

# **Family Structure and Family Behavior over the Life Cycle in Brazil**

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# **1. Introduction**

## **1.1. Motivation**

The relationship between family and welfare distribution is strong, direct and has an endless scope. First, a family is the basic distribution unit, responsible for coordinating the pooling process of income of all its members. The family is also responsible for the distribution process of the benefits arising from the pooled income among its members. The outcome of these two processes – pooling and distribution – is the fact that welfare is distributed on a much more equal basis than the distribution of income per capita, which is a fact common to all societies.

Secondly, families interfere in the welfare distribution to the extent that they are the basic decision-making units of a society. Families have to take decisions about time allocation of each of their members, how the family income must be earned and how it will be divided between consumption and savings. Moreover, families play an important role in deciding how many children they will have and on the future distribution of welfare, since they are responsible for investing in the human capital of their children and thereby determining the level of human capital of the next generation. In short, family structure and behavior are of the utmost importance in forming the distribution of a society's welfare.

## **1.2. Objectives**

This study has two central objectives. We first describe in detail the structure and behavior of Brazilian families during their life cycle<sup>1</sup>. Secondly, we investigate the main socioeconomic determining factors of alterations in its structure and in its behavior which has been occurring over the past few decades. We, therefore, have two interrelating objectives. We describe how the patterns have changed in the past few decades, on the one hand, while on the other, we investigate how these changes in the structure and behavior of the families can be explained by concomitant variations in the Brazilian socioeconomic environment.

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<sup>1</sup> The analytical unit with which we will be working is the household and not the family. Nevertheless, we are using the word family throughout this study.

### **1.3. Structure**

The study is organized in four sections, in addition to the introduction. Section 2 describes the methodology and source of information used in every empirical study performed. Section 3 is structured in five subsections. The first investigates the form in which the family structure develops during its life cycle. The second analyzes the evolution of the educational capital stock for each cohort. The third subsection analyzes the ratio between wages and schooling during the life cycle and its variations for each cohort and over time. The fourth is devoted to the study of time allocation by the members of the family, particularly of its share in the labor market during the life cycle and how this allocation has changed between cohorts. Lastly, the fifth subsection looks at the investment made in educational capital of its children and how this investment varies during the school life cycle and for each cohort. Section 4 of this study is organized in six other subsections. The first studies the connection between schooling and fertility. The second investigates the determining factors of the growing prevalence of women as heads of families. The third investigates how socioeconomic factors determine retirement. The fourth and fifth subsections investigate the determining factors of female and child labor, respectively. Lastly, the sixth subsection looks at the determining factors of the children's educational performance. The final Section 5 summarizes the principal conclusions of the study.

## **2. Methodology and source of information**

### **2.1. Methodology: the question of identification**

We can generally say that the central objective of this study is to look at how certain family characteristics (its nature or behavior): (i) evolve during its life cycle,  $v$ , (ii) has varied between cohorts,  $c$ , and (iii) has varied over time,  $t$ . So if  $I$  is any indicator of interest, then the objective is to find function  $h$  so that

$$I = h(v, c, t)$$

In this case, function  $h$  reveals how this indicator varies during the life cycle, between cohorts and over time.

For us to estimate function  $h$  it would be necessary for us to obtain data on how indicator  $I$  varies during the life cycle,  $v$ , for each cohort,  $c$ , and point in time,  $t$ . However, as it always true that

$$t = c + v$$

it is clearly impossible to vary one of these variables, say  $v$ , and keep the other two,  $t$  and  $c$ , constant. In other words, it is impossible to see how indicator  $I$  varies during the life cycle,  $v$ , for each cohort,  $c$ , and point in time,  $t$ , and, therefore, it is impossible, without further hypotheses on the form of  $h$ , to estimate this function.

A particular case where function  $h$  can be estimated is when the indicator does not vary over time, varying only for each cohort and during the life cycle. Family characteristics, such as, for instance, size and composition, that vary significantly during the life cycle and from cohort to cohort, but are influenced very little by the socioeconomic conditions at a certain time, are included in this case. Also included here are the indicators for the children's educational performance. These indicators vary widely with the child's position in its life cycle and from cohort to cohort, but the influence of the socioeconomic conditions at a certain moment is relatively slight. In the above examples, we can approximate function  $h$  by

$$I = h(v,c)$$

And it can be estimated providing that it is possible to follow each cohort during the life cycle. Based on an annual poll series, it is always possible to accompany cohorts during their life cycle. In this study we can refer to 16 annual studies covering a 19-year period (1979-97) and can, therefore, follow each cohort for 19 years during its life cycle.

A second case is that of indicators that do not vary over time nor during the life cycle. The schooling of the adult population, for example, that in the absence of adult education programs, is a function only of the birth cohort is included in this case. Function  $h$  can, then, be approximated by calculating

$$I = h(c)$$

and be estimated on the basis of a single household poll. The only advantage of a series of polls, in this case, is to permit an increase in the number of cohorts that can be investigated.

In both the aforementioned cases, the absence of time-effect permits us to estimate function  $h$  and, therefore, isolate the effects of the life cycle from the cohort-effect. However, when all three effects are present it is impossible to identify function  $h$ , unless certain further characteristics of this function are known.

In this study, the three effects are relevant in three situations and, therefore, there is a problem of identification. This is the case of the rate of return on education, which certainly depends on the economic conjuncture, as well as the worker's experience in the labor market, unless to the extent that general and specific human capital are complementary to production. Furthermore, to the extent that different cohorts are imperfect substitutes in production, the rate of return shall depend on the size of the cohorts and distribution of education in each of them. A similar situation occurs with the rate of participation in the labor market, which is influenced both by the economic conjuncture and structural factors (cohort) and by the position in the life cycle. Lastly, you have the family income per capita, which also depends on both conjuncture and structural factors, in addition to varying during the life cycle.

In such cases, further hypotheses on function  $h$  are required for us to be able to estimate it. In this study we used two alternative strategies, one proposed by MaCurdy and Mroz (1995) and another by Deaton and Parkson (1994).

## **2.2. Source of information**

Basic information for all empirical analyses in this study comes from a series of 16 Pesquisas Nacionais por Amostra de Domicílios - PNAD (National Household Sample Polls) from 1979 to 1997. The PNAD is an annual household research conducted by the Instituto Brasileiro de Geografia e Estatística - IBGE (Brazilian Institute of Geography and Statistics) at a national level and carried out in the third quarter of each year. Each poll involves interviewing around 100,000 households.

This research began on a national scale in 1971 and underwent a major revision between 1990 and 1992<sup>2</sup>. The research contains extensive information on individual characteristics, including information about all sources of income, participation in the

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<sup>2</sup> We are not using 1971-78 PNADs in the study due to the difficult access to their databases.

labor force and school attendance, among others. As the research is on a household basis there is also detailed information about the family structure. The fact that there are many PNADs and each poll includes a very large sample makes them very useful in describing the life cycle patterns and their variations over time and through cohorts.

### **2.3. Start-up**

Between 1979-97, 16 PNADs were collected covering all 19 years in the period, except for 1980, 1991 and 1994<sup>3</sup>. Thus, based on this research, it is possible to almost continually follow the life cycle of each cohort over the 19-year period, except for the three years mentioned herein. In order to eliminate the three gaps, the information was completed by using the information from the adjacent years relating to the same cohort. For example, as no PNAD was done in 1980 there is no information for the 30-year old cohort born in 1950 although there is information for this cohort at 29 years old in the 1979 PNAD and for the same cohort at 31 years old in the 1981 PNAD. Thus, we chose to complete the information for this cohort relating to 30 years old as the average between the values for this cohort obtained in the two 1979 and 1981 PNADs<sup>4</sup>.

In this study we address two kinds of life cycle: the life cycle of individuals and the life cycle of families. To characterize the family life cycle we use the age of the family head. Despite the magnitude of the PNAD sample, it is quite limited in some cells. This is why we endeavor to pool the cohorts in five-year birth groups (1900-04, ..., 1985-1989) and thus obtain a more suitable cell size (see Table A4 and A5 in the Appendix).

During the study, we accompanied the performance or behavior of cohorts over time or of their life cycle without, in fact, having access to truly longitudinal information. The principle that permits us to accompany it is that, in the absence of mortality or selective migration, an average relating to a cohort in a poll collected five years after the other is an unbiased estimate of the average situation of that cohort five years later, even when the people or families effectively interviewed five years later are

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<sup>3</sup> In 1980 and 1991 PNAD was not performed as the Population Census was carried out instead. In 1994 PNAD did not go to the field.

<sup>4</sup> Table A1 in the Appendix shows how the data of the evolution during the life cycle of the different indicators used in this study was organized in five-years birth groups. In this table each line corresponds to an interval of five-years in the life cycle and each column to a birth cohort. Note that since PNAD had not been carried out for three years in the 1979-97 period, there are no primary data on four diagonals in this table. Tables A.2 and A.3 in the Appendix give the number of people and families interviewed in each cell obtained by comparing age and birth cohort.

not the same. However, as we have already mentioned, the validity of this approach depends on the absence of mortality or differentiated migration. If these conditions are not ascertained, averages for the same cohort in consecutive polls will not properly represent the evolution of the behavior or performance of the cohort during the life cycle or over time.

### **3. A description of the patterns of the family life cycle, structure and behavior**

#### **3.1. Family structure**

This subsection describes the typical development of the Brazilian family structure throughout its life cycle and it has four objectives. First, we looked at the behavior of the family size, its composition by age and gender, and kin relationship between its members<sup>5</sup> and the head. Secondly, we looked at how the patterns described in the first objective have changed over time. Thirdly, we looked at how the family characteristics vary during its life cycle. Finally, in fourth place, we investigated how the characteristics of the family to which a person belongs vary during his/her own life cycle.

As mentioned in subsection 2.3 we will use the age of the head of the family to identify the family's position in the life cycle.

Figures 3.1 to 3.14 provide estimates of the life cycle pattern for a variety of family characteristics for each birth cohort. Once these estimates are obtained from a series of 16 household polls covering the 1979-97 period, the available information covers only a small fraction (19 years) of the life cycle of each cohort. To simplify the presentation, these figures show the results only for cohorts born every five years. A series of regularities can be identified from these figures:

- **Family size**

Figure 3.1 reveals that the family size reaches its peak when the head of the family is approximately 40 years old. There is evidence that, as time goes by, this peak occurs increasingly early in the life cycle. The position of this peak is determined principally by age at which people marry and by the number and intervals between

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<sup>5</sup> Family members are the head, spouse, children, other family members and kin. Boarders, domestic staff and their relatives are not considered members of the family.

children. As time goes by, the age at which people marry has been delayed, pushing the peak to a later point in the family's life cycle. On the other hand, the number of children has diminished, pushing the peak to an earlier point in the family's life cycle. Generally speaking, the second effect prevails, leading the peak of the family size to occur earlier in its life cycle. Moreover, this figure reveals one more regularity: there is a drop in the family size when we move from the older to the younger cohorts. While those born in 1950 have families with a maximum size of 4.6, the family size was 5.4 for those born ten years earlier. Hence, the maximum family size is diminishing at a rate of 0.8 members per decade. However, there is evidence that this downward rate is decreasing.

- **Number of children**

Figure 3.2 reveals that the number of children under six years old per family reaches the peak earlier in the family life cycle. This peak is reached when the head is between 25 and 30 years old. There is also evidence that the peak occurs increasingly early among the young cohorts. We can also see from this figure that the maximum number of children has dropped considerably when comparing young and old cohorts. While the maximum number of children for the cohort born in 1950 was approximately 1.5, the average children was 1.2 for the cohort born in 1960. In other words, we may say that the maximum number of children under six years old has dropped at a rate of 0.3 per decade.

Lastly, it is worth mentioning that the number of children under six years old has dropped substantially, after reaching the maximum, when these children move up to the next age group. This rate of decline is faster than the family size rate, since the change in the children's age group does not necessarily mean a change of family.

- **Number of juveniles**

The number of juveniles between 7 and 14 years old per family reaches the peak when the heads are over 30 years old, which can be seen in Figure 3.3. This figure reveals a gentle move towards an earlier peak in the life cycle of the younger cohorts.

As in the case of the children, there is clear evidence of the sharp drop in the number of juveniles per family. The maximum is around 1.5 for the cohorts born in 1945, while the number is less than 1.3 for cohorts born ten years later.

Figure 3.4 however permits us to conclude that, taking children and juveniles as a whole, the number of children has dropped from a maximum of 2.6 for the cohort born in 1945 to a maximum of 2.1 for the cohort born in 1955.

- **Number of young adults**

We can conclude from the analysis Figure 3.5 that the number of young adults with work potential (people between 15 and 21 years old) reaches a peak when the head of the family is approximately 45 years old. The figure also shows that the maximum number of people in this group has steadied at about one person per family among the younger cohorts.

- **Number of adults**

The number of adults (people between 22 and 64 years of age) is approximately two at the start of the family life cycle, rising to 2.5 when the children become adult. We can see this from Figure 3.6 which does not show changes in the pattern of the life cycle of the number of adults among the cohorts. Thus, the changes between the cohorts in the number of people per family are fully caused by changes in the number of children and juveniles.

- **Number of elderly**

We can see from Figure 3.7 that the number of 65-year olds or over per family is very small, being less than 0.1 per family. This figure indicates a slight increase in the number of the elderly during the family life cycle but no difference in the pattern of the life cycle between the cohorts.

- **The age of the youngest and oldest member**

Figure 3.8 shows how the average age of the youngest member varies in the family life cycle. This figure reveals that in the first half of the family life cycle (before the head is 50 years old), the youngest person is around ten years old. In this interval of the family life cycle the age of the youngest person is constant.

Once the head of the family is 50 years old, the age of the youngest member starts to increase in the same proportion as the head's age, indicating that the fertility cycle has ended. We can see from Figure 3.9 that the oldest member of the family is

very close to the age of the head, indicating that, in general, the head is the oldest family member.

Lastly, it should be mentioned that these figures show very slight variations between the cohorts with regards to both the age of the youngest and the age of the oldest family member.

- **Gender of family head**

With regards to the gender of the head of the family, Figure 3.10 shows that the proportion of heads that are women increases during the family life cycle. This rise is the result of the cumulative effects of both separations and the woman's tendency to live longer than the man. Moreover, the figure also shows that the number of female heads of family is higher among the younger than among the older cohorts, and that the growth rate is approximately 4% every decade. Hence, the percentage of female heads in the cohort born in 1940 is close to 12%, while this percentage is 16% in the cohort born in 1950.

- **Relationship with head**

Figure 3.11 shows the number of the head's children per family during the life cycle per birth cohort. This figure reveals that the number of children reaches its peak when the head is approximately 40 years old. We can also see that the maximum number of children has dropped sharply over time. More precisely, this number has dropped from 3.3 in the cohort born in 1940 to 2.6 in the cohort born in 1950, showing a drop of approximately 0.7 every ten years. As the drop in the family size is 0.8 per decade, we can conclude that the responsibility of the total drop in family size is essentially the decrease in its number of children.

Another relevant aspect is that the percentage of families with spouse present decreases almost throughout the life cycle (see Figure 3.12) as a consequence of separations and mortality. More specifically, the percentage of families with a spouse present increased substantially in the earlier stages of the life cycle, reaching 85% of the families with 30-year old heads. From this point in the life cycle, this percentage dropped to around 57% among the 70 year old heads.

Figure 3.13, however, shows the evolution of the average number of kin who are not children and spouses during the life cycle. This figure shows that the number of other kin tends to drop to the minimum (0.2 person per family) when the heads are in

the 30-year old age group. When the head's age group moves from 40 to 60 years old, the average number of other kin triples, reaching the maximum of 0.6 person per family. With regards to the life cycle pattern of the number of family members that are not children and spouses, the results show that there is very little difference among the cohorts.

Lastly, Figure 3.14 reveals that the number of non-kin is very small (close to 0.02 person per family). Moreover, this figure does not vary much during the life cycle of the cohorts.

### **3.2. Stock of human capital**

In this subsection our objective is to provide a good view of the evolution of the education performance in Brazil since the start of the century. Estimates, thereby, are given of the education distribution per birth cohort. Besides these distribution estimates per cohort, we looked at the average level of education, inequality in the education distribution, education density and retention rates for each cohort. These estimates are given in Figures 3.15 to 3.25, from which we can identify a series of regularities:

- **Illiteracy rate**

By studying Figure 3.15 we can conclude that illiteracy is still high even among those born in 1970. In fact, almost 10% of the cohort born in 1970 is illiterate. The illiteracy rate has, however, dropped slightly since the start of the century at a rate close to 7.5% every ten years. At the beginning of the century the illiteracy rate was over 50%, which confirms the decrease in this rate. At this downward rate (7.5% per decade), illiteracy should be eradicated in Brazil by the next decade. However, there is also evidence of a recent lagging in the declining illiteracy rate. In fact, when we compare the illiteracy rate between the cohort born in 1950 with that born in 1970, we find that the illiteracy rate is now dropping at a rate of 5% per decade.

- **Average education**

Despite the continuing rise since the beginning of the century, average education is relatively low, even among those born in 1970. In fact, the cohort born in 1970 has completed an average of only 6.5 years of study, as we can see in Figure 3.16. This

figure shows that in the 1920s and 1930s the average education increased 0.75 per decade and in the 1940s and 1950s this rate rose to 1.25. For the overall period, the rate of increase in education was one year per decade. Finally, we should mention that there was a sharp drop in the growth rate of average education since the cohort born in 1960. In fact, if we compare the average education of the cohort born in 1960 with that of the cohort born in 1970, we can see an improvement in the average education of only one quarter of a year's education. This improvement is modest from a historic viewpoint and in terms of the experience of other Latin American countries.

- **Inequality in education distribution**

Figure 3.17 shows the evolution of the standard deviation of the education distribution for each birth cohort. It shows a sharp rise in inequality from the beginning of the century until the cohort born in 1950. During this period, the standard deviation almost doubled, rising from 2.5 to 4.5 years of education and the average education at least tripled. Consequently, the variation coefficient, a weighted average of inequality, decreases due to a smaller rise in the standard deviation than in relation to the increase in the average. However, for cohorts born after 1950, inequality dropped even when measured by the standard deviation.

- **Education density**

With regards to education density, Figures 3.18 to 3.21 show the evolution of the percentage of adults in the population with a given level of education.

Figure 3.18 reveals that even among the younger cohorts, the percentage of the population with zero years of education is still very high, 10%, although it has been steadily dropping since the beginning of the century. As in the case of the illiteracy rate, we can clearly identify the existence of a recent deceleration in the downward rate. Figure 3.19 shows that the percentage of the population with exactly four years of education was 25% in 1950. This percentage has dropped significantly since the 1955 cohort, even reaching 15% for the younger cohorts. In relation to the percentage of the population with 8 and 11 years of education, Figures 3.20 and 3.21 show that this percentage has increased throughout the period of analysis.

- **Accumulated distribution of education**

The evolution of the percentage of the adult population with a level of education higher than a given level is shown in Figures 3.22 to 3.25. Figure 3.22 shows that even among the younger cohorts, the percentage of people with some formal education is still far from 100%. Although it continues to rise since the start of the century, we can see a recent drop in its growth rate.

Figure 3.23 gives the percentage of the population that has at least four complete years of education, that is, the first stage of junior school (1<sup>st</sup> to 4<sup>th</sup> grades). Although this percentage is rising over time, only 60% of the adult population, even among the younger cohorts, completed the fourth grade. A similar analysis can be made for the fraction of the population that has at least completed junior school. Figure 3.24 shows that, although the percentage of the population with at least eight years of education is rising over time, even among the younger cohorts, only 30% of the adult population has completed the eighth grade. With regards to the percentage of the population that completed at least 11 years of education, that is, has completed high school, Figure 3.25 shows that, although this percentage is also rising over time, even among the younger cohorts, only 10% of the adult population has completed high school.

- **Retention rates**

We define herein the retention rate at a given level of education as being the percentage of the adult population that has this level of education is a proportion of the population that has reached at least this level of education. Thus, the retention rate in the first grade of junior school is the ratio between the percentage of people who has this grade (at most) and the percentage of people who have at least completed this grade. The results obtained are given in Figures 3.26 to 3.36.

When we study Figures 3.26 to 3.29 we can perceive that the retention rate of the first stage of junior school (former primary) has dropped over time. Figure 3.29 shows, however, that despite this improvement, the retention rate in the fourth grade is still 20%, even among the younger cohorts, which means that 20% of all children who completed the fourth grade did not move on to the next one.

Figures 3.30 to 3.33, however, show that the retention rate of the whole second stage of junior school (from 5<sup>th</sup> to 8<sup>th</sup> grades) did not drop over time, except in the case of the eighth grade. However, the retention rate of the eighth grade is still 25% despite

the decrease, even among the younger cohorts. In other words, 25% of the children who complete junior school do not go on to high school.

In relation to high school, the results in Figures 3.34 to 3.36 show that the retention rate has increased over time, that is, dropping out of school at the secondary level has become an increasing problem in recent decades. Moreover, Figure 3.36 shows that the retention rate at the end of the high school education has continued at a very high level (55%) and constant over time, at least until 1950. There is, nonetheless, some evidence of an increase in the retention rate after 1955. In other words, the probability that a juvenile who has completed high school goes on to university is not high (45%) and has dropped over the last few decades.

### **3.3. Returns on human capital**

In this subsection we estimate the relationships between wages and education for each cohort and time period. Basing ourselves on these estimates, we looked at the form in which the returns on education have developed among the cohorts and during the life cycle. We used non-parametric specifications to be able to obtain estimates separately for marginal returns at all levels of education. In particular, we give estimates of the evolution of the returns on the levels of junior, high and university education over time and for each cohort. These estimates are found in Figures 3.37 to 3.43. A series of regularities were identified based on these figures:

- **Average returns**

The evolution of the average impact of one extra year of education on the wages (return on education) during the life cycle, per cohort, is given in Figure 3.37. This figure shows that the returns on education in Brazil are between 10% and 17% for each extra year of education, which can be considered extremely high if compared to international standards. Moreover, these returns on education are rising at the start of the life cycle, at least until 35 years old. We noted a clear downward trend of the returns as time went by, but it was not clear if this drop is due to cohort or time effects.

- **Regional differences**

The evolution of the impact of one extra year of schooling on wages during the life cycle, per cohort, in the Southeast and Northeast regions is given in Figures 3.38 and 3.39. Although the patterns are the same, the returns are higher in the Northeast.

- **Returns per education level**

Figures 3.40 to 3.43 show the evolution of the impact of an extra year of education on the wage during the life cycle for each cohort, separately for each level of education. First, Figure 3.40 shows that the returns on education in the first stage of junior school seem to increase during the life cycle. We can also perceive that the return has dropped over time, being higher for the older cohorts. By comparing Figures 3.40 to 3.43, we can see that, among all education groups, the returns on university education are the highest and the returns at 1<sup>st</sup> to 4<sup>th</sup> grades come close behind.

In relation to the returns at the second stage of junior school, Figure 3.41 shows that they seem to be much less sensitive to the life cycle than the returns in the first stage. Moreover, there is strong evidence that the returns at the second stage of junior school have dropped over time, being much higher for the older cohorts. When we compare Figures 3.40 to 3.43 we find that the return in the second stage of junior school is the lowest of all the other education groups.

Figure 3.42, in its turn, shows that the returns for high school education has a pattern in the shape of an inverted U, where the return rises until 35 years old and falls for the following ages. There is also clear evidence that these returns have dropped over time and are much higher for the older cohorts. When we look at Figures 3.40 to 3.43 we can find that the returns on high school education are high but are still lower than university education. The comparison with the returns on education in the first stage of junior school depends on the cohort. The returns are higher in the 1<sup>st</sup> to 4<sup>th</sup> grades among the older cohorts, while among the younger cohorts the returns on high school education are higher.

Finally, Figure 3.43 shows that there is no defined pattern for the life cycle of the returns associated to university education. Unlike the other education levels, there is evidence that returns have increased over time. As we have already mentioned, by comparing Figures 3.40 to 3.43 we can see that the returns on university education are always higher than the returns at other education levels.

### **3.4. Time allocation**

In this subsection we discuss how families allocate time of their members between activities in the labor market and domestic production or leisure, during their life cycle. The development of this pattern in the life cycle is analyzed for each birth cohort each year. More specifically, in this subsection we investigate the differences in the share in the labor market, over time, for each cohort and gender, as well as the differences in these patterns between regions and through the different education levels. We also investigated two alternative ways of breaking down the participation rate. First, the participation rate is broken down into half-day and full-day activities. Secondly, participation is broken down according to the nature of the employment relationship: self-employed, formal and informal employee.

The estimates for life cycle patterns for all these definitions of a participation rate are given in Figures 3.44 to 3.67, based on which some regularities were found:

- **Male patterns**

For a series of birth cohorts, Figure 3.44 presents the life cycle pattern for the participation rate of men in the labor force. There is little variation in this pattern over time and between cohorts, where the sole exception is the participation of juveniles in the labor force, which has a slight decrease in time and between cohorts. In general terms, Figure 3.44 shows a sharp rise in participation in the labor force until 25 years old, when the participation rate reaches 90%, and continues above 90% until 50 years old. After this age, participation in the labor force drops at a 20% rate per decade.

- **Female patterns**

The pattern of the life cycle for the rate of female participation in the labor force for a series of birth cohorts is given in Figure 3.45, which, unlike the preceding figure, shows substantial variations between the cohorts. The participation in the labor force tends to be much higher in the younger than in the older cohorts. When we compare women at the same age in different cohorts, we can see that the female participation in the labor force has increased 15% each decade. However, most changes occurred in a concentrated way in adult women, with very little variation in the participation of juveniles in the labor force.

We can also conclude that currently female participation in the labor force is 60% and that the age at which a woman reaches the peak depends heavily on the cohort:

the younger the cohort, the earlier the peak. Moreover, the fact that participation of older women in the labor force is still growing while the participation of younger women is apparently steady, may be considered evidence that, in addition to the cohort effect, a time tendency also influences the female participation in the labor force. This participation starts to decrease five years earlier than male participation. In fact, while male participation in the labor force starts to drop at 50 years old, the participation in the labor force among women begins to drop at 45 years old.

- **Regional disparities**

Figures 3.46 to 3.49 give the rate of participation of men and women in the labor force during the life cycle for each cohort and region. These figures show that the regional disparities are not very important either for men or women. Nevertheless, there is a trend that there is a bigger drop in participation in the Southeast than in the Northeast, when addressing people over 50 years old. In other words, retirement seems to be more important in the Southeast than in the Northeast of Brazil. Surprisingly, with regards to the juvenile labor force, the differences between both regions are not significant.

- **Differences per education level**

Figures 3.50 to 3.57 show the life cycle pattern of the rate of participation of men and women in the labor force for each cohort and education level.

The evidence for women given in Figures 3.50 to 3.53 shows that the rate of participation in the labor force is considerably higher among women with a high level of education than among women with a lower level of education. In fact, if we consider women born in the 1960s, the participation of the 30 to 40 age groups in the labor force varies from 50% for women with the first stage of incomplete primary schooling to 75% among women who have completed high school. These figures show that the difference between young and old cohorts regarding participation in the labor force is much less for women who have completed high school than for women with a lower level of education. Furthermore, these figures show a bimodal pattern for women with a lower level of education, while for women with a higher level the pattern is single mode.

The evidence for men is given in Figures 3.54 to 3.57, which show slight differences at each level of education. The most obvious difference is in the period when they enter the labor force. Since the group with a higher education level needs to

stay longer at school, they are forced to postpone their admission to the labor force. Besides, although the differences in age when the education groups enter the labor force, their retirement age is quite similar. As a result, on average, the groups with less education tend to work more years of their life than the groups with a higher level of education.

- **Full versus part-time work**

Figures 3.58 to 3.61 show the pattern of the life cycle of the composition of employment of men and women according to the hours worked. The results show that among adult workers (from 30 to 50 years old), 10% of the men and 35% of the women work part-time (less than 30 hours a week). In this way, women are more likely to occupy part-time jobs than the men. Among juveniles, however, part-time jobs are traditionally more common among both men and women.. Moreover, part-time jobs among juveniles are increasing fast over the last 20 years.

Among the young 15-year old adults the percentage of part-time jobs increased from 25% to 70% for men, similar to the variation for women. The same can be found for older people, where the percentage of part-time jobs is also higher. Among the 65 year olds, 50% of women and 15% of men perform part-time work.

- **Formal versus informal employment**

Figures 3.62 to 3.67 show the composition of male and female employment according to the nature of its relationship, formal, informal employee and self-employed. These figures show that the composition of employment for men and women changed very little over time and between cohorts. Nevertheless, we can see a tendency for women to increase the degree of formalization.

In relation to the life cycle patterns of the employment composition, they are extremely similar when comparing men and women. In both cases, the percentage of the labor force that works in self-employment has steadily risen during the life cycle at a rate of 7.5% per decade. However, this percentage is around 5% higher for men than for women, considering workers of all ages.

Informal jobs are quite common among both young men and women. For instance, 45% to 50% are informal jobs among the young 15-year old adults. However, when we consider people between 30 and 60 years old, the percentage of informal jobs is much lower and essentially constant: 15% among men and 20% among women.

With respect to the life cycle pattern, the figures show the percentage of formal workers in an inverted U form for both men and women. In both cases, the peak occurs at around 25 years old, when 40% of men and only 35% women have a formal job. After 25 years old, the percentage of formal employment drops, while the importance of self-employment increases.

### **3.5. Investments in human capital**

In this subsection we look at how the family invests in its future. More specifically, we do an analysis of the school attendance of the children over time and for each cohort. We look at how investment in human capital in children in Brazil developed over the last few decades and how this investment occurred during the child's education cycle.

Based on the 16 household polls used in this study, we can accompany the cohort born between 1969 and 1971 for most of its education life cycle. The 10 to 25 year old cohorts will be accompanied, and their education history is described in Figures 3.68 to 3.77, on which basis the following regularities can be identified:

- **First stage of junior school (1<sup>st</sup> – 4<sup>th</sup> grades)**

Figure 3.68 shows that 25% of all 11-year old children have not yet completed the first grade. Moreover, 14% of children at this age are still enrolled in the first grade, 8% of this cohort will not finish this grade and 10% will not pass to the next grade. With regards to the 2<sup>nd</sup> grade, we can see from Figure 3.69 that more than 40% of all 11-year old children have not yet completed the second grade. Also, 16% of children at this age are still enrolled in that grade, 10% of this cohort will not finish it and 15% will not pass to the next grade. Figure 3.70, however, shows that more than 60% of all 11-year old children have not yet completed the third grade. Also, 19% of the children at this age are still enrolled in this grade, 15% of this cohort will not finish it and 21% will not pass to the next grade. Lastly, with respect to the fourth grade, Figure 3.71 shows that more than 80% of all 11-year old children have not yet completed this grade. Moreover, 19% of the children at this age are still enrolled in the grade, 22% of this cohort will not finish it and 35% will not pass to the second stage of junior school.

- **Second stage in junior school (from 5<sup>th</sup> – 8<sup>th</sup> grades)**

Figure 3.72 shows that at 11 years old, at least 20% of children in this cohort have already reached the 5<sup>th</sup> grade. Only 15% of the children at this age are enrolled in this grade, 36% of this cohort will not finish it and 45% will not pass to the sixth grade. Considering the 12-year olds, we can see in Figure 3.73 that less than 15% of the children in this cohort have already reached the 6<sup>th</sup> grade. Only 12% of children at this age are enrolled in this grade, 45% of this cohort will not finish it and 51% will never pass to the next grade. In relation to the 7<sup>th</sup> grade, we can see from Figure 3.74 that 13% of the 13-year old children have already reached the 7<sup>th</sup> grade. Only 11% of the children at this age are enrolled in the seventh grade, 52% of this cohort will not finish it and 57% will not pass to the next grade. Finally, with regards to 14-year old children, Figure 3.75 shows that 12% of them have already reached the 8<sup>th</sup> grade. Only 10% of the children at this age are enrolled in the eighth grade, 58% of the children of this cohort will not finish it and 68% will not go on to high school.

- **Secondary education (from 1<sup>st</sup> – 3<sup>rd</sup> year)**

Figure 3.76 shows that 10% and 27% of 15 and 18 year old people, respectively have been admitted to high school. Moreover, 71% of this cohort will not complete high school and around 91% will not go on to university.

- **University**

The results in Figure 3.77 show that only 5% and 9% of 18 and 21 year old people, respectively, have already gone to university, and only 5% of this cohort completed the university course before reaching their 26<sup>th</sup> birthday.

#### **4. Determining factors of family structure and behavior**

The objective of this section in the study is to investigate the main determining factors of the family structure and behavior. To do so, we organize our analysis in five subsections. The first studies the relation between fertility and education, taking into consideration the existing disparities both in regional terms and between the cohorts. In the second subsection we look at the socioeconomic determining factors for female participation in the labor market. The third subsection contains an analysis of the determining factors for people leaving (early) the labor market, and in the fourth we discuss the socioeconomic determining factors of child labor. Finally, in the fifth

subsection, we submit an analysis of the determining factors for the young portion of the population's lag at school.

## **4.1. Investment in human capital and drop in fertility**

In Section 3 herein we show that the main transformation that affected Brazilian families over the past few decades was the sharp drop in the number of children. We also show that the average level of education of the adult population tripled during this period. In this subsection, we look at the connection between these two phenomena. More specifically, three issues are examined. The first refers to the relationship between fertility and women's education. To analyze this relationship, we estimated the impact of an extra year of education for women on the number of children. We also investigated how this impact varies with the women's original level of education. More specifically, we examined if an extra year of junior school has the same impact on fertility as an extra year in high school, and how the impact of education varied over time and between regions. Secondly, we will analyze the extent to which the fertility occurring in the past ten years can be explained by the increase in education. Finally, we look at the importance of the noticeable differences in school attendance to explain the regional differences in fertility.

### **4.1.1. The impact of education on fertility**

We use the number of births as a measurement of fertility. In order to find an approximate overall fertility, the analytical universe was restricted to women between 45 and 69 years old. To calculate the impact of education on fertility, we went back to our measurement of fertility in education, using the women's age, race and home region as control variables. The regression also includes an indicator for dwelling in urban areas.

In the regression we do not assume that the relationship between education and fertility is linear. On the contrary, we left this relationship completely free, including an education indicator for each level. Table 4.1 gives the estimated figures.

This table shows that, on average, an extra year of education reduces fertility by 0.32, that is, a woman needs around three more years of education to reduce the number of children in a unit. The impact of education, however, is not linear. As Table 4.1 shows, fertility is more sensitive to the first years of education (junior school) than for

variations in education above this level. In fact, while an extra year of education in junior school reduces fertility by around 0.33, an extra year in high school reduces fertility by around 0.15, and an extra year at university reduces fertility by around 0.10. In other words, we find that basic education has, on average, an effect on fertility twice (three times) greater than an extra year at high school (university).

### **4.1.2. Disparities between cohorts**

Fertility has been dropping significantly in Brazil as time goes by. Table 4.2 shows the average number of children born to various cohorts, showing a 0.9 drop every ten years. At the same time, we find that education is increasing at a rate of 1.2 for every extra year of education per decade.

We then look at the extent to which the drop in fertility is due to the increase in education. So we re-estimated our regression for each cohort. The results are given in Table 4.3. This table shows that the average impact of education on fertility has been decreasing as time goes by, that is, the impact is greater among the older than among the younger cohorts. Based on our regressions and the distribution of education per cohort, we find that the increase in education would reduce fertility by around 35% in relation to the level found (see Table 4.4a). In other words, we find that more than one third of the drop in fertility was due to increases in the women's level of education.

### **4.1.3. Disparities between geographic regions**

Based on information in Table 4.2, we can see that there is less fertility and more education in the Southeast region than in the Northeast. In fact, average education in the Southeast is 1.7 years more than in the Northeast.

We now move on to investigate the extent to which differences in fertility can be explained by differences in the level of education. So we re-estimated our regression per geographic region. The results are given in Table 4.4. This table shows that the average impact of education on fertility is stronger in the less developed regions, such as the Northeast. Based on these regressions and distribution of education between the regions, we estimated how much the regional differences in fertility can be reduced if the regional differences in education are eliminated. The results given in Table 4.4a show that the regional differences in education explain 25% of the differences in fertility. In

other words, we find that one quarter of the highest fertility in the Northeast can be explained by the women's lower level of education in this region.

## **4.2. Socioeconomic determining factors of female participation in the labor market**

The woman's participation rate is another characteristic identified in the second part of the study as having sharp variations both in time and between cohorts. In this subsection we examine to what extent these variations can be explained by concomitant changes in the socioeconomic environment during the life cycle, between cohorts and as time goes by.

Bearing this goal in mind, we relate the evolution of the female participation rate during the life cycle for a group of cohorts to those that would be its most immediate socioeconomic determining factors: (a) average woman's wage, (b) net family income per capita from the earnings from women's work, and (c) proportion of families headed by women. From a theoretical viewpoint, we should expect that the rise in the participation rate is partly explained by the rise in their wages and increase in the prevalence of families headed by women. On the other hand, the increase in net family income per capita from the earnings from the women's work appears as a factor that would induce decreases in the female participation rate. In order to find factors not included in the analysis and which vary either during the life cycle or between cohorts, we also included in the analysis the age and birth cohort (time). The less important this variable is the greater the capacity of the included variables for explaining the variations per cohort and during the life cycle.

The results obtained are in Table 4.5. This table shows that both the effect of women's wages and the effect of the family income are statistically insignificant. The only statistically explanatory significant factor obtained in these regressions was the prevalence of families headed by women. Estimates obtained show that the increase in the proportion of families headed by women has been an important factor in raising the women's participation rate over the past few decades.

### **4.3. Socioeconomic determining factors for retirement**

One of the main conclusions from studying the participation rate in the labor market conducted in the second part of this study was that the participation rate in Brazil starts to drop very early in the life cycle. In fact, as we can see in Figures 3.44, the participation rate starts to plummet long before 50 years old.

Two kinds of socioeconomic factors influence the behavior of the participation rate. On one hand, there are what are called supply factors that influence the reserve wages, such as family income per capita and the availability and generosity of the pension. On the other hand, there are what are called demand factors, represented fundamentally by the market wage. The higher the market wage in relation to the reserve wage, the more likely the person is to remain in the labor market.

In order to check the importance of these socioeconomic factors to explain the exit of people 50 years old or over from the labor market, we estimate the relationship between the participation rate in the labor market and these factors based on the Probit model shown in Table 4.6. In this model, the wage-hour was calculated for those outside the labor force as being equal to the average wages of workers with identical personal characteristics (education, age, gender, race and geographic location) who are still in the labor market.

The results obtained are in Table 4.6 and show that, despite the importance of all the socioeconomic factors under study, age is still a major factor in determining the participation rate, indicating the existence of important bound factors (such as health, for example) that were not included in the analysis.

The sign of the impact of the socioeconomic factors estimated in Table 4.6 is fully in agreement with what would be expected in theory. All factors that raise the reserve wage – such as pension availability and generosity, reduce the participation rate in the labor market. The wage-hour, however, has a positive statistically significant impact on the participation rate, as expected. In short, we find that the sharp drop in the participation rate since the 50 year olds in Brazil is, to a great extent, explained by demand factors (lower wage-hour) and supply (more access to retirement). It is worth mentioning, however, that the impact of age is still relevant, indicating that other factors bound to the life cycle, such as deterioration in health conditions, are also very important.

#### **4.4. Socioeconomic determining factors of child labor**

One of the major conclusions from the analysis on the participation rate in the labor market conducted in the second part of this study was that, in addition to the sharp rise in female participation and the early departure from the labor market of people close to 50 years old, Brazil continues to show a high rate of child participation in the labor market.

As in the case of the adults, two kinds of socioeconomic factors influence the behavior of the children's participation rate in the labor market. On one hand, there are what are called the supply factors that influence the reserve wages, such as family income per capita, size of family, education of parents, and school availability. On the other hand, there are what are called demand factors represented, basically, by the market wage and available work in the family business. The higher the market wage and possibilities of employment in relation to the reserve wage and education possibilities, the more likely the child or teenager is to enter the labor market.

In order to check the importance of these socioeconomic factors to explain the inclusion of children in the labor market, we estimate the relationship between its rate of participation in the labor market and these factors based on the Probit model in Table 4.7. In this model, the wage-hour was calculated for those without a job as equal to the average wage of those with identical personal characteristics (education, age, gender, race and geographic location) with a job.

The results obtained show that at least the sign of the impact of the estimated socioeconomic factors are fully in accordance with what would be expected in theory. Every factor that raises the reserve wage, such as income per capita and education of parents, reduces the rate of participation in the labor market. Similarly, the factors that reduce the reserve wages, such as family size, raise the labor market participation rate. The wage-hour, however, as expected in theory, has a positive statistically significant impact on the rate of participation.

In short, we find that the high prevalence of children's labor in Brazil is, to a great extent, explained by demand (lower wage-hour) and supply (poor quality of family environment and inadequate school access) factors. The parents' level of education seems to be the most important of the factors in the study.

#### **4.5. Determining factors of lag in education among juveniles**

The analysis of the educational performance among the juveniles has shown that a significant portion are either out of school or enrolled in grades far below what would be expected for their age group. This poor learning performance is partly the result of the high degree of poverty and low level of education of their parents. Moreover, no access to school and its poor quality and the high prevalence of child labor are also important factors in explaining this poor educational performance.

In this subsection we look at the relative importance of these factors in explaining the poor Brazilian educational performance. Bearing this objective in mind, we use a linear regression to relate the grade-age lag with these determining factors.

The results in Table 4.8 show that both personal and family environment characteristics are of major importance in explaining the lag in school education. Particularly important is the education of the parents, mainly of the mother. The family income per capita has the expected impact but its scope is much more limited than that of the parents' level of education.

With regards to the availability and quality of the school, we find that, despite the importance of the family environment, important regional differences prevail, indicating that differences in school availability and quality are very important. The results obtained also show that the occurrence of child labor increases the lag at school significantly.

### **5. Conclusion**

In this study we endeavored to present a detailed description of the structure and behavior of Brazilian families during their life cycle and also look at the main socioeconomic determining factors in changes in its structure and behavior occurring over the past few decades, based on the National Household Sample Research (PNAD).

Hence, on one hand, we describe how the patterns shift over the past few decades and, on the other, look at how these changes in structure and behavior of the families can be explained by concomitant variations in the Brazilian socioeconomic environment. There are nine main conclusions in this study.

First, in relation to *family structure*, we find that the family size reaches its peak when the head of the family is around 40 years old, although this maximum has been occurring increasingly early in the family life cycle. Moreover, evidence has shown that

the family size of the younger cohorts tends to be smaller than those of older cohorts. The main explanation for this drop in family size was the smaller number of children between the older and younger cohorts. Another important finding was that the proportion of families headed by women in Brazil has increased during the family life cycle, with the younger cohorts presenting a larger proportion of female heads of family than the older cohorts.

In relation to the *education capital stock*, evidence has shown that the illiteracy rate has been decreasing since the beginning of this century, although the downward rate has slowed down for the cohorts born after 1960. Although it has continued to grow through the birth cohorts, average education is still relatively low, reaching only 6.5 complete years of study for the cohort born in 1970. Moreover, we identify the existence of a clear slowdown in the growth rate of average education for the cohorts born after 1960. Educational inequality – measured by the standard deviation – rises fast until the cohort born in 1950, after which it drops. Although it is still low for the younger cohorts (75%), the proportion of the adult population that has studied to at least full 4<sup>th</sup> grade has increased significantly since the beginning of the century. The same proportion for those with more than eight full years of education has also grown considerably, albeit still low, even for the younger cohorts (30%). Although it has also increased, the proportion with at least complete high school education has not yet reached 10%. These conclusions are explained to a large extent by the decrease in the retention rate of the grades in the first primary cycle (up to 4<sup>th</sup> grade), a phenomenon which is not encountered in the second cycle. The retention rate for high school education has been increasing over time, so that the probability of a young adult, who has completed this cycle, entering university has lower in recent decades.

Thirdly, we find that the *returns on human capital* are quite high (10% to 17% on average per extra year of study), principally when compared to international standards. Moreover, these returns are rising at the start of the life cycle and then dropping after around 35 years old. We cannot identify whether this profile is due to the cohort-effect or time-effect. We also found that the returns on education tend to be less for the younger than for the older cohorts. Returns on education provide a heterogeneity between the different stages of the education cycle and are relatively higher for university education and the first stage in primary schooling.

In relation to *time allocation*, we confirm the inverted U format for the male participation pattern in the labor force with negligible differences between the birth

cohorts. The life cycle pattern for the rate of female participation is also in the inverted U format, but with a significantly lower peak than that of the men (60% against almost 100%). Unlike the men, the female participation has wide variations between the cohorts, chiefly in the adult stage. Women tend to leave the labor force at 45 years old, while the men tend to leave later when they are 50 years old. There is no difference in the male and female participation patterns between the Southeast and Northeast regions, although the downward trend in the participation rate for both genders occurs earlier in the former region. There is very little difference in the male participation pattern for level of education. In the woman's case, however, we found that the participation rate tends to be significantly higher for those with a higher educational level. In terms of duration of a day's work, the evidence shows that women over 25 years old are more likely to occupy part-time jobs than the men in the same age group. We also found a substantial increase in part-time jobs in the past 20 years for young adults of both genders. With regards to employment relationship, evidence has shown a steady upward trend in self-employment over time, for both men and women. Informal employment is higher at the start of the man's and woman's life cycle, until they are 15 years old when it decreases until reaching stability at around 20%. Formal employment shows an inverted U profile during the male and female life cycle.

In relation to the *impacts of education on fertility*, we found that an extra year of education reduces the fertility of the women by an average of 0.32 child. However, this impact is quite distinct according to the women's education group, being three (four) times higher for those who have an extra year of basic education than for those who had an extra year of higher education (university). When this same analysis was performed for different female cohorts it showed that the impact of education is stronger for the older than for the younger cohorts. We could estimate from this that more than one third of the drop in fertility was due to the rise in women's level of education. In regional terms, we found that the average impact of education on fertility is greater in the less developed regions, such as the Northeast.

In relation to the *economic determining factors of female participation*, our study shows that the only factor that was statistically significant in explaining the increase in the female participation rate was the increase in the proportion of families headed by women. The effects associated to the women's wages and family income were shown to be statistically insignificant.

Considering the *economic determining factors of retirement*, we could see that the decrease in the participation rate after 50 years old is to a great extent explained by the drop in wages, further access to retirement and age. These results are fully in agreement with what would be expected in theory. It is worth noting that the impact of the age factor indicates the importance of other factors relating to the life cycle, such as health.

With respect to the *socioeconomic determining factors of child labor*, we could see that the high prevalence of child labor in Brazil could be explained by what are called demand (market wage) and supply (family size, education of parents and available schools) factors. The parents' education plays the most important role of all factors involved in the study..

The results of the *socioeconomic determining factors of young adults' learning gap* show that both personal characteristics and those of the family environment are of major importance in explaining the lag in education at school. In particular, the education of the parents – namely that of the mother – plays a crucial role. We also found that regional differences are important, indicating the relevance that the availability and quality of the school can have. Child labor was also found to be considerably significant in explaining the young adult's lag in their education.

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**Table 4.1: Fertility determining factors**

Variables	Coefficient	P-value (%)
<b><i>Intercept</i></b>	-0,90	52
<b><i>Personal characteristics</i></b>		
Age	0,26	0
Age squared (x100)	-0,17	0
Color (white)	-0,44	0
<b><i>Education (years of schooling)</i></b>		
1 (primary school)	-0,32	0
2	-0,62	0
3	-1,09	0
4	-1,75	0
5	-1,78	0
6	-2,16	0
7	-2,23	0
8	-2,60	0
9 (high school)	-2,54	0
10	-2,86	0
11	-3,07	0
12 (university)	-3,13	0
13	-3,20	0
14	-3,14	0
15	-3,57	0
16	-3,71	0
17 onwards	-3,67	0
<b><i>Region of residence</i></b>		
Mid-West	-0,60	0
North	0,41	0
Southeast	-1,37	0
South	-1,23	0
<b><i>Area</i></b>		
Urban	-0,72	0

Source: Based on Pesquisa Nacional por Amostra de Domicílios (PNAD).

Notes: (1) The dependent variable is the number of births

(2) Study group: women between 45 and 69 years of age.

(3) Dummies omitted: Education - 0 years of study; Region of residence - Northeast; Area - rural.

**Table 4.2: Average fertility and woman's education**

Variables	Fertility (number of births)	Education (number of years of schooling)
<b><i>Age group</i></b>		
45 - 49 years of age	3,9	5,1
50 - 54 years of age	4,5	4,4
55 - 59 years of age	5,1	3,6
60 - 64 years of age	5,5	3,0
65 - 69 years of age	5,7	2,7
Variation per decade	0,9	1,2
<b><i>Region</i></b>		
Mid-West	5,3	3,6
Northeast	6,4	2,5
North	6,1	3,5
Southeast	4,1	4,2
South	4,4	4,0

Source: Based on Pesquisa Nacional por Amostra de Domicílios (PNAD).

Notes: (1) The dependent variable is the number of births.

(2) Study group: women between 45 and 69 years of age.

**Table 4.3: Fertility determinig factors by age group - 1996**

Variables	Age group									
	45 to 49 years of age		50 to 54 years of age		55 to 59 years of age		60 to 64 years of age		65 to 69 years of age	
	Coefficient	P-value (%)	Coefficient	P-value (%)	Coefficient	P-value (%)	Coefficient	P-value (%)	Coefficient	P-value (%)
<b>Intercept</b>	103,93	0	-96,00	0	107,47	0	173,95	0	233,15	0
<b>Personal characteristics</b>										
Age	-4,24	2	3,94	10	-3,51	29	-5,49	20	-6,69	23
Age squared	0,05	1	-0,04	11	0,03	29	0,05	19	0,05	23
Color (white)	-0,51	0	-0,33	0	-0,51	0	-0,50	0	-0,33	4
<b>Education (years of schooling)</b>										
1 (primary school)		2	-0,36	9	-0,27	25	-0,20	50	-0,26	48
2		0	-0,92	0	-0,29	15	-0,45	5	-0,45	10
3		0	-1,12	0	-1,14	0	-0,88	0	-1,13	0
4		0	-1,76	0	-1,89	0	-1,74	0	-1,67	0
5		0	-1,99	0	-2,10	0	-0,76	23	-3,40	0
6		0	-1,71	0	-2,39	0	-2,39	0	-2,44	0
7		0	-2,34	0	-2,11	0	-2,33	0	-3,26	0
8		0	-2,51	0	-2,73	0	-2,84	0	-2,68	0
9 (high school)		0	-2,17	0	-3,76	0	-3,35	6	-4,61	1
10		0	-2,98	0	-2,90	0	-2,64	1	-4,39	0
11		0	-3,11	0	-3,27	0	-3,24	0	-3,37	0
12 (university)		0	-3,49	0	-4,61	4	-2,95	41	-3,78	34
13		0	-3,32	0	-3,24	5	-2,17	38	-2,88	46
14		0	-3,66	0	-3,70	0	-3,64	0	-3,46	0
15		0	-3,73	0	-3,89	0	-4,05	0	-5,10	0
16		0	-4,05	0	-4,04	0	-3,93	0	-4,13	0
17 onwards		0	-3,55	0	-4,22	0	-4,07	0	-3,51	1
<b>Region of residence</b>										
Mid-West		0	-0,76	0	-0,48	0	-0,26	0	-0,29	0
North		36	0,84	0	0,67	2	0,41	25	-0,07	86
Southeast		0	-1,39	0	-1,33	0	-1,45	0	-1,57	0
South		0	-1,35	0	-1,06	0	-1,24	0	-1,40	0
<b>Area</b>										
Urban	-0,78	0	-0,75	0	-0,69	0	-0,52	0	-0,89	0

Source: Based on Pesquisa Nacional por Amostra de Domicílios (PNAD).

Notes: (1) The dependent variable is the number of births

(2) Study group: women between 45 and 69 years old.

(3) Dummies omitted: Education - 0 years of study; Region of residence - Northeast; Area - rural.

**Table 4.4: Fertility determining factors by geographic region**

Variables	Region									
	Mid-West		Northeast		North		Southeast		South	
	Coefficient	P-value (%)	Coefficient	P-value (%)	Coefficient	P-value (%)	Coefficient	P-value (%)	Coefficient	P-value (%)
<i>Intercept</i>	-4,22	36	0,62	85	-18,77	0	-1,12	57	-2,09	45
<i>Personal characteristics</i>										
Age	0,30	7	0,19	11	0,90	0	0,24	0	0,26	1
Age squared	-0,18	23	0,00	28	-0,01	0	0,00	1	0,00	5
Color (white)	-0,39	0	-0,16	12	-0,55	1	-0,51	0	-0,93	0
<i>Education (years of schooling)</i>										
1 (primary school)	-0,32	32	-0,40	7	-0,34	48	-0,24	16	-0,28	19
2	-0,42	10	-0,71	0	-0,83	2	-0,59	0	-0,51	0
3	-0,52	3	-1,08	0	-0,90	1	-1,12	0	-1,03	0
4	-1,37	0	-1,55	0	-1,45	0	-1,83	0	-1,55	0
5	-1,58	0	-2,52	0	-2,02	0	-1,39	0	-2,09	0
6	-2,52	0	-2,49	0	-1,49	5	-2,01	0	-2,11	0
7	-2,03	0	-1,86	0	-2,63	0	-2,30	0	-2,32	0
8	-2,09	0	-2,73	0	-2,59	0	-2,61	0	-2,37	0
9 (high school)	-2,21	9	-3,13	0	-2,36	2	-2,42	0	-2,31	0
10	-3,67	0	-2,47	0	-3,39	0	-2,88	0	-2,55	0
11	-2,87	0	-3,69	0	-3,89	0	-2,81	0	-2,74	0
12 (university)	-1,17	46	-4,23	5	0,00	-	-3,49	0	-2,26	2
13	-2,50	9	-4,63	0	-3,17	29	-2,80	0	-3,33	0
14	-3,46	0	-4,21	0	-3,84	0	-2,83	0	-2,94	0
15	-3,31	0	-4,59	0	-4,93	0	-3,29	0	-3,13	0
16	-3,30	0	-4,96	0	-4,53	0	-3,29	0	-3,50	0
17 onwards	-3,30	0	-4,66	0	-4,66	1	-3,40	0	-3,24	0
<i>Area</i>										
Urban	-0,59	0,1	-0,53	0	0,25	61	-1,14	0	-0,57	0

Source: Based on Pesquisa Nacional por Amostra de Domicílios (PNAD).

Notes: (1) The dependent variable is the number of births

(2) Study group: women between 45 and 69 years of age.

(3) Dummies omitted: Education - 0 years of study; Region of residence - Northeast; Area - rural.

**PROJETO : BID 98 - DETERMINANTES DA FECUNDIDADE**  
**PEDIDO : DETER4**  
**BASE DE DADOS: PNAD96**  
**DATA:02/02/98**

**media da fecundidade escolaridade para mulheres de mais de 45 anos 2436**

OBS    \_TYPE\_   \_FREQ\_   FEC45   ESCOL45  
 1        0     36021   4,9369   3,67094

**media da fecundidade escolaridade para mulheres de mais de 45 anos 2437**  
**por faixa de idade**

OBS    FXIDADE   \_TYPE\_   \_FREQ\_   FEC    ESCOL  
 1 .....        0     6491   5,64412   2,29116  
 2 45a49        0     8648   3,92551   5,10171  
 3 50a54        0     6641   4,53705   4,37251  
 4 55a59        0     5530    5,104    3,55883  
 5 60a64        0     4831   5,48161   3,00022  
 6 65a69        0     3880   5,68743   2,72401

**media da fecundidade escolaridade para mulheres de mais de 45 anos 2438**  
**por regio**

OBS    REGIAO   \_TYPE\_   \_FREQ\_   FEC    ESCOL  
 1 co            0     2908   5,29174   3,57327  
 2 ne            0    11084   6,41947   2,53402  
 3 no            0     2017   6,11873   3,47541  
 4 se            0    13514   4,12937   4,24448  
 5 su            0     6498   4,43077   3,9897

**media da fecundidade escolaridade para mulheres de mais de 18 anos 2440**

OBS    \_TYPE\_   \_FREQ\_   FEC18   ESCOL18  
 1        0     107705   2,92373   5,73075

**Explanation Rate of Fertility by Age and Region**  
**(with and without family income per capita as an independent variable)**

<b>Rate A</b>		<b>Rate B</b>	
with income	without income	with income	without income
0,325	0,354	0,239	0,252

Source : Based on data in the 1996 PNAD National Household Sampling Research

Note: Rate A = 
$$\frac{\sum \mathbf{b}_i \text{Educação}_{i_{69}} - \sum \mathbf{b}_i \text{Educação}_{i_{45}}}{\text{fecundidade}_{69} - \text{fecundidade}_{45}}$$

Rate B = 
$$\frac{\sum \mathbf{b}_i \text{Educação}_{i_{NE}} - \sum \mathbf{b}_i \text{Educação}_{i_{SE}}}{\text{fecundidade}_{NE} - \text{fecundidade}_{SE}}$$

**Table 4.5: Determining factors of female participation in the labor market by cohort and during the life cycle**

Variables	Regression including dummies for cohorts		Regression including dummies for time	
	Coefficient	P-value (%)	Coefficient	P-value (%)
<i>Personal characteristics</i>				
Age	0,18	0	0,11	0
Age squared	-0,25	0	-0,26	0
Head (female )	4,24	0	11,43	0
<i>Earnings</i>				
Family income per capita (log)	0,16	0	0,15	0
Wage (log)	-0,03	1	0,08	1

Source: Based on Pesquisa Nacional por Amostra de Domicílios (PNAD).

Notes: (1) The dependent variable is the log of the participation rate.

(2) The family income per capita variable excludes the income from the women's work.

(3) The regression includes dummies for the cohorts.

**Table 4.6: Economic determining factors of retirement**

Variables	Coefficient	t-Statistics
<i>Intercept</i>	1,49	13,4
<i>Personal characteristics</i>		
Age	-0,03	-46,2
Gender (male)	0,93	47,5
<i>Inclusion in labor market</i>		
Retired	-0,58	-29,0
<i>Earnings</i>		
Net family income per capita from wage	0,00	-9,4
Allowance or retirement income	0,00	-15,0
Hourly wage	0,07	13,5

Source: Based on Pesquisa Nacional por Amostra de Domicílios (PNAD).

Notes: (1) The study group is of people between 50 and 64 years of age.

(2) The dependent variable is to have or have not participated in the work force (Probit).

(3) The wage-hour was calculated for those outside the labor market as being equal to the average wage of workers who are still in the labor market with identical personal characteristics.

**Table 4.7: Socioeconomic determining factors of child labor**

Variables	Coefficient	t-Statistics
<b><i>Intercept</i></b>	-0,66	-13,2
<b><i>Personal characteristics</i></b>		
Gender (male)	0,39	14,9
<b><i>Area</i></b>		
Urban	-0,83	-34,3
<b><i>School attendance</i></b>	-0,42	-14,6
<b><i>Family environment</i></b>		
Father's level of education		
Incomplete primary education	-0,08	-3,3
Incomplete secondary education	-0,18	-4,3
At least complete secondary education	-0,29	-5,7
Mother's level of education		
Incomplete primary education	-0,07	-3,1
Incomplete secondary education	-0,21	-5,3
At least complete secondary education	-0,36	-7,9
Gender of head (male)	-0,10	-3,2
Number of children	0,02	4,7
<b><i>Occupation</i></b>		
Occupied head	0,22	6,6
<b><i>Post in occupation</i></b>		
Self-employed head	0,41	19,9
<b><i>Earnings</i></b>		
Net family income per capita from wage	0,00	-3,1
Hourly wage	3,97	5,3

Source: Based on Pesquisa Nacional por Amostra de Domicílios (PNAD).

Notes: (1) The study group is that of children between 10 and 14 years old.

(2) The dependent variable is to have or have not participated in the work force (Probit).

(3) The wage-hour was calculated for those outside the labor market as being equal to the average wage of workers who are still in the labor market with identical personal characteristics.

**Table 4.8: School lag determining factors among juveniles**

Variables	Coefficient	t-Statistics
<i>Intercept</i>	-1,37	-240,9
<i>Personal characteristics</i>		
Age	0,31	3245,7
Gender (male )	0,45	786,8
Color (white)	-0,39	-622,7
<i>Region of residence</i>		
Northeast	0,61	690,2
Southeast	-0,12	-150,6
<i>Area</i>		
Urban	-0,38	-502,1
<i>Family environment</i>		
Father's level of education		
Incomplete primary education	-0,48	-601,2
Incomplete secondary education	-0,49	-426,7
At least complete secondary education	-0,49	-403,7
Absent father	-0,25	-107,3
Mother's level of education		
Incomplete primary education	-0,67	-921,5
Incomplete secondary education	-0,85	-793,0
At least complete secondary education	-1,09	-979,0
Absent mother	0,14	72,3
Gender of head (male)	-0,27	-126,3
Number of children	-0,01	592,0
<i>Family income</i>	0,00	-478,7
<i>Participation in work force</i>	0,47	588,4
<i>Community environment</i>		
Primary school in the state (*)	0,91	145,7
Secondary school in the state (**)	-0,89	-280,8

Source: Based on Pesquisa Nacional por Amostra de Domicílios (PNAD).

Notes: (1) Study group: children between 7 and 18 years of age.

(2) The dependent variable is the school lag measured by the class-age gap.

(\*) Proportion of public primary schools in the person's residence state.

(\*\*) Proportion of public secondary schools in the person's residence state .