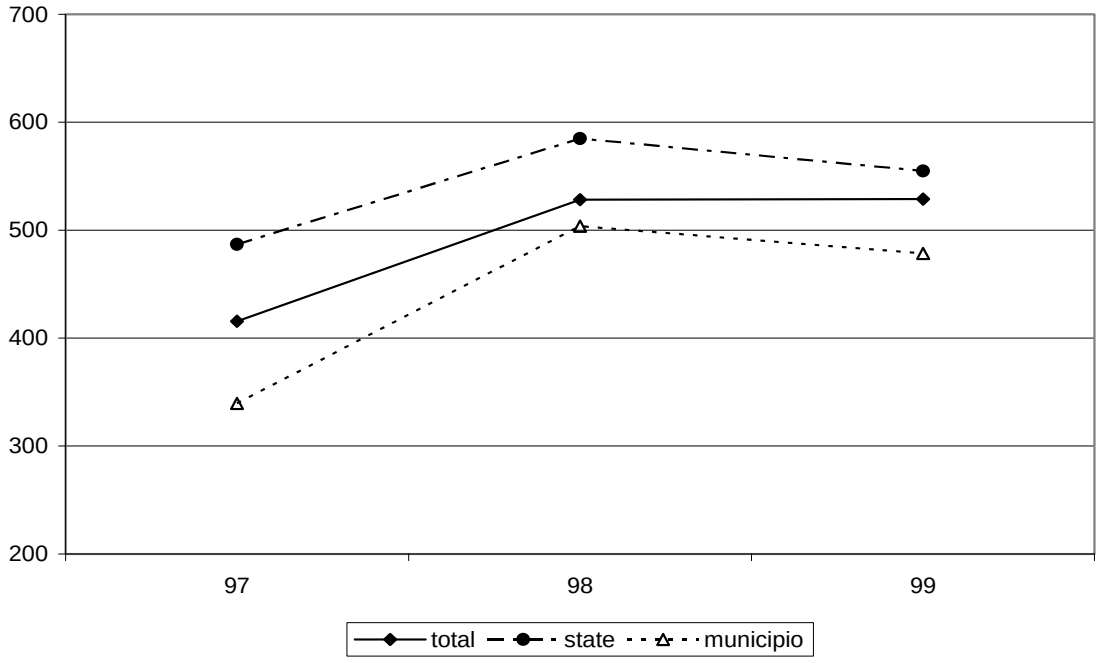

Figure 8 - Real Expenditures per Pupil - Fundamental Education -SE

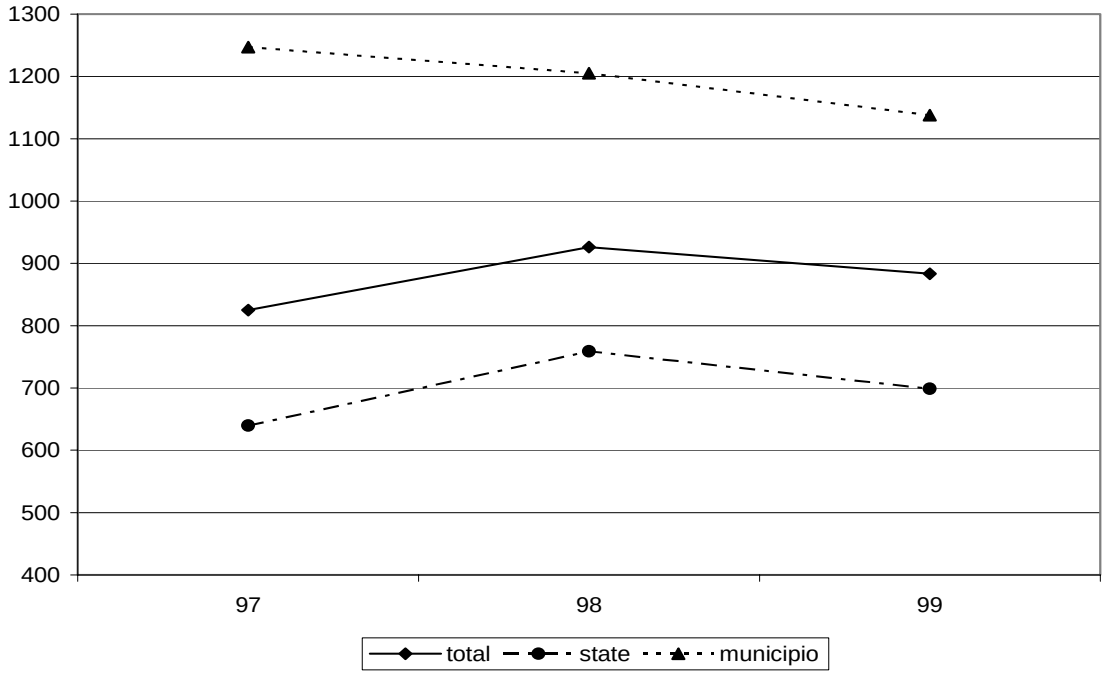

Figure 9 - Number of Schools - BR

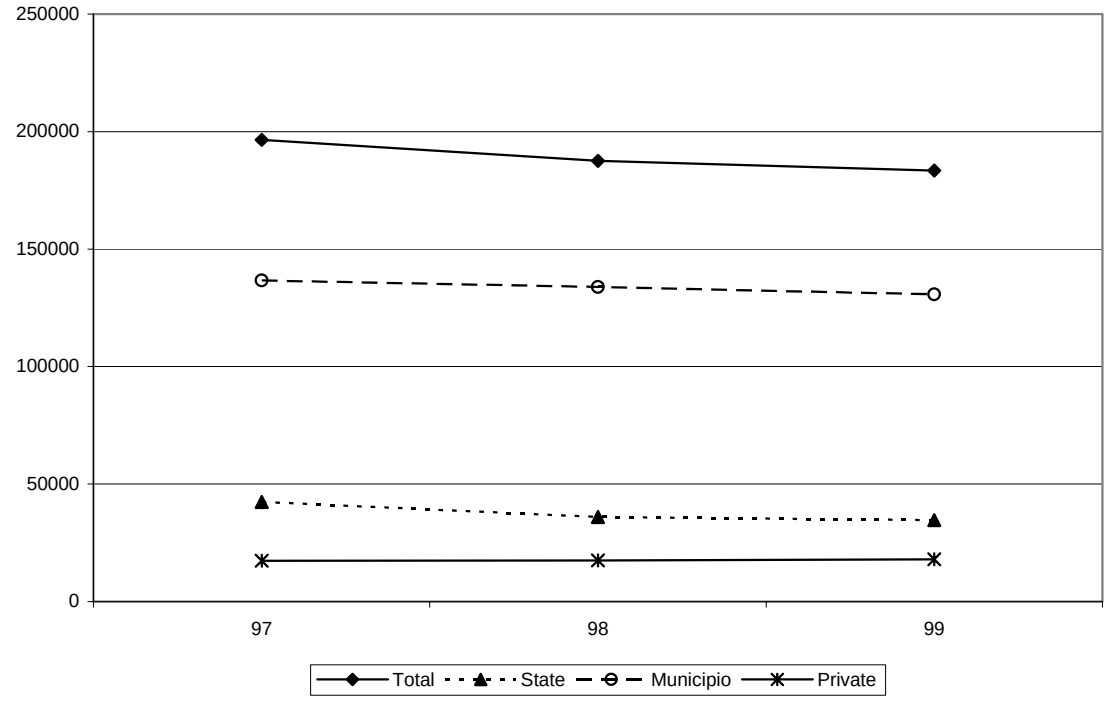

Figure 10 - Number of Teachers - BR

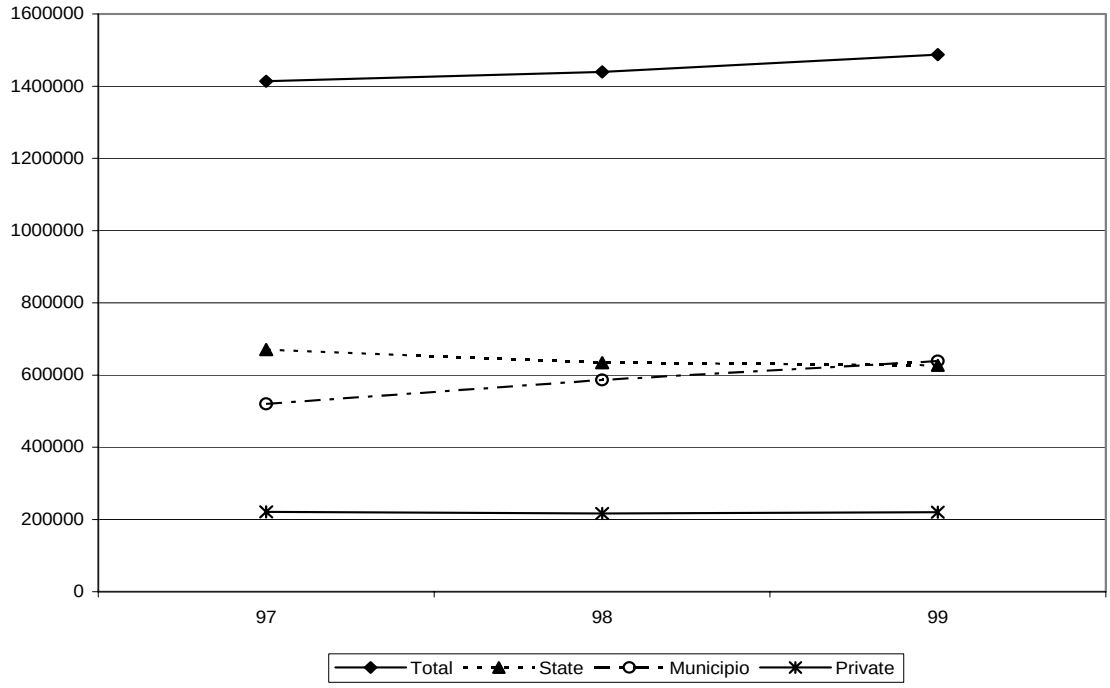

Figure 10 - Class Sizes - BR