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SHIFT ALLOCATION AND SCHOOL SEGREGATION: DISCUSSING INTRA-SCHOOL INEQUALITIES

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ABSTRACT

The paper analyzes patterns of intra- and interschool segregation for the entire Rio de Janeiro, municipal school system from 2004 to 2010. The research design captures the "net effect" of "schooling in shifts/sessions, a mandatory distribution of pupils across morning and afternoon "shifts" or "sessions". Segregation was assessed utilizing the Segregation Index considering four different pupil characteristics: poverty, color/race, parents' education and age/grade distortion. The results indicate that "school shifts" increase the overall level of segregation and that the pupils are being consistently selected based on prior educational attainment, reinforcing the existence of "informal tracking" in Rio de Janeiro public schools.

SCHOOL SEGREGATION • SCHOOL SHIFTS • EDUCATIONAL POLICY

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THIS PAPER ANALYZES THE IMPACT OF THE ALLOCATION OF STUDENTS IN DIFFERENT school shifts on levels of segregation in the Rio de Janeiro municipal public schools. The policy is observed in the majority of cities in Brazil and other developing countries, and basically organizes pupils into "school shifts", that is, morning and afternoon sessions. The research design captures the "net effect" of the policy and provides figures to compare the current segregation levels with a hypothetical scenario with no such policies. There are two possible outcomes for the test: 1) no impact; 2) an increase in segregation. Since there is no specific legislation to regulate the allocation of pupils across shifts, a random allocation would be expected. The question to consider is if a random allocation actually occurs.

The term segregation used here refers to an uneven distribution of pupils with similar characteristics across a school system and assessed utilizing the Segregation Index (referred to here as GS). Four different indicators of potentially disadvantaged pupils were calculated a) poverty; b) parents' education; c) colour[1]; d) age/grade "distortion" (being left back). This last variable summarizes information on all pupils that have not followed a regular age/grade flow in different educational transitions.

The concept of segregation should not be considered a synonym of discrimination or unfairness. It is possible to state that – as measured here – segregation is almost unavoidable to some extent. Nevertheless,

1 American or European studies tend to use "ethnic background". We think that "color" is more appropriate to the Brazilian situation, where it is more difficult to assign the cultural dimension present in the "ethnic background" concept.

the importance of being aware of the phenomenon in order to discern expected or "fair" segregation from inequality enhancing practices and policies should be highlighted.

Evidence from many different countries suggests that school segregation is a universal phenomenon and has to be considered as a consequence of residential segregation, educational policies and parental choice, which are presumed to correlate with social, economic and cultural isolation (HARRIS, 2011). The paper focuses on the role of just one educational policy and, therefore, a large part of variation in the segregation levels will not be explained by this model. The impact of residential segregation, parental choice and other elements of the educational policy should be addressed in future works in order to have a better understanding the causes of segregation in public school system in Brazil.

Within the international debate about school segregation, two crucial questions stand out. The first one is related to the impact of clustering pupils with similar characteristics. Are there any potential benefits or deleterious effects to intentionally clustering pupils? Evidence from different educational systems suggests quite different effects for segregation. On the one hand, it is reasonable to argue that clustering pupils with specific characteristic/needs can be efficient when seeking to implement focused policies directed to help these groups. On the other hand, there is an increasing amount of evidence suggesting that clustering pupils with similar characteristics can have an impact on how they are treated at school, the quality of teaching, overall levels of achievement, the probability of moving on to higher education; an increasing association between academic achievement and socio-economic status (HAARTH et al., 2005; EGGRES, 2005; BRITO; COSTA, 2010; ROSENTHAL; JACOBSON, 1968).

A second question refers to the role of educational policies on segregation levels. Do the policies influence the overall level of segregation? It is reasonable to say that policies that deliberately aim to separate pupils based on, for example, skin colour has lost legitimacy throughout the years. The apartheid system in South Africa, for instance, which intentionally segregated pupils based on ethnicity (white and black population) is most likely to be considered unfair and illegal in most democratic countries.

Nonetheless, the decision to intentionally cluster pupils with similar characteristics can be seen as fair and desirable when seeking to make the educational system less stratified, at least in terms of student achievement.

Differentiation procedures can be applied with the objective of diminishing existing social inequalities. The new understanding of what is fair in terms of educational opportunities creates a new

opposition between more comprehensive educational systems and more segmented systems, with different "types" of schools, curriculum and incentives. However, new policies that endeavour to address pre-existing social inequalities can also inadvertently increase segregation. This "adverse effect" should be taken seriously by researchers, since it can interfere with the possible benefits of the policy.

There are many examples of policies that can unintentionally impact the segregation levels. Charter schools in the U.S. are one example of an attempt to make the educational system more diverse and appealing. Another example is the tracking system that takes place, for example, in Germany or Hungary. There is robust evidence suggesting that the allocation of pupils in a stratified educational system is highly correlated with pupils' socio-economic status. The attempt to track by pupils' ability can, at least in some cases, end up being not very different from selecting based on socio-economic status. A third and last example is the School Choice policy that, among other things, is intended to increase parental choice. There is no consensus among researchers on the impacts of incentive for choosing schools on school segregation (GORARD; TAYLOR; FITZ, 2003).

All policies mentioned above are intended to increase both the quality and equity of educational systems. Despite the fact that there is empirical evidence that these two goals are not incompatible, it seems a hard equation to resolve. Robust research designs that can estimate, not only the intended impact of educational policies, but also the unintended ones, can help policy makers to take further action to improve the educational system.

The paper is divided into six sections, including this introduction. The next section contextualizes the public school system of Rio de Janeiro,, offering data about the policy of allocating students by shifts Following this is the description of the study design, presenting the Segregation Index and the main variables used to describe students with potential disadvantage. The fourth section describes patterns of segregation in the municipal public school network. The fifth provides results of the impact of shift allocation on school segregation. The sixth and final section highlights the main findings, discussing their potential future use in terms of educational policy.

THE CITY OF RIO DE JANEIRO AND ITS EDUCATIONAL POLICY

The city of Rio de Janeiro has the largest public municipal school system in Brazil. There are approximately 1,300 schools providing pre-school and what is known in Brazil as fundamental educational (the equivalent of elementary and middle school). There are more than 600,000 students at

the fundamental level divided into first segment (1st to 5th grade) and second segment (6th to 9th grade). This article is dedicated to the compulsory years, which only corresponds to fundamental, analysing its total population in about 900 schools that provide instruction at this level.

In Brazil, about 18% of pupils are enrolled in private schools. In Rio de Janeiro, this number is even higher, at 25%. Unfortunately, at the moment, there is no data available from private schools to allow a more robust analysis which would consider the t entire pupil population in elementary and middle schools.[2] Since mainly the middle class and the economic elite attend private schools, it is reasonable to assume that the segregation levels presented in this paper will be underestimated. The reason is simple. The data available deals with a more homogeneous part of the population and, therefore, it is most likely that a part of the variation that would influence the segregation index has been left out of the analysis.

Previous studies in the city of Rio de Janeiro highlighted a singular pattern of residential segregation that combines spatial closeness with social distance. Urban sociology has long shown that the isolation of certain groups (for example, poor families) in distant parts of the city can have a negative impact on individuals from the most deprived neighborhoods, beyond the simple disadvantage of being poor. Presumably, isolation diminishes the opportunities for interaction among different groups and could have a greater deleterious effect for those at a potential disadvantage (WILSON, 1987). This pattern of residential segregation known as core-periphery is common in many cities in the U.S. and European countries.

Nonetheless, Ribeiro and Koslinski (2009) showed that the core-periphery model cannot be fully applied to Rio de Janeiro and, presumably, to other big cities in developing countries. In many cases, the cities present a more complex pattern of residential segregation, with some clusters of poor communities spread all over the city, including the most exclusive neighborhoods.

Alves, Lange and Bonamino (2010) published a mapping of the city of Rio de Janeiro with the Social Development Index – SDI – It is possible to identify two concomitant segregation processes. The first one, similar to many European cities, shows the most developed area, close to the coast, apart from the less developed one. However, the same figure highlights that even areas with a very high Social Development Index (SDI) can be very close to poor neighborhoods. This is due to the phenomenon of shantytowns ("favelas") that characterize the city. Around 25% of the population that lives in the most expensive neighborhoods actually live in favelas. In fact, it is possible to observe upper, middle and lower class people living in close proximity to each other, but with little social interaction (RIBEIRO et al., 2010).

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Information about private school students is contained in the Inep database, which is a different source than the one utilized here, therefore requiring verification and reconciling of information, which has not yet been conducted.

It is reasonable to presume that this type of residential segregation would have a positive impact on school segregation. However, previous studies have shown the opposite reality (RIBEIRO; KOSLINSKI, 2009; BRUEL; BARTHOLO, 2012; COSTA; KOSLINSKI, 2011; COSTA, 2008). It is possible to point out at least two levels of school stratification: 1)- regional segmentation, according to the patterns of socio-economic inequality; 2)- segmentation within each region of the city. The distribution of students attending municipal public schools seems to have a complex pattern that overlaps/conjugates socio-economic aspects, residential segregation and academic performance. However, it is relevant to notice that previous research analyzed a limited number of schools, with possible implications for selection bias. This is the perhaps the first attempt to measure segregation in a major Brazilian city using data for all public schools.

The role of location/territory is something that will be fully investigated in future papers. For now, the focus is on analysing the impact of educational policy on the current segregation levels. Some believe this is the most relevant question for the educational field (HARRIS, 2011). In general terms, the municipal public educational system, not only in Rio de Janeiro, but also in other cities, could be described as a broad, comprehensive school system. There are no major differences among schools and, at least in theory, all schools should provide the same curriculum.

More recently, there have been some initiatives in Rio de Janeiro to create different "types of schools", especially in the most vulnerable areas. One example is the recent policy called "Escolas do Amanhã" (Schools of Tomorrow), which began in 2009 in a total of 150 school, located in poor neighborhoods or those with serious problems in terms of low academic performance. This policy, which aims to improve the performance of these schools, provides additional funding so that schools can extend their daily hours and offers more diverse activities to the pupils. There is also an economic incentive for teachers to work in these schools. The main focus is to hire more experienced and motivated professionals for this work. The curriculum, however, as is the case with the "Schools of Tomorrow", does not vary significantly when compared to regular public schools.

Rio de Janeiro's enrolment legislation has been previously analyzed and includes two distinctive approaches. On the one hand, parents have purported freedom of choice. There are no formal restrictions on allocating pupils according to family residence, and the policy of free public transport for pupils allows for greater mobility to attend classes in a school located far from their neighborhoods. On the other hand, schools have control over their intake, especially in the case of oversubscription (BRUEL; BARTHOLO, 2012; BARTHOLO, 2013). Since

schools have different reputations, it is more likely that over enrollment occurs mainly in two scenarios: a) highly dense regions with a low supply of public schools; and b) schools that have a good reputation – so called high performance. If these assumptions are correct, the segregation levels could be influenced by the current legislation.

The unfettered movement of pupils across schools is another issue observed in different educational systems. Saporito (2003), analyzing the impact of Magnet Schools in Philadelphia, showed that the transfers are not random and can increase the segregation levels. Bruel and Bartholo (2012) observed a similar outcome in analyzing public schools in Rio de Janeiro. The lack of transparency and a clear protocol to regulate transfers allows for different procedures by the school principal or members of the administrative staff, such as informal interviews, selection based on previous achievement (school report cards), and other criteria.

Recent evidence has shown that pupil´s family can use a personal connection with members of the administrative staff to gain access to the most prestigious schools (COSTA; KOSLINSKI, 2012). In Brazil, patrimonialistic practices by public servants reinforce the idea that not all individuals are equal. Perhaps all of these issues are linked to the fact that the school principal and/or staff participate actively in the entire enrolment process and approvals of transfers. It is what part of the international literature about school stratification is referring to when it mentions school principals as "gatekeepers" (SMYLIE et al., 2004) of the school.

More than 90% of all the Rio de Janeiro public schools have two or more "shifts" or "sessions". Basically, the "shift policy" has been the solution for the increasing number of pupils enrolled in elementary and middle school in Brazil in the past decades and the lack of new schools (buildings). During the 20th century, in just 40 years, the urbanization process rapidly inverted the proportion of the population living in rural areas and cities. There is data from the 1970s that reveals the existence of schools with four "shifts" in one day. Today, the most common situation is a school with two "sessions (morning and afternoon), but it is still possible to observe schools that present a third one – known as the "night session. Undoubtedly, there is an effort to increase the total number of hours pupils spend at school per day, which necessarily demands one "shift" for each school building.

Everything, besides the building and the principal, can change from one shift to another: teachers, staff, even working materials, can vary from one "shift" to another. In some cases a change in session represents a change in class level (first or second segment), but, in others, the level can be exactly the same. Perhaps the most relevant information for research purposes is the criteria for allocating pupils

into "sessions". Since there is no specific regulation or clear criteria, the school bureaucracy has autonomy in organizing the allocation. It is possible to say that the school staff have control over three moments of admission: initial enrollment, transfer of students among schools, and allocation of pupil in shifts. In reality, what characterizes the "shift policy" is the absence of any regulation regarding the allocation of pupils.

It is important to make a distinction between the "shift policy" and the more classical definition of educational policy that presents a collection of laws and regulations with a clear intention to address issues of public interest. The two daily sessions are so well incorporated that they seem to dispense with any regulation and control in regards to student allocation.

The study aims to answer one key question: does the distribution of pupils across school sessions have any impact on segregation levels? Or rephrasing the question: is there random distribution of students? Previous studies have analyzed this issue in a very limited number of schools and with a weaker research design, with potential selection bias problems. The lack of solid evidence has so far precluded public debate about this issue.

METHODS

The paper presents data provided by the Rio de Janeiro Municipal Educational Department – SME-RJ – for all schools, from 2004 to 2010. The Segregation Index – GS – was assessed considering all available indicators of potential disadvantage, widely known in Brazil and also in other countries, to correlate with student achievement.

The GS indicates the exact proportion of disadvantaged pupils who would have to move from schools (or shifts) for there to be no segregation for the specific characteristics expressed in the indicator. The formula below describes the GS

$$GS = 0.5 * \{\sum|Fi / F - Ti / T|\}$$

where: 1) "Fi" is the number of potentially disadvantaged pupils in school " i ", where " i' varies from 1 to the number of schools; "F" is the total number of potentially disadvantaged pupils in Rio de Janeiro public municipal schools; "Ti" is the total number of pupils in school i, where i varies from 1 to the total number of schools; "T" is the total number of pupils in Rio de Janeiro public municipal schools (GORARD; TAYLOR: FITZ, 2003).

The index presents a simple value for the set of schools, indicating an uneven distribution of pupils with a shared characteristic.

Since there are many indices available in the "market", it is important to evaluate the appropriateness (strengths and weaknesses) of each indicator before choosing one. Gorard (2009), dealing with a specific poverty index, highlights four desirable properties that such indices must present, regardless of the research field for which they are used:

> 1) organisationally invariant, such that if a school is broken into two, or if two schools merge, with the same proportion of FSM[3] [Free School Meal] pupils in all, then the value of the index remains the same; 2) size or scale invariant, such that if the number of both FSM and non-FSM pupils is multiplied by a constant in all schools, then the value of the index remains the same; 3) compositionally invariant, such that if the number of FSM pupils is multiplied by a constant in all schools, then the value of the index remains the same (equivalent to the margin-free criterion in sex segregation analysis) and; 4) affected by transfers, such that if an FSM pupil moves from a school with more FSM pupils to a school with less, then the value of the index goes down. (GORARD, 2009, p. 644)

Organizational invariance is key property for the design presented in this study. In order to measure the impact of the allocation of pupils across "school shifts", the index of segregation must be organizationally invariant. One simple example, using simulated figures, might help clarify the concept for the analysis. Imagine a school system with just two schools and 200 pupils divided into equal numbers between them.

If school "A" has 30 pupils considered poor and school "B" only has 10, the index should be able to capture some degree of segregation. In this case, GS would show a 25% level of segregation. Assuming that both schools ("A" and "B") have two "shifts" (morning and afternoon) each "shift" with 50 pupils, if disadvantaged pupils are equally distributed among shifts, the levels of segregation calculated by GS, considering each school shift as an autonomous entity, will not change. The simulation in Table 1 demonstrates this.

TABLE 1
SEGREGATION INDEXES, BY SCHOOLS AND BY SHIFTS

	DEPRIVED PUPILS	TOTAL PUPILS		DEPRIVED PUPILS	TOTAL PUPILS	DEPRIVED PUPILS	TOTAL PUPILS
School A	30	100	Shift 1	15	50	25	50
			Shift 2	25	50	5	50
School B	10	100	Shift 1	5	50	9	50
			Shift 2	5	50	1	50
GS	25%			25%		38%	

Source: Municipal Educational Department of the City of Rio de Janeiro.

3
In the studies by Gorard (2009) and various others, in Great Britain, the FSM – Free School Meal – is the greatest variable, recorded on an individual level, used as proxy of socioeconomic status. It records eligibility considerations for the student to receive the benefit.

The index correctly captures that, if a school were split into two, keeping the same proportion of disadvantage in both, then segregation remains the same. However, if the allocation of pupils across shifts concentrates the disadvantaged group in one specific shift, then GS increases.

The simulation in Table 1 shows a non-random allocation of disadvantaged pupils across sessions. School sessions A1 and B1 have more poor pupils than what would be expected in a balanced distribution – A1 with 25 and B1 with 9. In this case, GS increases up to 38%. This is an example of how schools can become more segregated after allocating students into sessions.

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Four characteristics of disadvantaged were chosen based on international studies related to the subject of school segregation. Parents' educational level is one of the best predictor of children's long-term learning trajectory. Even in countries with high rates of social mobility, parental characteristics, such as occupation and educational level, are the best predictors of children's success (GORARD; SEE, 2013).

Based on the data utilized, parental education is an ordinal variable, with five possible outcomes: 1) illiterate; 2) did not complete middle school – first 9 years of compulsory school; 3) finished middle school; 4) finished high school – first 12 years of schooling; 5) entered into higher education. In order to construct the segregation indices, the variable was reduced, creating two potentially disadvantaged groups: 1) parents who did not finish middle school-EduEF; 2) parents who did not finish high school-EducFM.

The "poverty gradient" is perhaps the most important subject in the field of education and social justice. Overcoming disadvantage in education is, among other things, closing the gap between pupils brought up in poverty and the rest of the population. If a government had to choose one single variable to track school segregation, poverty should probably be the one.

Since 1990, the Brazilian Federal Government, along with state and municipal administrations, has implemented a number of social policies in an attempt to reduce poverty. The cash transfer policies, through the National Social Registry [*Número de Identificação Social*] – NIS –[4], has made it possible to identify the families that are eligible to receive this benefit.

This is a simple binary variable yielding the total number of pupils at each school who were likely to be living in poverty. We are thus using the existence of a NIS in the pupil record in the SME RJ as a proxy of economic disadvantage. This is not a perfect indicator of

4 "Single Registration for Federal Government, instituted by Decree 6.135/07, is an instrument for identification and socio-economic characterization of low-income Brazilian families, understood primarily as those whose monthly per capita income is up to half a minimum wage. Families with higher income (up to three minimum wages) can also be registered, for the planning or implementation of specific social programs. In this way, the number of families registered is greater than the number of families benefite by the Programa Bolsa Família." See: <http://www.mds.gov.br/falemds/perguntas-frequentes/bolsa-familia/cadastro-unico/beneficiario/cadunico-inclusao>.

this condition, mainly because former records have not been updated as people left conditional cash transfer programs. The existence an unknown number of false positive cases is likely. Otherwise, false negative cases must be improbable as the NIS register for schooling is required for enrollment into such programs.

The third variable, pupil's color, has been used in social sciences to assess social inequalities, not only related to educational opportunities, but also in the labor market, exposure to violence etc. This variable, collected aligned with values adopted by Instituto Brasileiro de Geografia e Estatística – IBGE –, was recoded in two distinctive summary variables for potentially disadvantaged groups: non-white pupils; black pupils.

The last variable, called age-grade "distortion" includes information on all pupils that have not followed a regular age/grade flow. In order to detect "distortion", two variables were used: the pupil's date of birth and his/her grade. The potentially disadvantaged group is composed of any pupil that: a) were held back in any school year(s) – retained; b) started the first year of elementary school at age 7 or older (6 being the correct age) ; c) left school and returned after a certain period of time. The variable presents values corresponding to: a) Distortion 1 as one or more years of age-grade distortion; b) Distortion 2 as two or more years of age-grade distortion.

The research design compares the levels of segregation, calculated as GS, considering every "school shift" as an independent unit, differing from the usual approach that considers each "school building" as a single unit (disregarding the allocation of pupils across the "shifts").Any differences observed in every year should be attributed as the "shift effect". The analysis will present three different approaches to make the results more reliable: 1) all pupils enrolled in Fundamental (Elementary and Middle School) Education; 2) pupils in the first segment of Fundamental Education (1^{st} to 5^{th} grade); 3) pupils in the second segment of Fundamental Education (6^{th} to 9^{th} grade).

The research design was thought to provide two important pieces of information. The first one is the net effect of one specific educational policy. If any difference appears between the GS levels considering the "school building" as one unit and the "school shift", it will be possible to state that the change is due to the policy and nothing else. All the other elements that can influence school segregation, such as residential segregation or parental choice, are controlled by this design.

The second important point is to rule out any plausible alternative explanations in the case of a positive effect of the policy. The design accounts for this in two ways. First, replicating the outcomes over seven years (2004-2010). If the results were constant, showing a similar pattern, it would be very unlikely that this could be due to fluctuation of data (error) in any specific year. Second, by calculating

the "shift effect" separating pupils in the first and second segments of Fundamental Education, the design prevents the likely event that the "shift effect" would be confused with the "segment effect".

This could happen because of two reasons: a) some schools offer all grades of Fundamental Education and organize the "shift" considering the grade (for example, younger pupils separated from the older groups by "school shift"; b) the proportion of potentially disadvantaged pupils in different segments is most likely to be different (mainly because of drop-outs and pupils retained at the end of each school year).

PATTERNS OF SCHOOL SEGREGATION OVER TIME (2004-2010)

The levels of segregation for students in the Rio de Janeiro public municipal schools from 2004 to 2010 are presented in Table 2. Initially, there are two points to highlight. The first one is the fact that the actual GS levels are very different when comparing the indicators. This is not a surprise and it is possible to observe three indicators that show the highest values: GS Distortion 2, GS EducFS and GS NIS (beneficiary of cash transfer program). The second issue regards the patterns of segregation over the years. All variables, with the exception of age-grade distortion, present a decline over the period analyzed. Is there some plausible explanation for this result?

TABLE 2
SEGREGATION INDEX – GS (%) FOR ALL SEGREGATION INDICATORS

GS	2004	2005	2006	2007	2008	2009	2010
Black	19	18	17	16.5	16	15.5	15.5
Non White	12.5	9	8	7.5	6.5	6.5	6.5
Parents Education Below Elementary	30.5	29	27	25	23.5	21.5	20.5
Parents Education Below High	15	14	12.5	11.5	10.5	10	9.5
Income Cash Transfer	28.5	24	20.5	18.5	19	19	20
Distortion 1+ years	14.5	12	13	11.5	12.5	11.5	13.5
Distortion 2+ years	29	28.5	29	31	33	30.5	30.5

Source: Municipal Educational Department of the City of Rio de Janeiro.

The fact that the decline is constant, especially for pupils' colour and parents' education, should raise concern. Over the period analyzed, there were no obvious changes in educational policies or any other alternative explanation that would help to understand the figures. The most likely explanation is related to missing data from the dataset, which can influence all indicators, with the exception of distortion, with precise and complete records for all years. Table 3 presents the

data with the proportions of disadvantaged pupils and missing data for each variable.

TABLE 3
PROPORTION OF MISSING DATA AND DISADVANTAGED PUPIL FOR COLOUR AND PARENTAL EDUCATION

	2004	2005	2006	2007	2008	2009	2010
Missing Data Colour	0.24	0.13	0.06	0.05	0.04	0.04	0.04
Black Pupils	0.10	0.11	0.12	0.12	0.12	0.12	0.11
Non White Pupils	0.49	0.56	0.61	0.61	0.61	0.61	0.61
Missing Data Parents' Education	0.20	0.18	0.16	0.13	0.12	0.11	0.11
Parents Education Below Elementary	0.18	0.20	0.21	0.22	0.23	0.24	0.24
Parents Education Below High	0.56	0.57	0.59	0.60	0.610	0.61	0.60
Distortion 1+ years	0.57	0.59	0.58	0.59	0.57	0.57	0.57
Distortion 2+ years	0.30	0.31	0.30	0.28	0.26	0.26	0.27

Source: Municipal Educational Department of the City of Rio de Janeiro.

Missing data in any research is a challenge, mainly because it can interfere with the results and lead the researcher to wrong interpretations. For longitudinal designs, the risk is even higher, since the quality of data can differ over the years. Results from Table 3 suggest: that the quality of data is better in the more recent years (2007-2010); the missing data is not randomly distributed, with a higher proportion of disadvantaged pupils among the "missing group". There is empirical evidence that, when poverty indicators rise (for example, in economic crises), the segregation levels tend to decline, such as with the "equality of poverty" effect. The inverse situation is also true (GORARD; TAYLOR; FITZ, 2003).

Whatever the case, a detailed analysis of the dataset allows a deeper understanding of the missing data problem. Breaking down the data, not only by year, but also considering pupils' allocation by first or second segment of Fundamental Education, it is possible to observe that the data is better, not only for the most recent years, but also for the younger pupils (from the first segment), as is observed in Table 4. A plausible explanation can be related to the fact that pupils enrolled in the first segment have entered the educational system more recently, when the protocol to collect data started to significantly improve.

TABLE 4
PROPORTION OF MISSING DATA FOR 1ST AND 2ND SEGMENT PUPILS

	2004	2005	2006	2007	2008	2009	2010
1st Segment - Colour	0.13	0.09	0.05	0.04	0.04	0.03	0.03
2nd Segment – Colour	0.40	0.19	0.09	0.06	0.05	0.05	0.05
1st Segment – Parental Education	0.12	0.10	0.09	0.08	0.08	0.08	0.08
2nd Segment – Parental Education	0.29	0.23	0.18	0.14	0.11	0.10	0.10

Source: Municipal Educational Department of the City of Rio de Janeiro.

If it is true that the missing data are not randomly distributed and artificially inflate GS, then it would be expected that the index values calculated for the first and second segments separately, would present different patterns. Tables 5 and 6 show the trends of GS for all available indicators of potentially disadvantaged pupils for both segments.

TABLE 5
SEGREGATION INDEX – GS (%) FOR ALL AVAILABLE INDICATORS – FIRST SEGMENT SEGMENT PUPILS

GS	2004	2005	2006	2007	2008	2009	2010
Black Pupil	18	18	18	18	17.5	17.5	17
Non White Pupil	7.5	7.5	7.5	7.5	7	7	6.5
Parents Education Below Elementary	27	26.5	25.5	24	23	22	20.5
Parents Education Below Higher	10.5	10.5	10.5	10	9.5	10	9.5
Income Cash Transfer	17	16.5	16	15.5	16	17.5	18
Distortion 1+ years	15	9.5	10.5	8.5	9	8.5	13
Distortion 2+ years	32.5	27	27.5	26	27	26	27

Source: Municipal Educational Department of the City of de Janeiro.

TABLE 6
SEGREGATION INDEX – GS (%) FOR ALL AVAILABLE INDICATORS – 2ND SEGMENT PUPILS

GS	2004	2005	2006	2007	2008	2009	2010
Black Pupil	20.5	19.5	17	15.5	15	14.5	14.5
Non White Pupil	13.5	11.5	9	7.5	6.5	6	6
Parents Education Below Elementary	34.5	30.5	27	24.5	23	21.5	20.5
Parents Education Below Higher	18.5	15	12.5	10.5	9.5	9	8.5
Income Cash Transfer	30	22	19	17	17	16.5	17
Distortion 1+ years	13	11.5	12.5	9	11.5	9.5	11
Distortion 2+ years	22.5	20.5	21.5	18.5	21	19	22.5

Source: Municipal Educational Department of the City of Rio de Janeiro.

The figures corroborate the initial hypothesis regarding the influence of missing data on GS, and reinforce the idea that the missing data is not randomly distributed. This is an important finding that should be taken into consideration for future interpretation in this paper. Virtually all longitudinal studies that use secondary data face similar problems, and the real question is not if there will be missing data (as this is most likely), but how researchers approach the problem and take these issues into consideration in their interpretations (YORKE, 2011).

Also it raises the question: what student profile is presented in the missing data? Gorard (2012) conducted an analysis with pupils who did not have information about free school meals – FSM (proxy of poverty) – in English state-run schools. The findings showed that the "missing group" presented the lowest achievement when compared to pupils eligible and not eligible to free school meals. They were termed "super deprived". Bartholo (2014) replicated the same model using data from Prova Rio 2010 for all municipal public schools and found a similar outcome: students with missing data regarding potential disadvantage indicators presented significantly lower scores, compatible with the potentially disadvantaged group. The analyses suggest the need for better data collection in specific educational authorities and also a prudent use of the available data.

IS THERE ANY SCHOOL "SHIFTS" EFFECT? IS THE DISTRIBUTION OF PUPILS IN SHIFTS RANDOM?

School shifts are a reality in around 90% of all Rio de Janeiro public municipal schools. It is known that this phenomenon happens in most of the other capitals in Brazil and in many other developing countries. The main concern with the "school shifts" is that they represent, in practical terms, two or three entirely different schools functioning in the same school building. An attempt to estimate the compositional effect (HARKER; TYMMS, 2004) in schools should in fact consider every school "shift" as an independent institution (BARTHOLO, 2014).

From the methodological point of view, the challenge is to aggregate pupil data at the different levels: 1) each school building as a unit; 2) each school "shift" as a unit. This is the most appropriate design to measure the impact of the school "shifts" on the overall level of school segregation. Since there is no specific policy that guides the distribution of pupils across "shifts", a random distribution of pupils would be expected.

The analysis is presented in three stages: 1) all pupils enrolled in municipal public schools (1st to 9th grade); 2) pupils enrolled in the first segment; 3) pupils enrolled in the second segment. The design

measures the net effect of the school "shifts" ruling out any alternative explanations.

Table 7 presents the relative percentage increase in the "shift" effect considering all indicators of potentially disadvantaged pupils. The figures were calculated with the formula below, where: "GSte" is the GS calculated with "school shifts" as the unit of analysis; "GSpe" is GS calculated with "school building" as the unit of analysis.

{ GSte – GSpe } / GSpe

The calculations for the "shift" effect were replicated 49 times (seven indicators for seven years) considering all pupils and grades. All the values in Table 7 present a positive impact on school segregation, with the exception of GS for Non-White pupils in the year 2008. This is important, because it reveals a clear pattern of the "school shift" effect on the overall level of segregation.

TABLE 7
SCHOOL "SHIFT" EFFECT FOR ALL AVAILABLE INDICATORS

	2004	2005	2006	2007	2008	2009	2010
Black Pupil	+12	+13	+10	+14	+14	+15	+15
Non White Pupil	+19	+06	+07	+07	-	+08	+08
Parents Education Below Elementary	+05	+05	+08	+04	+07	+05	+05
Parents Education Below Higher	+07	+12	+14	+15	+11	+11	+12
Income Cash Transfer	+19	+20	+17	+15	+15	+15	+15
Distortion 1+ years	+71	+41	+53	+44	+56	+44	+50
Distortion 2+ years	+38	+36	+35	+29	+32	+27	+33

Source: Municipal Educational Department of the City of Rio de Janeiro.

Nonetheless, the impact is not linear when comparing different indicators. It is possible to divide all seven indicators into three different groups considering the overall percentage increase in GS: 1) very low positive impact – parents' education and non-white pupils; 2) medium positive impact – poverty and black pupils; 3) high positive impact – Distortion 1 and 2.

The research design measures the net effect of the school "shift". In practical terms, it means that all other elements that can influence the overall segregation levels are being controlled in this model: parental choice, residential segregation, etc. That data suggest that the "shift" effect explains around 50% of the between-school segregation for Distortion 1. In theory, if there were no "school shifts", it would be

possible to reduce school segregation for all indicators, in some cases the reduction could be up to 50% of nominal values.

The next question is: Will the results show a similar pattern when the "shift" effect is calculated separately for pupils in the first segment (1st to 5th grade) and the second segment (6th to 9th grade)? Table 8 shows the figures for first segment pupils for all available indicators for the seven years (2004-2010). The patterns are somewhat different. It is possible to see that the effect of the school "shift" was reduced for parents' education, pupils' color (on-white and black) and poverty (cash transfer policies beneficiaries). It is still possible to see the effect of two-digit growth for black students in the last four years – the most reliable in the databases, with a relative percentage increase of 13% on overall segregation levels.

TABLE 8
"SCHOOL SHIFT" EFFECT FOR ALL AVAILABLE INDICATORS – 1ST SEGMENT PUPILS

	2004	2005	2006	2007	2008	2009	2010
Black Pupil	+09	+09	+09	+13	+13	+13	+13
Non White Pupil	+07	+07	+07	+07	+08	+08	-
Parents Education Below Elementary	+05	+05	+08	+04	+07	+05	+05
Parents Education Below Higher	-	+05	+05	+05	-	+05	-
Income Cash Transfer	+06	+06	+07	+03	+03	+06	+06
Distortion 1+ years	+131	+46	+62	+31	+50	+55	+100
Distortion 2+ years	+48	+32	+28	+16	+20	+16	+38

Source: Municipal Educational Department of the City of Rio de Janeiro.

The new calculations for age-grade distortion demonstrate that this variable presents the greatest relative increases. In relation to Distortion 1, the data show an average relative percentage increase of around 50%, with the real possibility of the effect doubling the overall level of school segregation. The impact of Distortion 2 is a bit smaller, but still relevant, being responsible for one third of the variation of school segregation. Comparing the results of Tables 7 and 8, it is possible to state that young pupils (generally those between ages 6-11) are being systematically tracked by their previous academic performance. Future studies should analyse this tracking at an individual level. Some questions that the data raises: Do schools deliberately change a pupil's "shift" based on his/her achievement? At what time during the schooling process does this type of tracking occur?

Table 9 presents the relative increase for all available indicators for pupils in the second segment (6th to 9th grade). Are the results similar to the patterns observed in the first segment? The answer is yes. Once again, comparing Table 9 and Table 7 it is possible to observe that a

large part of the variation in school "shifts" for parental education, colour and poverty indicators has disappeared. It is worth observing that in Table 8, GS for black pupils presents a relative two-digit increase for all years analysed.

TABLE 9
"SCHOOL SHIFT" EFFECT FOR ALL AVAILABLE INDICATORS - SECOND SEGMENT PUPILS

	2004	2005	2006	2007	2008	2009	2010
Black Pupil	+14	+11	+13	+11	+11	+12	+16
Non White Pupil	+17	+10	+13	+07	-	+09	+09
Parents Education Below Elementary	+08	+07	+06	+04	+07	+05	+05
Parents Education Below Higher	+06	+03	+09	+05	+06	+06	-
Income Cash Transfer	+36	+16	+09	+03	+06	+03	+03
Distortion 1+ years	+136	+92	+127	+100	+109	+73	+120
Distortion 2+ years	+96	+78	+87	+54	+68	+52	+80

Source: Municipal Educational Department of the City of Rio de Janeiro.

The age-grade distortion once again presented the biggest relative percentage increase for the impact of the school "shifts". However, the figures are even higher when compared to Table 8, which suggests that the tracking intensifies throughout education. It appears that the school system consistently tracks pupils based on educational progress. This might explain why all the other indicators still present a positive impact, though smaller. Despite the fact that there are no formal tracking policies, the results indicates systematic "informal tracking" for pupils who are held back.

All calculations so far failed to show where potentially disadvantaged pupils are more likely to be clustered: morning or afternoon "shift". Tables 8 and 9 only indicated that the distribution of disadvantaged pupils in school shifts is not equal. Interviews with school principals, teachers and families suggests that the morning "shift" usually concentrates pupils with desirable characteristics and the afternoon and the night "shift" has more "problem students" or those with learning difficulties (BRITO; COSTA, 2010). Table 10 shows a descriptive analysis with figures from the morning and afternoon "shifts" in year 2010. It becomes clear that the morning "shift" presents a lower proportion of disadvantaged pupils.

TABLE 10
PROPORTION OF DISADVANTAGED PUPILS ENROLLED IN EACH SHIFT – 2010

	Black	Parents Education Below Elementary	Income Cash Transfer	Distortion 1+ years	Distortion 2+ years
1st Segment Morning Shift	0.10	0.24	0.27	0.36	0.08
1st Segment Afternoon Shift	0.11	0.26	0.28	0.53	0.14
2nd Segment Morning Shift	0.11	0.20	0.28	0.54	0.22
2nd Segment Afternoon Shift	0.11	0.22	0.27	0.65	0.30

Source: Municipal Educational Department of the City of Rio de Janeiro.

Some questions should be raised based on the results above. What are the reasons for systematic tracking of lower performance students pedagogically articulated? What are the pedagogical reasons for this systematic tracking of pupils with lower attainment? What are the impacts of this policy on learning, future education aspirations and the standards of sociability developed by students? These are not new questions, but they are practically unaddressed in Brazil.

CONCLUSION

The unintentional impact of educational policies on school segregation levels is a relevant subject related to educational opportunities and social justice. There is solid evidence that suggests that school segregation can have deleterious effects, with a greater impact on the most disadvantaged pupils, especially on future educational aspirations, the quality of teaching, advanced education subsequent to the compulsory level and an increasing association between academic performance and socio-economic status (EGGRES, 2005). If these assumptions are correct, researchers and policy makers should be aware of the risks and potential "adverse effects" of any legislation that can potentially increase the overall school segregation levels.

The measurements presented in the study (with a total of 147) clearly show a pattern that indicates that the "shift policy" has an impact on the overall segregation levels. Comparing different indicators, it is possible to state that pupils are being systematically selected based on prior educational achievement, measured by the age-grade distortion variable. Not only are the values of GS for such variables higher, the shift-effect undergoes a greater increment in regards to these variables. There are two processes of segregation within the school system. The second, which was of particular interest in this study, refers to a process of segregation operating within the schools, given the differentiation between shifts. We can treat these two processes as a kind of two-stage segregation. The first is influenced by aspects of residential segregation,

parental choices, but also, in some measure, by selective mechanisms within the framework of the educational bureaucracy. The second stage, which we call net effect of allocation in shifts, or shift-effect, can be attributed almost exclusively to selective procedures within the schools, so widely controlled by the school bureaucracy.

Despite the lack of specific regulation for the allocation of pupils across "shifts", the regularity of the measurements suggests an intentional selection process. Of a total of 147 measures across seven years, 140 showed that the shift allocation increased overall segregation levels. As far as we know, this is the first study to analyze the impact of school shift allocation on an entire school system, the largest in the country at this level of instruction. Previous studies worked with a limited number of cases and with potential selection biases.

It is not possible to say, based on the models presented here, what the net effects of each factor on the process of segregation associated with the school shifts might be, since multivariate models were not applied to distinguish the relative weight of the age-grade distortion, colour, parental education and condition of poverty, in models with reciprocal controls. It is likely, including for its greater raw weight, that that distortion is the main factor. As we all know, school systems traditionally arrange students by age, which means the chances of increased segregation grows with grade progression and as students get older. Being held back would act as a kind of summary of segregation factors. So, it is no surprise that increasing segregation for Distortion will be greater in the second segment. After all, these are students with a greater chance of presenting age-grade distortion, with the phenomenon manifesting itself more intensely.

The reduction in indicators of segregation from the first to the second segment is due to a strictly statistical effect: a sudden reduction in the number of schools that offer second segment, increasing the chances of making schools more mixed (less segregation). The opposite effect can be observed when students are allocated into different shifts. In this situation, it is very likely that segregation levels will rise. However, data indicated that the effect for some variables were higher, suggesting an intentional selection process.

Our intention was to draw attention to the need for open discussion, not just sociologically, but pedagogically, about the phenomenon of student allocation into this kind of identified informal tracking by school shifts. It is recognized that the allocation of students into classes by ability is a worldwide practice and is likely supported by solid pedagogical reasons. However, the distribution between shifts seem cloaked by other aspects, since it may be associated with creation of strongly differentiated school environments in ways that seem most relevant to the facilitation of learning and the development

of other desirable skills in school, embodied in "school climate". The question is: does classifying and designating students with recognized potential disadvantage into separate school environments – such as the shifts – contribute to accentuating reproductive characteristics of the educational system, by means of self-fulfilling prophecies?

Our ongoing studies aim to scrutinize the effects of this type of organization on academic performance of students, seeking to contribute to the discussion inaugurated by school effectiveness studies, which call for conciliation between quality and equity.

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