Graduation Tables: a proposal for projecting educational indicators in Brazil

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1. Introduction

In spite of the great concern in diagnosing the levels of education in a variety of countries and regions, especially in underdeveloped areas, academic studies still need to develop appropriated methods to deal with demographic data. Moreover, in areas characterized by social, economic and regional inequalities the search for disaggregated information is particularly recurrent.

In Brazil, a promising field of studies has been attempted with the use of the so-called PROFLUXO Model, developed by Fletcher and Fletcher and Ribeiro[1]. This model is a class of the well-known "Transition Rate Models", elaborated by UNESCO, in which the enrollments in a given year are related to the enrollments of the previous grades of the previous year. The transition rates describe the move of the students between grades year to year.

One of the greatest advantages of the PROFLUXO is that:

> "Based upon age and grade declarations, together with optional classificatory variables (sex, region, income group, etc.), the model can be applied to virtually any census or large scale sample survey in any country in any year" (Fletcher and Ribbeiro, 1989).

In summary, PROFLUXO is basically used to create a grade transition matrix, with coefficients describing age-specific intake, promotion, repetition, and dropout in each grade.

PROFLUXO Model will not be described in detail, because we are not concerned in calculating the transition rates (promotion, repetition and dropout). One of the reason is the PROFLUXO assumption of stability of the educational system, which does not hold anymore in Brazil and many Latin America countries, since the 90's – certainly it is also true for many other underdeveloped regions. However, we will take into account the idea of considering a curve describing the graduation by age and grade. This will be the basis for a more detailed study of a series of educational indicators. The concepts developed in this article search for alternatives to the study of demand for and the levels of schooling in Brazil, in spite of being applicable in any country or region that have age

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[1] FLETCHER, P.R. *A mathematical model of school trajectory, repetition and performance of first level schooling in Brazil* (Brasília, DF: CNRH, 1985).

FLETCHER, P. R. and RIBEIRO, S. C. Modeling Education System Performance with Demographic Data: an introduction to the Profluxo Model. 1989.

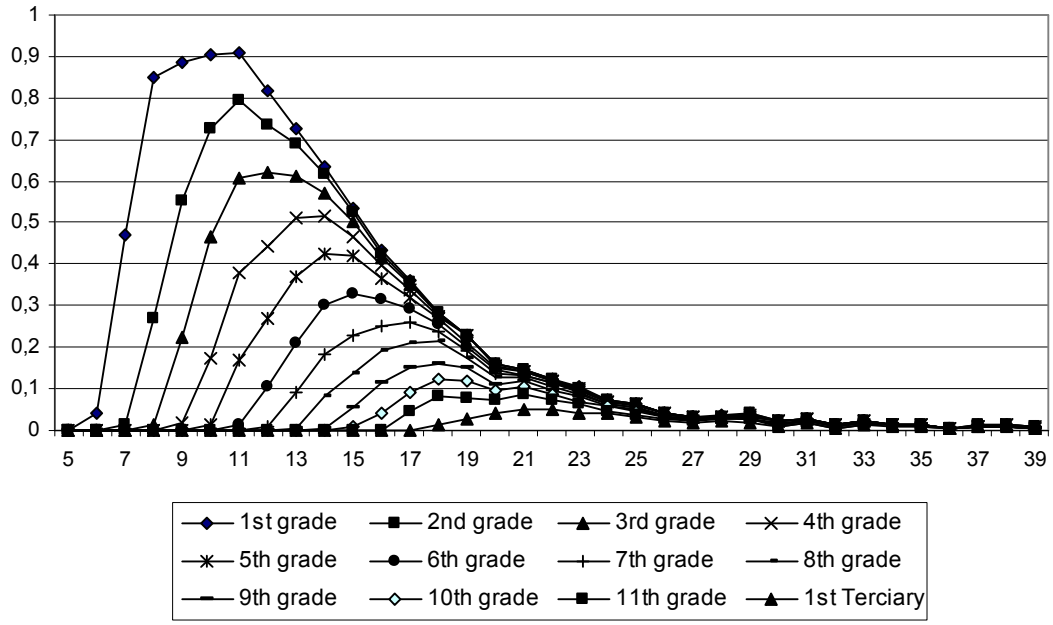
and grade information. Thus, the paper principal aim is to suggest some techniques of demographic analysis for the diagnostic and prognostic of the Brazilian schooling.

For each of the 11 grades of Brazilian basic education, it is necessary to select the individuals of a given age enrolled in a specific grade as well as people of the same age having left school after concluding at least that grade. The frequencies of individuals by age having passed a given grade are accumulated with the previous grades – the people who graduated in a grade must be graduated in all the previous grades[2]. Then, we will obtain all the individuals having passed the grade. In other words, students in the grade i+*1*, who completed the grade *i*, are added to all those having concluded their studies up to grade *i*.

For example, Figure 1 represents the frequency of graduated people attending school in each grade, for the case of Minas Gerais, a populous Brazilian State, in 1982.

Figure 1

Minas Gerais - Graduation frequency of people who attend school, by single year of age and grade - 1982



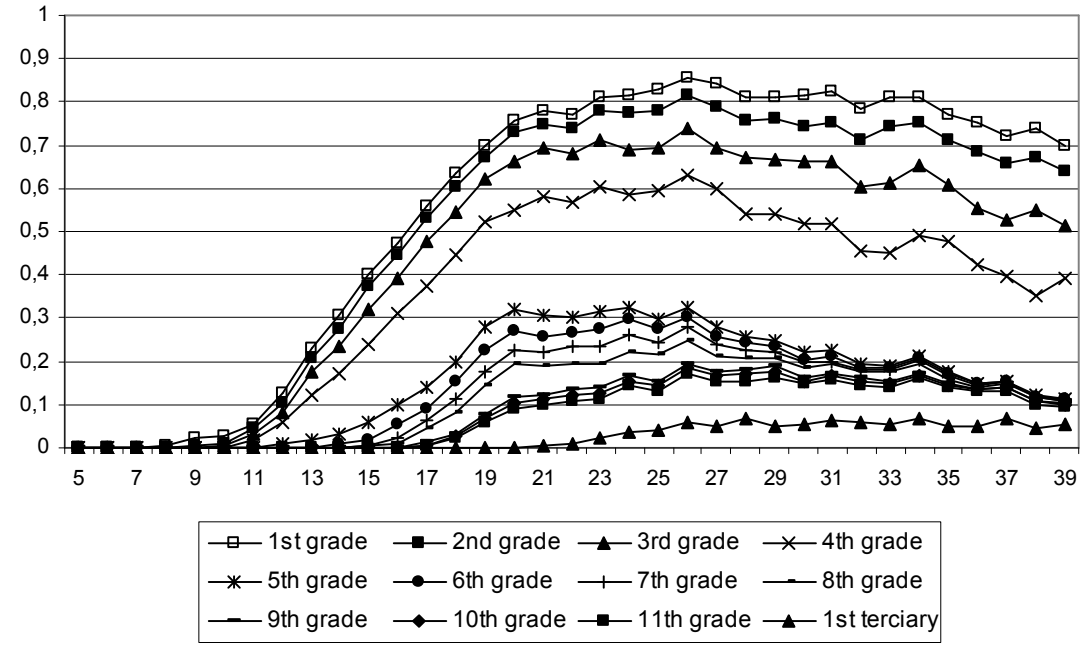
Source: IBGE, Pesquisa Nacional por Amostra de Domicílios, 1982.

[2] One grade completed corresponds to one year of schooling.

In the Figure 2 we have the proportion of graduated people who have left school, in each grade and single year of age.

Figure 2

Minas Gerais - Proportion of graduated people who do not attend school, by single year of age and grade - 1982



Source: IBGE, Pesquisa Nacional por Amostra de Domicílios, 1982.

The merge of both proportions results in all the people ever-graduated by grade, as shown in the Fig. 3.

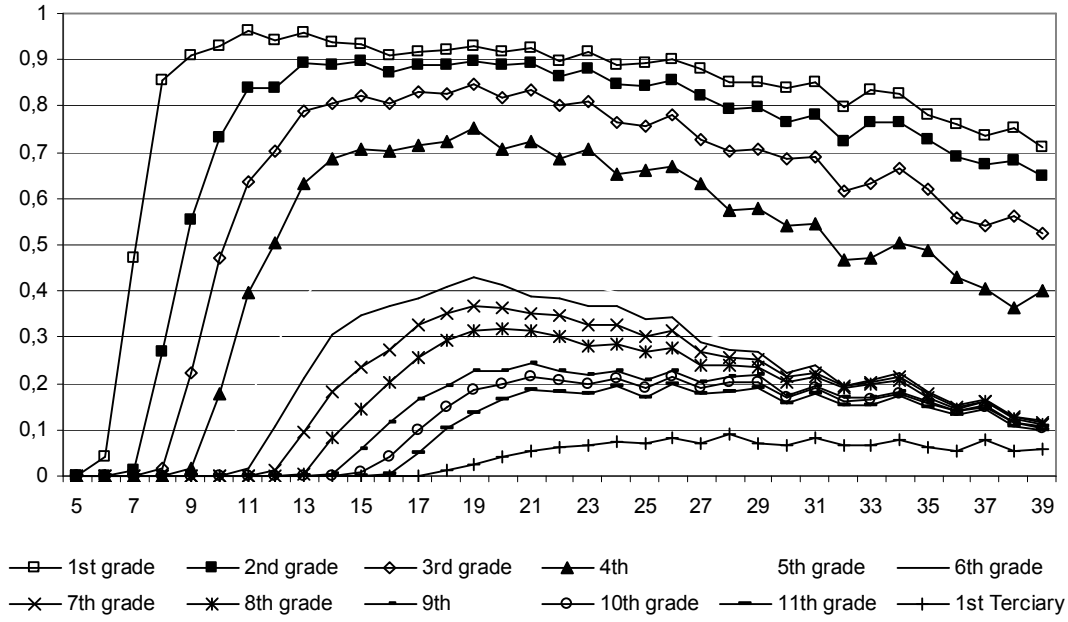
The vertical axes of the curve in Fig. 3 represents the level of graduation in each grade, rising from an initial age up to a maximum, where the proportion begins a steadily decrease. This happens because the curve is assembling several cohorts, and also reflecting the experience of schooling in the past, when the coverage of the educational system was much lower. If we can not interpret this performance as cohort experience – the students will not lose education already attained –, we can take advantage of the known similarities in the age patterns of the proportion ever-graduated among Brazilian regions. Despite the social, economic and regional inequalities, Rigotti (2001)[3] observed that the Brazilian regions have clear age patterns in terms of graduation by grades. The differences are due the age of access in a grade and level of graduations. Thus, this paper follows in the tradition of many demographic studies that search for empirical

[3] RIGOTTI, J. I. R. A transição da escolaridade no Brasil e as desigualdades regionais. **Revista Brasileira de Estudos Populacionais**. ABEP, Campinas, v.18, n.1/2, 2001, p.59-73.

regularities, particularly in the age patterns, as mortality, fertility, migration or marriage (Coale and Trussel, 1996)[4]. Indeed, we have noticed the similarity between the proportions ever-married studied by Coale (1971)[5] and the proportion ever-graduated focused in this paper.

Figure 3

Minas Gerais - Proportion of people ever-graduated, by single year of age and grade - 1982



We will take into account the proportion of people ever-graduated in each grade of the basic level – eight years for the primary school and three years for the secondary school. In other words, it will be considered a hypothetical cohort[6], without differences in the selectivity of migration and mortality by level of schooling.

The model in the next section can be considered a Graduation Table, in which each function corresponds to a step implemented on the software under construction specifically for this purpose. In the following section, the methodology will be applied to

[4] COALE, A., TRUSSELL, J. The development and use of demographic models. *Population Studies*, Vol. 50, No. 3, Nov., 1996, pp. 469-484.

[5] COALE, A. Age Patterns of Marriage. **Population Studies**, Vol. 25, No. 2, july, 1971, pp. 193-214.

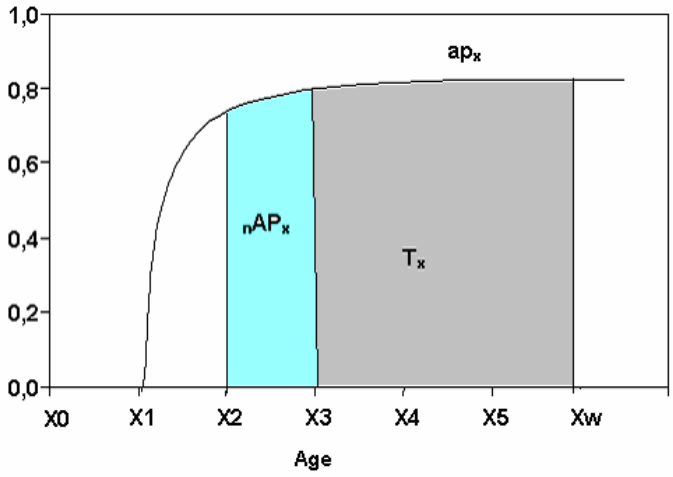
[6] In a census period, several cohorts constitute the population. As we say “hypothetical cohort”, we are ignoring differentials in mortality or migration. On the other hand, the effect of the population growth is eliminated through normalization, dividing the number of graduated people in a given age over the population of the same age.

the five Brazilian Regions, even though it could be replicated in any country or region that contains declarations about grades completed and age.

2. *Functions of the model "Graduation Table"*

The age frequency distribution of people who have graduated from a given grade can be transformed into proportions, as showed in the previous section. The proportion of people ever-graduated will be called ***the graduation rate***, $\boldsymbol{ap}_x$, plotted in Fig. 4.

Figure 4 - Functions of the Graduation Table



Thus, the first function is the graduate rate itself. Next, we will describe each function that will estimate some educational indicators of the Brazilian population.

The first step is smoothing or fitting a curve that represents the proportion of an age group that has *passed* a given grade[7], **the graduation rate,** $\boldsymbol{ap}_x$. Age-grade proportions represent the cumulative frequency distribution for graduated people by age and grade in a cohort. For cross-section data many cohorts are put together, reflecting their particular experiences of promotion, repetition and drop-out. Thus, according to Figure 4, in a hypothetical cohort $\boldsymbol{ap}_x$ equals the number of graduated people of exact age *x* who completed grade *i* (there is a function for each of the 8 grades of Elementary School and 3 grades in the Secondary Education in Brazil). The sequence of points $\boldsymbol{ap}_x$ rises to a maximum, representing the flow of students passing grade *i*. After this point, the curve continues constant, i.e. there is no new graduation. In a curve directly observed from the census, after the maximum, the line falls down, because it expresses older cohorts who obtained their schooling in past years.

[7] The expression "having passed a given grade" means "graduating from a grade" and denotes those who have successfully completed a grade.

The second step is calculating $\boldsymbol{a_x}$, the probability of graduating from age *x* to age *x+n*:

$$a_x = \frac{ap_{x+1} - ap_x}{1 - ap_x}.$$

The third step is calculating person-years graduated between age *x* to age *x+n* ($_nAP_x$) – see Fig. 4. In a hypothetical cohort it can be interpreted as the number of years lived as graduated for a person with at least *i* years of schooling (each given grade corresponds to one year of schooling):

$_{\mathrm{n}}\mathrm{AP}_{\mathrm{x}} = \int_{x}^{x+n} \mathrm{ap}_{\mathrm{x}}\mathrm{a}\, da$, being "*a*" variable of integration to differentiating it from *x*.

The fourth step is calculating the number of years lived as graduated in a given grade *i* from age *x* to *w* (*w* should be any age after the rising of the proportions in the $\boldsymbol{ap}_x$ curve for the last grade):

$\mathrm{T}_{\mathrm{x}} = \int_{x}^{x=w} \mathrm{APa}\, da$, being "*a*" variable of integration to differentiating it from *x*.

The fifth step is calculating the expectation of years lived with at least a given grade *i*, from age *x'* (appropriated for the grade) to age *w*: [8]

$e_x^i = \frac{T_x}{l_0}$, being x ≥ x'.

Actually l_0 depends on the vertical scale adopted, in this case equals one.

The sixth step is calculating the Gap, $\mathbf{G_x}$, in years lived as graduated, or the years of schooling lost from a given age *x*.

[8] Actually it depends on the vertical scale, in this case equals one. Hence, the number of years lived with at least the grade *i*, from the ideal age x' equals 1*(w-x'). The ideal age for being graduated is 8 years old for the first grade, 9 years old for the second grade and so on.

Being $\overline{T}$ = l_0 *(w - x + 1)* the ideal number of years of schooling a cohort should pass from age x (appropriated to grade *i*) to age *w*, thus:

$$G_x^i = \frac{\overline{T}}{l_0} - e_x^i = \overline{e}_x^i - e_x^i$$

Where $\overline{e}_x^i$ equals expectation of ideal years of schooling with at least grade *i* completed.

These procedures must be repeated for all 11 grades of Basic Education of five Regions in Brazil.

The seventh step is calculating the average of grades completed (or years of schooling) by the hypothetical cohort from age x' to w (NGC):

a) $NGC_{EE} = \sum_{i=1}^{8}\left[\sum_{x=x'}^{w}\left(e_x^i / w-x\right)\Big/\left(w-x'\right)\right]$ (Elementary Education)

b) $NGC_{SE} = \sum_{i=9}^{11}\left[\sum_{x=x'}^{w}\left(e_x^i / w-x\right)\Big/\left(w-x'\right)\right]$ (Secondary Education)

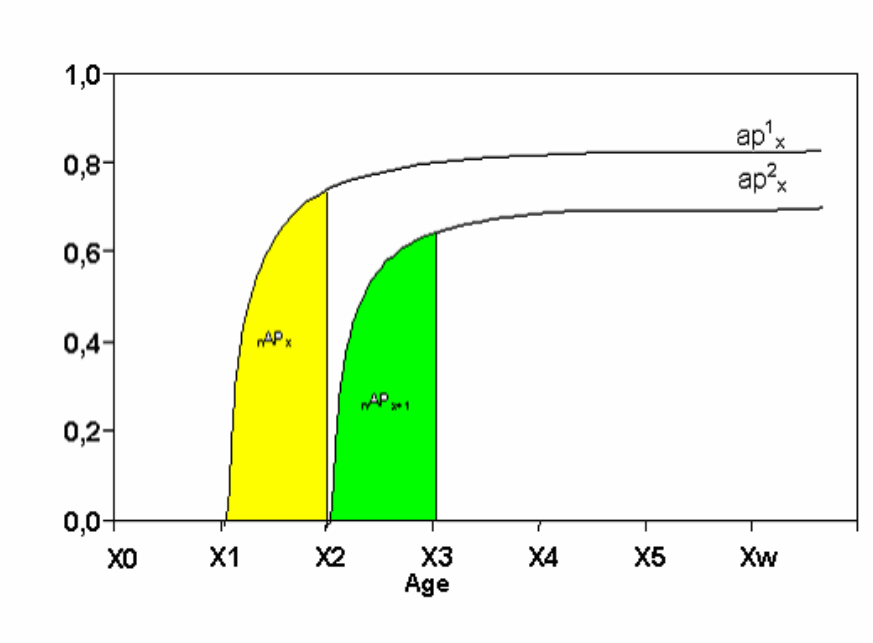
c) $NGC_{BE} = \sum_{i=1}^{11}\left[\sum_{x=x'}^{w}\left(e_x^i / w-x\right)\Big/\left(w-x'\right)\right]$ (All Basic Education)

Where *i* corresponds to the grades and *x'* is the appropriated age for that grade.

The eighth step is calculating the probability of graduation from age *x* to age *x+n*, in a given grade *i*, the Graduation Ratio ($_n$**RA$_{x,x+n}$**) – Figure 5.

$$_{n}RA_{x,x+n} = \frac{_{n}AP_{x+n}^{i+n}}{_{n}AP_{x}^{i}}$$

Figure 5 - Graduation Ratio

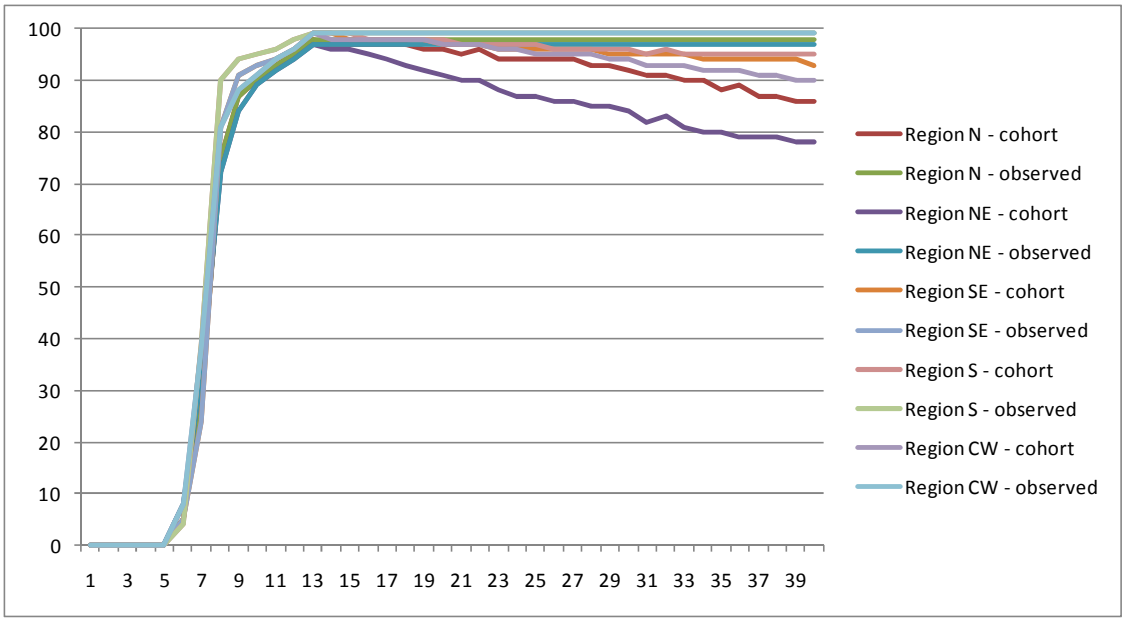


The ideal situation to be reached by the education system is when the areas under the two consecutives curves equal 1 (one), that is, all the people would be graduated in both grades. From now on, we will undertake an analysis to assess how far the five Great Regions of Brazil are of the ideal educational indicators.

3. Demographic and regional analysis of the Brazilian schooling in 2000

The next curves show, for the five Brazilian regions, the improvement in attendance of the educational system during decades. The observed curves rise to a maximum and then decline with the advancing age. After the maximum they represent the graduation of past years, when the older age cohorts completed their schooling. Graduation rates are increasing over time - younger generations present much higher promotion, showing the changes of the educational system, as the increase of coverage and the decline of repetition.

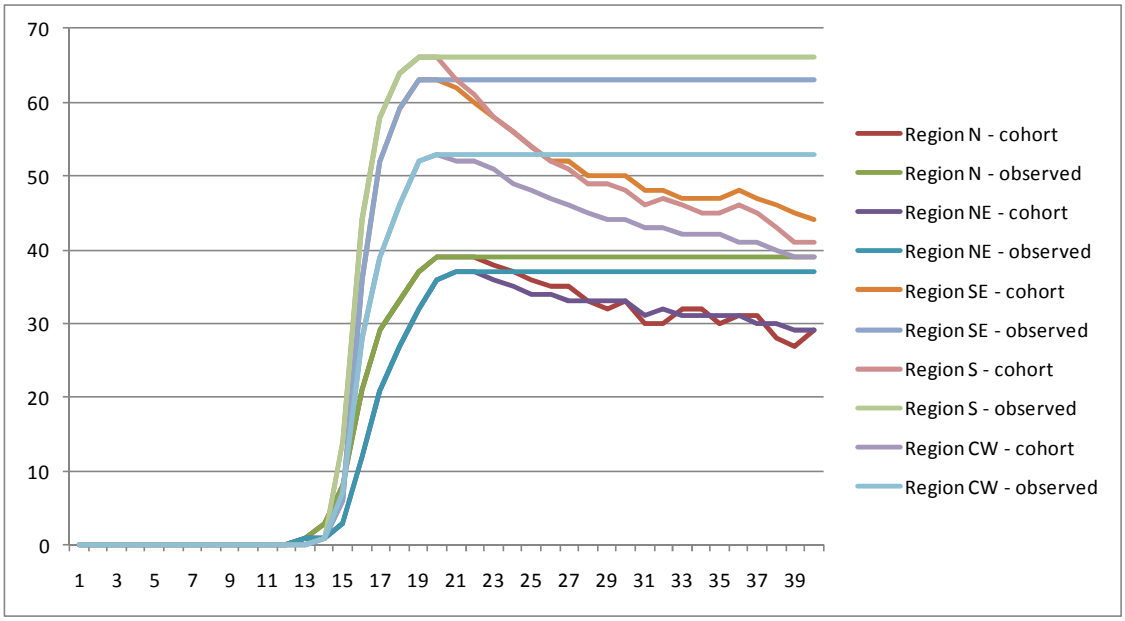
Figure 6 - Curves of the graduation rates of the grade one, by age and Brazilian regions, 2000.



The more advanced the grades, the larger will be the gap between the line corresponding to a hypothetical cohort and the line related to the observed population in the Brazilian Demographic Census of 2000. It is noticeable that in the first grades less developed regions have larger distances between the two curves, as North and Northeast (Figures 6). This occurs because poor areas had much lower coverage, as well higher repetition.

On the other hand, more developed regions, like South and Southeast, present larger distances between the observed and hypothetical curves in the higher grades, indicating a faster increase in graduation, particularly for the secondary education. Two factors concur for this situation: the slow increase of the graduation rate in regions like Northeast and North, as well higher repetition in those areas. Actually we cannot say that the graduation rates are satisfactory even in the South, because there less than 70% of a cohort completes the ninth grade (the first grade of secondary school) - Figure 7.

Figure 7 - Curves of the graduation rates of the grade nine, by age and Brazilian regions, 2000.



In spite of the dramatic low coverage in poor regions, as well the immense necessary effort to improve the levels of promotion in the higher grades, as the increase of the graduation rates in the higher grades is occurring precisely in the more developed regions, a first conclusion is that regional inequalities tend to continue in the future.

The curves representing the hypothetical cohorts also permit to infer that higher dropout occurs in less developed regions. Table 1 depicts the maximum graduation rates for the five Brazilian regions, in the first, fifth, ninth and eleventh grades.

Table 1 - Maximum graduation rates in grades one, five, nine and eleven. Brazilian regions, 2000.

Grade	N	NE	SE	S	CW
1	98	97	99	99	99
5	85	70	91	94	89
9	39	37	63	66	53
11	25	25	45	46	36

At the first grade, Brazil practically has guaranteed universal coverage, since the proportion of graduated arrived at 97% in Northeast - the worst rate in 2000. Unfortunately, the country has demonstrated not being capable of ensure the school for everybody up to the end of the basic level. Indeed, at the fifth grade the graduation rate drop to 94% in the South (the best performance) and 91% in the Southeast, near followed by the Center-West with 89%. North and Northeast present rates of 85% and 70%, respectively.

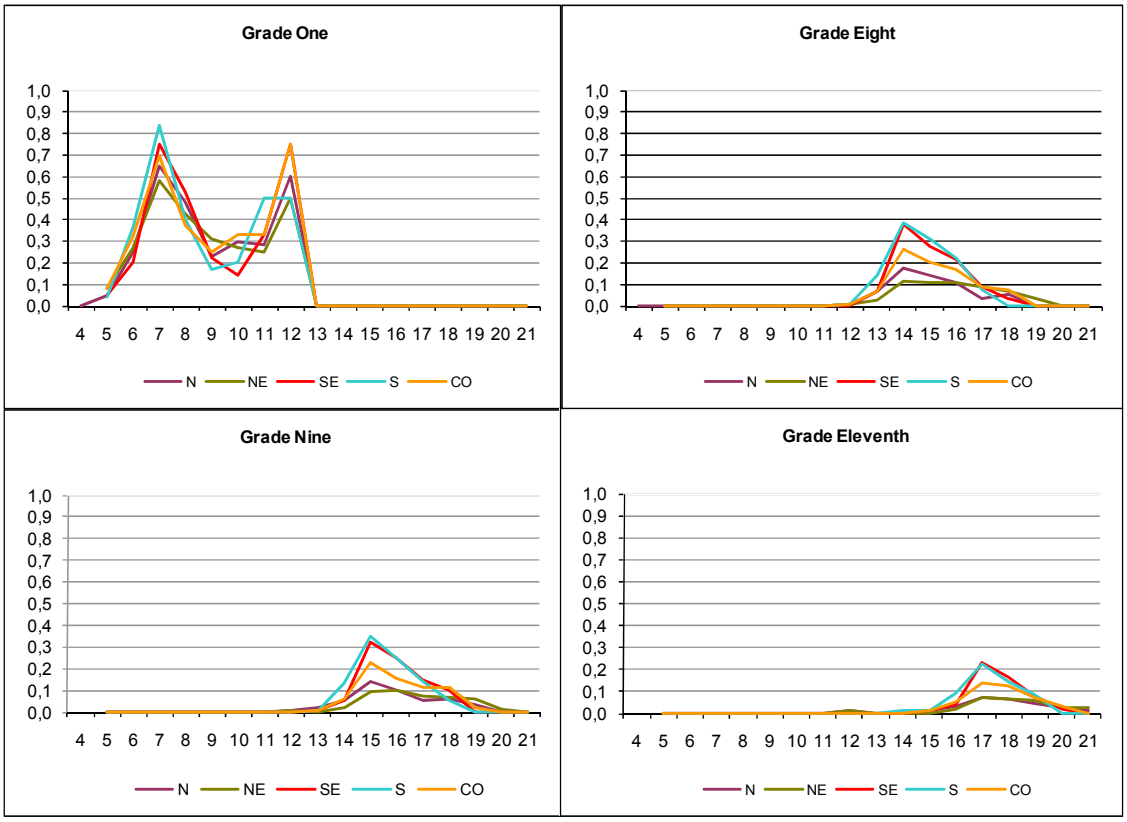
The situation worsens as the grades progresses. At the ninth grade the rates fall deeply, but vary across the regions. Again, the lowest levels take place in the Northeast and the North, where the rates do not exceed 40%. An intermediary rate is found in Center-West, while the higher levels occur in the South and Southeast, even though they do not surpass 70%.

In 2000, only a quarter of a cohort was able to conclude the basic level in the Northeast and North. The graduation rate of the eleventh grade in the Center-West did not exceed 36%, and the more developed regions, South and Southeast presented 46% and 45%, respectively. In other words, at the beginning of the new century neither half of the Brazilian population concluded the basic education. The situation is aggravated by the fact that the regional inequalities tend to be deeper, as indicated by the faster increase of the levels of graduation at higher grades in more developed regions.

Another aspect of all the grades and regions considered refers to the age when the maximum of the graduation is reached. The lower is the rate, the greater the age. This indicates a greater age-grade mismatch.

Now, we evaluate some other results of our model. For ease of comprehension we will focus the next analysis at the beginning (grade one) and in the end of the primary education (grade eight) as well as of the secondary education (grades nine and eleven, respectively).

Figure 8 - Probability of graduating in grades one, eight, nine and eleven, by age and Brazilian regions, 2000.



The indicators of the graduation tables reinforce the problems of the Brazilian educational system and the regional inequalities. Ideally the probability of graduation, $\boldsymbol{a_x}$, should be near 100%, when the age is that appropriated for concluding a given grade. As Fig.6 shows, in grade one the probability of a child to be graduated from age seven to eight is 84% in the South, the highest of all Brazilian regions. On the other hand, the Northeast is the region with the lowest probability, less than 70%. Between these two indicators the values follow the order comment previously for the graduation rate: Southeast (75%), Center-West (69%), and North (65%).

It also can be observed that the a_x curve is bimodal in grade one, i.e. after the age seven there is another peak in the age twelve. Therefore, despite the repetition, a minority continues studying until concluding the grade. It is interesting to observe that this pattern repeat for all Brazilian regions, which suggest a considerable effort to avoid a drop out at the school. It is probably that the students of around twelve years old entered in the school before the educational polices to ameliorate the high Brazilian repetition rates. Thus, they were stimulated to continue at school to pass the first grade even though later. The same pattern repeats to grade two and grade three, although these cases were not showed in figure 6.

Unfortunately, after a few grades the repetition has the perverse characteristic of promoting a kind of "survival of the strongest" – i.e. the one who failed to pass the grade dropout the school. The second chart in the Figure 6 represents this phenomenon. In grade eight we can see a more appropriate age-grade relationship. The modal age is twelve years old, the correct one, but the levels of a_x curves are far from ideal, since even in the South and Southeast the probability does not exceed 40%, while in the Northeast the value is little more than 10%.

The situation becomes more dramatic once we move forward in the series. The range in grade eleven varies between 7% (Northeast) and 22% (South and Southeast). Once more, Center-West obtains an intermediary situation, i.e. 18%. Besides the very low probabilities, we also observe a considerable delay in concluding grade eleven in regions North and Northeast, where the curve is much more flat. In short, if the educational system does not improve its transition from grade to grade less than a fifth of a cohort will conclude the basic education in Brazil as a whole.

The results of the dropout for the first and the last grade of the Basic Education can be seen from the tables 2 and 3, where we only show the region with the worst indicators contrasting with one of the better regions.

Table 2 - Functions of the Graduation Tables, First Grade (Elementary Education). South and Northeast Regions, Brazil, 2000.

South - 1st Grade							Northeast - 1st Grade						
Age	a_x	$_1APx$	Tx	$\bar{T}x$	e_x	G_x	Age	a_x	$_1APx$	Tx	$\bar{T}x$	e_x	G_x
7	0,84	92,0	3249,5	3300	-	-	7	0,58	78,0	3159,5	3300	-	-
8	0,40	94,5	3157,5	3200	31,58	0,43	8	0,43	86,5	3081,5	3200	30,82	1,19
9	0,17	95,5	3063,0	3100	30,63	0,37	9	0,31	90,5	2995,0	3100	29,95	1,05
10	0,20	97,0	2967,5	3000	29,68	0,32	10	0,27	93,0	2904,5	3000	29,05	0,95
11	0,50	98,5	2870,5	2900	28,71	0,30	11	0,25	95,5	2811,5	2900	28,12	0,89
12	0,50	99,0	2772,0	2800	27,72	0,28	12	0,50	97,0	2716,0	2800	27,16	0,84
13	0,00	99,0	2673,0	2700	26,73	0,27	13	0,00	97,0	2619,0	2700	26,19	0,81
14	0,00	99,0	2574,0	2600	25,74	0,26	14	0,00	97,0	2522,0	2600	25,22	0,78
15	0,00	99,0	2475,0	2500	24,75	0,25	15	0,00	97,0	2425,0	2500	24,25	0,75
16	0,00	99,0	2376,0	2400	23,76	0,24	16	0,00	97,0	2328,0	2400	23,28	0,72
17	0,00	99,0	2277,0	2300	22,77	0,23	17	0,00	97,0	2231,0	2300	22,31	0,69
18	0,00	99,0	2178,0	2200	21,78	0,22	18	0,00	97,0	2134,0	2200	21,34	0,66
19	0,00	99,0	2079,0	2100	20,79	0,21	19	0,00	97,0	2037,0	2100	20,37	0,63
20	0,00	99,0	1980,0	2000	19,80	0,20	20	0,00	97,0	1940,0	2000	19,40	0,60
21	0,00	99,0	1881,0	1900	18,81	0,19	21	0,00	97,0	1843,0	1900	18,43	0,57
22	0,00	99,0	1782,0	1800	17,82	0,18	22	0,00	97,0	1746,0	1800	17,46	0,54
23	0,00	99,0	1683,0	1700	16,83	0,17	23	0,00	97,0	1649,0	1700	16,49	0,51
24	0,00	99,0	1584,0	1600	15,84	0,16	24	0,00	97,0	1552,0	1600	15,52	0,48
25	0,00	99,0	1485,0	1500	14,85	0,15	25	0,00	97,0	1455,0	1500	14,55	0,45
26	0,00	99,0	1386,0	1400	13,86	0,14	26	0,00	97,0	1358,0	1400	13,58	0,42
27	0,00	99,0	1287,0	1300	12,87	0,13	27	0,00	97,0	1261,0	1300	12,61	0,39
28	0,00	99,0	1188,0	1200	11,88	0,12	28	0,00	97,0	1164,0	1200	11,64	0,36
29	0,00	99,0	1089,0	1100	10,89	0,11	29	0,00	97,0	1067,0	1100	10,67	0,33
30	0,00	99,0	990,0	1000	9,90	0,10	30	0,00	97,0	970,0	1000	9,70	0,30
31	0,00	99,0	891,0	900	8,91	0,09	31	0,00	97,0	873,0	900	8,73	0,27
32	0,00	99,0	792,0	800	7,92	0,08	32	0,00	97,0	776,0	800	7,76	0,24
33	0,00	99,0	693,0	700	6,93	0,07	33	0,00	97,0	679,0	700	6,79	0,21
34	0,00	99,0	594,0	600	5,94	0,06	34	0,00	97,0	582,0	600	5,82	0,18
35	0,00	99,0	495,0	500	4,95	0,05	35	0,00	97,0	485,0	500	4,85	0,15
36	0,00	99,0	396,0	400	3,96	0,04	36	0,00	97,0	388,0	400	3,88	0,12
37	0,00	99,0	297,0	300	2,97	0,03	37	0,00	97,0	291,0	300	2,91	0,09
38	0,00	99,0	198,0	200	1,98	0,02	38	0,00	97,0	194,0	200	1,94	0,06
39	0,00	99,0	99,0	100	0,99	0,01	39	0,00	97,0	97,0	100	0,97	0,03

The functions e_x indicate that in the South the expectation of years lived with at least the first grade, from age 8 to 40 is close to the ideal, 31.6 years out of 32 years (Table 1). Although with an expectation of 30.8 years, the Northeast demonstrates that almost everyone is graduating in the first grade.

However, the table 3 of the Fig. 8 shows how the Brazilian educational system is far from suitable. In the South there are lots of people who do not complete the Basic Education. The function $\mathbf{G_x}$ indicates that a cohort loses more than half of the number of years which should be lived as graduated in grade eleven (or with the complete basic level). In other words, from the appropriated age to be graduated in grade eleven, i.e. eighteen years old, a person should live 22 years as graduated on average, but she/he will live just 10.1 years - a loss of 11.9 years.

If this will happen in the region with the better educational indicators, in the Northeast the population lives only a quarter of your potential educational life with the Secondary Education completed. From eighteen years old a person tends to live 5.4 years as graduated in grade eleven, losing 16.6 years.

Table 3 - Functions of the Graduation Tables, First Grade (Elementary Education). South and Northeast Regions, Brazil, 2000.

South - 11th Grade							Northeast - 11th Grade						
Age	a_x	$_1APx$	Tx	$\overline{Tx}$	e_x	G_x	Age	a_x	$_1APx$	Tx	$\overline{Tx}$	e_x	G_x
16	0,09	21,0	1073,0	2400	-	-	16	0,02	6,5	561,0	2400	-	-
17	0,22	36,0	1066,5	2300	-	-	17	0,07	13,0	559,0	2300	-	-
18	0,14	43,5	1045,5	2200	10,10	11,91	18	0,07	18,5	552,5	2200	5,40	16,61
19	0,08	46,0	1009,5	2100	9,66	11,34	19	0,06	22,0	539,5	2100	5,21	15,79
20	0,00	46,0	966,0	2000	9,20	10,80	20	0,03	24,0	521,0	2000	4,99	15,01
21	0,00	46,0	920,0	1900	8,74	10,26	21	0,03	25,0	499,0	1900	4,75	14,25
22	0,00	46,0	874,0	1800	8,28	9,72	22	0,00	25,0	475,0	1800	4,50	13,50
23	0,00	46,0	828,0	1700	7,82	9,18	23	0,00	25,0	450,0	1700	4,25	12,75
24	0,00	46,0	782,0	1600	7,36	8,64	24	0,00	25,0	425,0	1600	4,00	12,00
25	0,00	46,0	736,0	1500	6,90	8,10	25	0,00	25,0	400,0	1500	3,75	11,25
26	0,00	46,0	690,0	1400	6,44	7,56	26	0,00	25,0	375,0	1400	3,50	10,50
27	0,00	46,0	644,0	1300	5,98	7,02	27	0,00	25,0	350,0	1300	3,25	9,75
28	0,00	46,0	598,0	1200	5,52	6,48	28	0,00	25,0	325,0	1200	3,00	9,00
29	0,00	46,0	552,0	1100	5,06	5,94	29	0,00	25,0	300,0	1100	2,75	8,25
30	0,00	46,0	506,0	1000	4,60	5,40	30	0,00	25,0	275,0	1000	2,50	7,50
31	0,00	46,0	460,0	900	4,14	4,86	31	0,00	25,0	250,0	900	2,25	6,75
32	0,00	46,0	414,0	800	3,68	4,32	32	0,00	25,0	225,0	800	2,00	6,00
33	0,00	46,0	368,0	700	3,22	3,78	33	0,00	25,0	200,0	700	1,75	5,25
34	0,00	46,0	322,0	600	2,76	3,24	34	0,00	25,0	175,0	600	1,50	4,50
35	0,00	46,0	276,0	500	2,30	2,70	35	0,00	25,0	150,0	500	1,25	3,75
36	0,00	46,0	230,0	400	1,84	2,16	36	0,00	25,0	125,0	400	1,00	3,00
37	0,00	46,0	184,0	300	1,38	1,62	37	0,00	25,0	100,0	300	0,75	2,25
38	0,00	46,0	138,0	200	0,92	1,08	38	0,00	25,0	75,0	200	0,50	1,50
39	0,00	46,0	92,0	100	0,46	0,54	39	0,00	25,0	50,0	100	0,25	0,75

Table 4 shows how perverse the final results of the dropout and the regional inequalities are. Once kept the same current conditions of the Brazilian educational system, the population of the more developed regions, South and Southeast, will barely reach nine grades completed out of eleven - 8.86 and 8.75, respectively. When we disaggregate these numbers by level of schooling, on average the population tends to complete a little more than 7 grades of the Elementary Education and less than 1.7 grades of the Secondary Education, in both regions.

Table 4 - Number of grades completed, by Regions, Brazil, 2000.

NGC	N	NE	SE	S	CW
Elementary Education	6,37	5,82	7,14	7,20	6,86
Secondary Education	0,94	0,92	1,61	1,66	1,32
All Basic Education	7,31	6,74	8,75	8,86	8,18

Whereas the population of Center-West only just concludes the Elementary Education, the Northeast and the North do not accomplish this level of schooling. On average, the residents of these two less developed regions are not able to conclude neither one year of study of the Secondary Education.

The previous indicators of the Brazilian educational system allow us to forecast the proportion of a cohort which will achieve the next grades, given the person-years graduated in an age group (Table 5). In Northeast, after the maximum of graduation in

grade one at the age 12, only 45% accomplish the last grade of the Elementary Education at age 19. Once more, this pattern is almost the same in the North, although in this case the graduation ratio for passing from grade one to grade eight is a little higher than in the Northeast; and the contrary happens with the chance of passing from grade eight to eleven.

Table 5 - Graduation ratios from grade one to Grade eight and grade eight to grade eleven, the Brazilian Regions, 2000.

RA	N	NE	SE	S	CW
${}_{8}RA_{12,19}$	0,48	0,45	0,72	0,75	0,63
${}_{11}RA_{19,22}$	0,53	0,57	0,63	0,62	0,58

As all other indicators comment, the South region had a higher chance of being promoted in the last grade of the Elementary Education, given that the person had been graduated in the first one (75%). On the contrary, Southeast region presented a little higher chance of getting a promotion in grade eight and concluding the Secondary Education (63%). The Center-West had an intermediary situation.

4. Concluding Remarks

Age-grade matrixes are relatively common in many demographic censuses, as well as large scale sample surveys. These are precious information for undertaken studies focusing the educational system. Despite the richness of possibilities, it is necessary explicitly to recognize that some assumptions do not hold any more for contemporary experiences, as the transformations in the transitions of students from grade to grade. This is precisely the Brazilian case, where educational policies are trying to overcome the very high repetition rates, since the mid 90's.

From a methodological point of view, the instability of the Brazilian educational system ask for new approaches taking into account the impossibility of considering it stable. On the other hand, the advances of demographical techniques in fields like mortality, fertility or marriage were not followed by the educational studies. Our paper makes an effort to contribute for shedding lights to this matter, maybe the most important issue in less developed and extremely unequal countries like Brazil.

Although we did not have focused in the critical problem of the quality of the Brazilian educational system, the indicators proposed showed how far the country is of the social justice in terms of schooling. In the less developed regions, the intake at school is delayed, condemning many young students to start in disadvantage. Besides the efforts to beat the repetition and public policies to transfer income - to a certain extent successful - Brazil is ahead of a long way to run. The dropout is still very high and achieve the most advanced grades is a privilege for few.

We used the information from Brazilian census of 2000, almost a decade ago. Some changes are on the way but recent research reveal that the school, particularly the Secondary Education, is far from interesting for Brazilian youngsters. Unquestionably,

the dropout is a strong obstacle to be defeated. As the indicators of our model showed, the regional inequalities need to be taken into account, urgently and seriously. Indeed, the increase in coverage and the progress among grades occurs faster in the more developed regions. Moreover, the chances to conclude the Secondary Education, given that a person has passed previous grades, are lower in poor regions, particularly in the North. This is a perverse reflex of the inequalities in Brazil.

Finally, a few words should be said about our model. Like a new technique, it needs a series of refinements, especially to deal with the less populated geographical units. Attempts to smoothing or fitting the curves of the graduation rate are under construction and it will be implemented on the software, EDUC 1.0. As a first application, we are conscious that many ideas discussed here need to be depth. One of them will be elaborate algorithms to simulate the impacts of possible changes in educational policies, as the reduction of dropout on the number of years of schooling, in a given region. Even the indicators discussed in this paper can be better exploited. For example, once available projections of population by age we can use the graduation ratio to forecast the human capital.

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Abstract

Demographic censuses usually contain information about a graded education system, i.e. age and grade declarations. This information can be used to estimate a series of indicators, useful for diagnostics and prognostics of the educational system. This paper proposes a new model for understanding the levels and perspectives of schooling in a given population of a country or region. It follows in the tradition of formal demographic methodologies used in analyzing and projecting population, such as Life Tables. One of the principal goals is to forecast population by levels of schooling. Thus, one could study the probable social consequences of the implementation of any educational policies related to promotion and retention practices, over the medium and long runs. This model can be considered an Educational Table. To implement the methodology, we are developing a software specifically for this purpose.