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Adolescents in Latin America and the Caribbean: Examining Time Allocation Decisions with Cross-Country Micro Data

by

Naercio Aquino Menezes-Filho (coordinator)*
Reynaldo Fernández*
Paulo Picchetti*
Ricardo Barros**
Carlos Corseuil**
Miguel Fogel**
Daniel Santos**
Simone Wajnman***
Maria Carolina Leme****

* Fundação Instituto de Pesquisas Económicas, Universidade de São Paulo
** Instituto de Pesquisa Económica Aplicada
*** Cedeplar Centro de Desenvolvimento e Planejamento Regional
**** Centro Brasileiro de Análise e Planejamento

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Abstract

This paper uses micro data from a collection of household surveys conducted in 17 countries in Latin America and the Caribbean to examine the time allocation decisions of adolescents. We find that an econometric model with household and country-level variables, when applied simultaneously to all the countries in the sample, is able to predict quite well the choices among school, work, both or neither in most of the countries. Moreover, the household variables alone, especially parental education, go a long way towards predicting the rates of school attendance, which means that the stage of development, as measured by per capita GDP for example, impacts human capital accumulation mainly through the households'characteristics.

Keywords: Schooling, Time Allocation, Child Labor, Latin America and the Caribbean

JEL Classification: O15, J24, O12, J13

1. Introduction

Latin American and Caribbean (LAC) countries generally face unsatisfactory outcomes in terms of income distribution and poverty, as compared to more developed areas of the world (see Ravaillon and Chen, 1997, for example). Many recent studies relate these problems to factors such as education, demography, industrialization (the Kuznets hypothesis) and macroeconomic policy.[1] The literature on the importance of human capital for economic development is particularly large.[2]

In order to better understand the differences in human capital accumulation across LAC countries it is essential to look at the framework surrounding the household decisions related to youth labor supply and education, that is, their time allocation decisions. These decisions are fundamental to the future of poverty and inequality outcomes in LAC. Moreover, the diversity of situations faced by youth and adolescents in this region makes a comparison among its different countries very fruitful, perhaps providing the identification conditions needed to carry out careful empirical work.

Most of previous analysis related to schooling decisions focused on a single country or used aggregate data for several countries. An exception is Behrman, Duryea and Székely (1999), who use a similar data set, but they focus on macro conditions and their permanent effects on schooling attainment. The main importance of this study is to compare the processes determining time allocation decisions in several LAC countries using comparable micro data, for different age groups, with the same methodology and incorporating both household-level and aggregate-level variables in the analysis.

The theme of child labor is receiving more and more attention in economics. Basu and Pham (1998) set up the theoretical foundations for the field. This is summarized, together with some empirical evidence in Basu (1999). In a recent survey on the subject, Psacharopoulos (1997) concludes the child labor contributes significantly to household income, although it is associated with a reduction in school attainment. Psacharopoulos and Arraigada (1989) find that school participation is positively related to household resources and negatively to demand for household labor. Jensen and Nielsen (1997) find for Zambia that poverty forces households to

[1] See Higgins and Williamson (1999), Agénor, 1998, Bourguignon and Morrison, 1998, Deininger and Squire, 1998, among others.
[2] See Behrman, Duryea and Székely (1999) and the references therein.

keep their children out of school, whereas Patrinos and Psacharopoulos (1997) emphasize for Peru that the number and age structure of siblings have important effects on schooling decisions.

Filmer and Prichett (1999) provide a comprehensive study on the effects of household wealth on education attainment in 35 countries (using Demographic Health Surveys) and find that, while the poor have lower attainment rates than the rich all around the world, the gap between the education levels of the rich and poor varies substantially among countries.[3] It ranges from 10 grade levels in India to 2 in Zimbabwe and the Philippines. In the LAC countries studied, the authors find that the gap is around 4 years of education, and although poor people do have basic education, they drop out much more frequently than the rich. However, the authors include only 5 LAC countries in their analysis and do not control for household background variables that may be very important determinants of school attendance, given the brief review of the literature above.

A careful analysis of the differences in the rates of school attendance across different LAC countries, together with their main similarities, can shed light on important issues related to the expected level of education of the labor force in the near future, as well as the consequences of low and unequally distributed levels of education. Moreover, it can highlight policy recommendations aimed at improving educational levels and the quality of education in Latin America.

With these objectives in mind, the main aim of this study is to examine and compare the microeconomic and macroeconomic determinants of the time allocation decisions across 17 Latin American and Caribbean countries using household level data. The paper first describes in detail the current situation of the different countries in terms of percentage of children who are attending schools, supplying labor in the market, doing both, or doing neither, using the micro data available from the household surveys for each country. This is to assess the quality of the data and compare the results with those of other studies on the subject.

The paper then pools the data across countries and investigates the conditional effect of various micro and macro variables on the decision to attend school, enter the labor market, do both, or do neither. This is done through a multinomial logit regression. As the focus is on one cross-section for each country, macroeconomic effects can be identified as long as they do not

[3] As the DHS do not measure income, Filmer and Pritchett (1999) construct a wealth measure using principal components analysis based on household characteristics. This measure should be correlated with permanent income.

include country-specific effects. The emphasis will be on the comparison between family and country effects in order to understand which factor is more important to school attendance: the country where one lives or one's family conditions.

2. Data and Specification

The main data used in this paper come from the household surveys for 17 Latin American countries, compiled and standardized by the Inter-American Development Bank (IDB). While Behrman, Duryea and Székely (1999) discuss this data set at length, comparing it with more widely used ones (such as UNESCO), this section discusses the data's main advantages and drawbacks. The countries studied here (survey year) are Honduras (98), Nicaragua (98), El Salvador (98), Brazil (97), Mexico (96), Dominican Republic (96), Venezuela (97), Bolivia (97), Paraguay (98), Ecuador (98), Colombia (97), Costa Rica (97), Chile (96), Panama (97), Peru (97), Uruguay (97), and Argentina (96). The surveys for Argentina e Uruguay cover only urban areas, and for Venezuela do not have a urban/rural identifier. The main problem of this data set is the time series variation in the surveys, so it is necessary to assume that the relationships observed are equilibrium relationships not affected by cyclical variations. The econometric exercise below includes cyclical variables to control for business cycle effects on time allocation decisions.

The sample was split into 4 age groups: 12/13, 14/15, 16/17 and 18/19. The dependent variable (time *Allocation*) is always defined as a categorical variable so that one of the following four values can be assumed:

- 0: if the adolescent is not studying and is not in the labor market (either working or looking for a job). This is the base (excluded) category.
- 1: if the adolescent is studying and not in the labor market.
- 2: if the adolescent is not studying and is in the labor market.
- 3: if the adolescent is studying and is in the labor market.

The variables used in the econometric analysis below can be divided into two groups: micro variables (that vary across households) and aggregate variables (country specific). Below is a definition of the variables to be used in the exercises, a rationale for their presence in the

equation, and an explanation of their predicted effect on the time allocation decisions. The equation to be taken to the data is:

$$Allocation = \alpha + \beta_1.age + \beta_2.gender + \beta_3.fincome + \beta_4.impyA\_h + \beta_5.nads + \beta_6.nchild + \beta_7.finch + \beta_8.finads + \beta_9.finc2 + \beta_{10}.finch2 + \beta_{11}.finads2 + \beta_{12}.educpar + \beta_{13}.occup + \beta_{14}.urban + \beta_{15}.compos + \beta_{16}.perc\_u + \beta_{17}.\ln pop + \beta_{18}.desemp + \beta_{19}.depend + \beta_{20}.GDP$$

The variables are defined as follows:

- age: is a dummy defining the specific individual age within each age group (the omitted category is the younger age). This variable is expected to have a positive impact on the outcomes associated with the working status, since older kids are more likely to have to help their families in work and/or to have dropped out from school following a failure.
- gender: defines the gender of the adolescent. For cultural and sociological reasons, boys are more likely to be working and girls to be at home, helping younger siblings. The predicted effect on the studying outcome is uncertain.
- fincome: is the total family income (excluding the adolescent own income) converted into 1995 dollars using PPP. This variable is predicted to have a positive effect on schooling since, in the presence of credit constraints, poorer households are less likely to be able to meet the direct and indirect costs of education. Note that, conditional on parental education (see below), this variable is expected to reflect mainly transitory shocks to income.
- impyA_h: is a variable identifying the households for which total family income was imputed. The imputation procedure was used because there was a number of missing values for individual incomes that varied a great deal across countries, which raised concerns regarding non-random mis-measurement of income.[4]
- nads: is the number of persons in the household older than 8 (excluding the own adolescent). The predicted effect of this variable is ambiguous since, on

the one hand it can rise the probability of the working outcomes since, conditional on family income, the higher the number of persons present in the household, the higher will the need for resources be. On the other hand, the older people in the household may take car of younger children, freeing other children to go to school.

- nchild: is the number of children in the household younger than 8. This variable is included in order to capture the number of children in the household that are in need of care. This will tend to increase the probability that the adolescent will stay at home to help with child raising or go to work to help with the family budget, since family income earned by adults is being controlled for.
- Finch: is an interaction between family income and the number of children in the household to examine the possibility that family income could be more important in households where the number of children is high.
- Finads: is an interaction between family income and the number of persons older than 8.
- Finc2: is family income squared to allow for possible non-linearities in the relationship between income and time allocation.
- Finch2: is an interaction between family income squared and the number of children in the household
- Finads2: is an interaction between family income squared and the number of persons older than 7.
- educpar: is the maximum parental education. This variable is expected to have a positive impact on adolescents' schooling outcomes for various reasons. It is a proxy for permanent family income, it may also indicate that the family has more information about the returns to education and, finally, educated parents can help children go through schooling with better performance, which may lower drop-out rates. This proxy is used because it seemed that one highly educated parent is sufficient to feed these effects through to the child, even if

[4] The imputation procedure was carried out by the IDB. Details are available from the authors upon request.

the other parent has a lower level of education. Moreover, there are many single-parent households in the sample.

- occup: is a dummy defining the occupation of the head of the household, that takes the value of 1 if the head is an independent worker (self-employed of manager) and 0 if he or she is an employee or is currently unemployed. This variable is predicted to have a positive effect on the probability associated with working outcomes, for it may increase the availability of labor market opportunities for the youngster.
- urban: is a dummy taking the value of one if the adolescent lives in an urban area. This variable is predicted to have a positive impact on studying, because of the availability and better quality of schools in urban areas and because of the attraction that agriculture work has for youngsters in rural areas.
- compos: is the household composition (1 a nuclear family and 0 designates an extended family).

The macro variables were taken from the World Bank's *Development Indicators* (1998). The main *macro variables* are:

- gdp – is the country per-capita GDP (converted into 1995 dollars using PPP). It is expected that richer countries will have a higher percentage of children in school, perhaps because of more resources devoted to human capital formation.
- depend – is the dependency ratio, defined by age structure of the population: [(n<15 or n>65)/15<n<65]), where n is the size of population in each group. It is expected that the higher the dependency ratio, the higher the outcomes associated with working, since adolescents may have to work to support those who are not in the labor force.
- pop – is log (population size) to capture possible scale effects.
- urban – is the urbanization rate.
- youth unemployment rate – unemployment of those between 12 and 19 years old to capture cyclical effects that mainly affect youth. The predicted effect of

this variable is to increase schooling probability, since a high unemployment rate will mean that the labor market is not very attractive and therefore represents a good opportunity to invest in human capital.

3. Econometric Methodology

The problem of time allocation decisions can be modeled within the following structure:

Choices: $j = 0,1,2,3$

Households: $i = 1,2,...,N$

Regressors: $p = 1,2,...,P$

Linear predictor for household i: $X_i \beta_j$

Probability of household i choosing j:

$$\Pr(Y_i = j) = P_{ij} = \frac{\exp(X_i \beta_j)}{1 + \sum_{k=0}^{J} \exp(X_i \beta_k)}$$

Vector of Probabilities (for all households in the sample):

$$\Pr(Y = j) = P_j = \frac{\exp(X \beta_j)}{1 + \sum_{k=0}^{J} \exp(X \beta_k)}$$

Estimation of this model through maximum likelihood is fairly straightforward (see Greene, 1993, p.667).[5] The mean predicted probabilities were computed by calculating the average of individual probabilities:[6]

$$\overline{\hat{P}}_j = \frac{1}{N} \sum_{i=1}^{N} \hat{P}_j$$

where the $\hat{P}_j$ is computed for each household, using the observed values of the regressors. To compute the marginal effects of a regressor X_p, the other variables were fixed for each

[5] Stata software was used to perform all the procedures described in this section.
[6] This approach was preferred to computing the probability at the average values of the regressors.

household at their actual values and then impute various values were imputed for X_p over the sample range:

$$\{\overline{\hat{P}}_j \mid x_p = x_{p,\min}, \overline{\hat{P}}_j \mid x_p = x_{p,z}, ..., \overline{\hat{P}}_j \mid x_p = x_{p,\max}\}$$

$\overline{\hat{P}}_j$ is then graphed as a function of $x_{p,z}$

4. Data Description

4.1. Descriptive Statistics

Table 1 presents some descriptive statistics of the variables used in the analysis, including the overall mean, variance, and a decomposition of the variance into within-countries and between-countries components.[7] In time allocation decisions, about 62 percent of adolescents in the sample (aged between 12 and 19) are studying only, whereas the rest are roughly evenly split among the three other states. One can notice as well that most of the observed dispersion occurs within countries, which is generally true for all the other variables as well.

The description of the household variables show firstly that the average number of younger children is less than one, with a standard deviation (s.d.) of about 1.2. Moreover, the average number of adults is quite high at 4.31, with an s.d. of 4.12. Mean total monthly family income is about US$1,000, with an s.d. of around US$2,300 due almost exclusively to variation across households within countries, which reflects the wide income distribution that prevails in most of these countries.[8] Mean parental education is about 7 years of schooling, with an s.d. of 4.5, and again about 90 percent of the variance comes from inside the countries. Finally, about 70 percent of the families live in urban areas. In conclusion, one can say that the countries in the sample look fairly homogeneous, with most of the variation observed among households arising from the high level of inequality that prevails in most of Latin America.

The description of the data set concludes by looking at the behavior of the aggregate variables.[9] As shown in Table 1, the urbanization rate is 75 percent (which confirms the micro information), the mean population size is around 29 million, the average youth unemployment

[7] The tables and figures are located at the end of the paper.
[8] It is important to emphasize that the sample only includes households with adolescents aged between 12 and 19.
[9] This information comes from the World Bank's *Development Indicators*.

rate (calculated from the micro data) is about 18 percent (and shows a great deal of variation among countries), the dependency ratio is 0.62 and the mean per-capita GDP is about US$5,700, with an s.d. of around US$2,300. If the mean GDP figure is divided by 12 a monthly GDP estimate of US$475 is obtained, which compares with the mean per capita family income (calculated from the micro data) of around US$200, which does not seem too bad, especially since only a fraction of the total sample is used.

4.2. Time Allocation

Figures 1 presents a description of the time allocation decision of adolescents at two different stages of their life cycle (12/13 and 16/17).[10] First, it is clear that the countries differ with respect to the percentage of adolescents in each of the four possible states defined in this study. It is important to emphasize that "work" here also encompasses cases where the individual is looking for job, that the Argentinean data refer to greater Buenos Aires and that the Uruguayan data refers to urban areas only.[11]

Keeping in mind the restrictions above, the countries are ordered in terms of the percentage of individuals in each age group who are studying, independently of the working status. In the first age group (12/13), Chile, the Dominican Republic, Argentina, Peru, Venezuela, Brazil, Panama, Bolivia and Colombia have more than 90 percent of young adolescents in school, whereas Colombia, Paraguay, Mexico, Costa Rica, Ecuador, and El Salvador[12] have between 80 percent and 90, while and Nicaragua and Honduras have between 70 percent and 80 percent. It is important to notice however, that some countries have very high shares of adolescents studying and working at the same time, even at this tender age. The countries with the most notable percentages are Peru (30 percent), Ecuador (25 percent), and Paraguay, Bolivia and Brazil (15 percent each).

In the 16/17 age group there is, as expected, a greater percentage of working adolescents. The countries where 70 percent or more of individuals are studying, independently of working status, are Chile, the Dominican Republic, Argentina, Uruguay, Peru, Brazil and Bolivia. These

[10] All results will only be presented for two of the four age groups for the sake of brevity. The results for the other two age groups (14/15) and (17/18) are available upon request.
[11] The survey in Uruguay is taken only for individuals 14 and older, so there are no results for the 12 to 13 age group.
[12] For a thorough study of the rapid improvement in school retention rates in El Salvador, see Cox-Edwards and Ureta (1999).

countries seem to be doing very well in terms of school attendance. The countries in an intermediate position, with between 50 percent and 70 percent of their youngsters in school, are Venezuela, Panama, Colombia, Paraguay, Costa Rica, Ecuador and El Salvador. The countries with less than 50 percent are Mexico, Nicaragua, and Honduras.

The overall picture that emerges from the analysis above is one of cautious optimism. Latin America does seem to be doing relatively well in terms of the education of young adolescents (12/13), since more than 75 percent of the individuals in this age group are studying in each and every country examined in this study. The problem remains with the education of the older group (16/17), who should be in the high school, although on average only 60 percent of adolescents are attending school. Moreover, the differences among countries and between regions within countries (not shown here) vary markedly, ranging from about 20 percent of students in the rural areas of Honduras, Nicaragua and for females in Mexico to 80 percent in urban Bolivia and the Dominican Republic (for both males and females). The possible determinants of this state of affairs are considered below.

4.3. Income Inequality and Time Allocation

In a recent survey on growth and inequality, Aghion, Caroli and García-Peñalosa (1999) emphasize the harmful effects that inequality can have on growth. The argument is that, in the presence of imperfect capital markets, (human) capital investments can remain below optimal levels, since some agents end up with relatively high levels of marginal productivity but without the funds necessary to carry out the investments. With the data set in hand, one can investigate whether this relationship holds true in different Latin American countries, that is, whether within-country income inequality is correlated with school attendance. In the econometric work below, this relationship will be conditioned on the controls described above.

Figures 2 and 3 relate the time allocation decisions of adolescents to the location of their families in the income distribution, for the two age groups defined above: 12/13 and 15/16. Concentrating firstly on the younger group, time allocation seems to be correlated with income per capita, especially in relation to the time devoted to work. But there is a wide variation in this correlation across countries. For example, in Chile, Argentine, Dominican Republic and Venezuela, almost everyone is in school, independently of family income.

The other clear pattern that emerges is that youngsters with families in the bottom of the distribution are much more likely to be working as well as studying, which probably means that credit constraints are binding and could lead to higher drop out rates when those children are older. This seems to be the case in Peru, Brazil, Bolivia, and Ecuador. For most of the other countries, the children in the poorest families are more likely to be working full time, with no time dedicated to formal schooling, or working and studying at the same time as compared to children in richest families.

For the older group (Figure 3) the differences in time allocation between the extremes of the income distribution are more dramatic. While the average school attendance for the tenth decile is 80 percent, in the bottom of the distribution this number is closer to 40 percent, and in some countries, like Honduras, Nicaragua, Mexico and Costa Rica, this figure falls to nearly 20 percent.

The ratio between the percentage of adolescents attending school among those in the top and those in the bottom of the income distribution is computed as an indicator of poor intergenerational mobility.[13] The countries with the highest ratio are Nicaragua (3.8) and Mexico (3.5). The middle group (with a differential between 2 and 3) is composed of Costa Rica (2.7), Bolivia (2.8), Panama (2.6), Ecuador (2.3), Honduras (2.3) and Uruguay (2). In the other countries access to education is more equitably distributed.

5. Results

This section reports the results of applying the multinomial logit regression to the data, explaining the time allocation decisions in terms of variables that vary across individuals, households and countries. The section will first present the estimated coefficients, then assess the fit of the model and finally present all the main results in the form of graphs that are easier to interpret than the regression coefficients, as the marginal effects can be very different from estimated parameters in this non-linear setting.

It is necessary to begin, however, by emphasizing the limitations of the present approach. A number of available country level variables are included in order to more precisely capture the micro effects and understand the impact of the aggregate variables themselves. However, it is

[13] Of course, this is only a raw indicator, since other possible determinants of school attendance are not being controlled for.

possible that variables like youth unemployment rates and per capita GDP are correlated with other omitted country-level effects. Household-level variation is additionally used to include country fixed effects and control for all time-invariant country specific determinants of time allocation decisions, but the coefficients on the micro variables do not change significantly.[14]

5.1. Estimated Coefficients

Tables 2 and 3 present the coefficients (standard errors) estimated by the multinomial logit regression for each of the three outcomes, relative to the omitted category "not working and not studying." Interestingly, the results are very similar for both age groups. One can note that most of the coefficients were precisely estimated, with the important exceptions of family income for both age groups and of family composition and population for the youngest group. Moreover, they have the predicted signs. For example, older children are less likely to be studying and males more likely to be working. The number of younger children seems to depress the probability of studying, while parental education and living in urban areas have the opposite effect. A more detailed examination of the regression results is found in the graphical analysis below.

5.2. Fit of the Model

Figures 4 and 5 describe the fit of the estimated models, comparing the observed frequencies with the average predicted probabilities and with the predictions using only the micro variables, for each outcome in each country. This assesses the ability of the model estimated with the pooled data to explain the resulting time allocation decisions in all the different countries. If the fit is good enough, it will mean that there is a common relationship between the independent variables and the time allocation decisions in all the countries under study.

The situations where the differences between the predicted and the observed outcomes are significant will mean that there are unobserved, perhaps institutional effects that make a country deviate from an predicted outcome. Moreover, by assessing the specification that includes only the micro variables, the figures examine whether household characteristics do a good job in explaining the schooling and work decisions, without the need for country-specific variables.

[14] The results are available from the authors upon request.

In general, the complete model is able to predict quite well the observed frequencies for the two age groups and four outcomes in Latin America and the Caribbean.[15] The only significant deviation in the younger group of adolescents occurs in Ecuador, where the percentage of children who are only working is higher than the predicted by the model; this is also reflected in a lower rate of individuals only studying.

With regard to the micro variables (individuals and household), they are also able to predict quite well the time allocation decisions of young adolescents. The main failures again occur in Ecuador and in Peru, which display a low share of children studying only, given their households characteristics. This situation is also reflected in a high rate of children working and studying at the same time.[16]

With respect to the 16/17 age group, the complete model is also able to predict quite well what is happening in terms of time allocation decisions, as Figure 5 demonstrates; this is perhaps surprising given the high variability in behavior across countries in this age group. The main deviations from predicted outcomes occur in Bolivia, Colombia, the Dominican Republic and El Salvador, which are all doing quite well in terms of "studying only" given their observables. On the other hand, Costa Rica, Ecuador, and Mexico are not doing so well in terms of full-time studying, as compared to the predictions of the model; correspondingly, these countries display a high rate of children only working.

In terms of the predictions using only the micro variables, one can see that they are close to the predictions that use the whole model, for most of the countries. This is an important result, since it means that the family and household characteristics are an important aspect behind the outcomes observed in some countries in terms of time allocation decisions. By looking at the regression results more carefully one will be able to gauge which are the most important variables driving this result.

A quick way to examine the cases where the micro model cannot explain as well as the complete model, is to look at the "working and studying" outcome. In countries like Argentina, Chile, Honduras, and Panama, the aggregate variables are important in explaining the small percentage of children attending school and working at the same time. The case of Paraguay is

[15] This might be not totally unexpected, given that the complete model includes the effect of some aggregate variables, especially per capita GDP, that are good predictors but miss a good explanation.
[16] It is important to note however, that this could be due to methodological differences in the way that the household surveys consider people to "be in the labor market."

peculiar, since the micro variables do a better job in predicting the observed percentages than the complete model. On the other hand, Brazil, Ecuador and Peru have, as shown before, a higher than predicted percentage of children in this group, perhaps because of institutional features intrinsic to these countries.

5.3. Main Effects

Figures 6 to 10 describe the effects of the main variables included in the multinomial logit regression for the two age groups examined here. The impact of parental education is the first variable considered, and it seems that this is one of the most important determinants of the time allocation decisions of adolescents in Latin American and the Caribbean, even after controlling for other household and country confounding effects. Moreover, its effect seems more intense among 16/17 year-old adolescents.

A rise in parental years of schooling increases the probability of the "only studying" outcome at the expense of all the other possibilities, particularly the "only working" alternative. The estimated probability of "study and not work" in the 16/17 age group ranges from about 30 percent for those whose parents are illiterate to about 85 percent for children of college graduates. The effect is also important among younger children. The obvious policy conclusion is that a boost in education can have dramatic effects for future generations in terms of productivity and growth.

Total income also has an impact on the allocation of time, even after controlling for countries' per capita GDP and for the number of younger and older people in the household. Interestingly enough, this impact is only significant among the older adolescents (aged between 16 and 17), where it increases the probability of the "study only" outcome from 50 percent to about 80 percent, when family income rises from US$200 to US$10,000 (which is the observed inter-quartile range). Family income also reduces the percentage of children working and not studying. In the younger group the effect is quite small, which means that family income is not an important factor for schooling decisions at this stage of the life cycle. It is important to emphasize that, once parental education is controlled for parental education, the income effects can be regarded as a proxy for transitory shocks to income.

Another very important determinant of the schooling and working decisions is the number of younger children in the household, especially for those between 16 and 17 years of

age. Figure 7 suggests that the probability of "studying only" for an adolescent in this age group declines from 60 percent to about 20 percent in a typical household, when the number of younger siblings goes from 1 to 10. For 12 and 13-year-olds the equivalent figures are 85 percent and 70 percent. All other outcomes are more likely in this case, especially the "working and not studying" outcome. It seems therefore that when the number of younger children is large, adolescents have to go to work in order to help with the family budget. On the other hand, the number of individuals older than 8 does not have an important impact on time allocation decisions. Its only tangible effect is to increase slightly the probability of the "working only" outcome for those between 16 and 17 years of age.

In terms of the occupation of the head of household and the family composition, the effects are also quite small. Neither having a head working independently nor living in an extended family has important effects on time allocation decisions, as Figure 8 shows. However, Figure 9 reveals that being male and living in urban areas both have tangible impacts in the sense of increasing the probability of outcomes associated with working. For the older group of youngsters, males are 20 percent more likely to be working than females, whereas those living in rural areas are about 10 percent more likely to work than those in urban centers.

Turning now to the country specific macro variables, one of the most important in the process of time allocation decisions is, as expected, GDP per capita (Figure 10). In both age groups, the greater the country GDP per capita, the higher the percentage of youngsters who study and do not work. For 16/17 year olds, for example, each additional US$1,000 of GDP per capita increases the probability of the "studying only" outcome by about 5 percent, linearly. Its other tangible impact is to reduce the probability of the "studying and working" outcome, from 60 percent (with a per capita GDP of US$1,000) to about 5 percent when it reaches US$10,000.

Youth unemployment also has an important impact on schooling, but this time the effect is more noticeable among younger children. The outcome "studying only," for those between 12 and 13, rises in probability terms from about 68 percent in countries with low unemployment (about 3 percent) to about 80 percent where the unemployment rate among the youth reaches 20 percent, with the effect stabilizing after that. The outcome whose probability is most reduced with the rise in unemployment is "working and studying," which goes from 30 percent in low unemployment countries to about 1 percent where the unemployment rate is very high.

6. Country Specific Results

An important question surrounding this work is whether the results obtained so far reflect an aggregation of different relationships between household characteristics and time allocation decisions taking place in different countries or whether there is a uniform pattern in the determinants of these decisions. In order to verify this question, separate regressions were run, using the same specification as before, for each of the countries in the sample. The results, interestingly enough, did not exhibit a great deal of variation with respect to those presented so far. Below are the cases where significant differences were observed across countries.

Figure 11 shows that the effect of a rise in the number of younger siblings in the time allocation decisions of young children (12/13) actually varies a great deal among countries. For example, in Argentina this has a negative impact on the probability of studying full time, and it increases the "not working, not studying" outcome. The effect in Colombia and El Salvador is to actually increase the probability of studying only, but only slightly. In Ecuador the effects are very complex, but they tend to indicate a decline in the percentage of kids working and studying at the same time and an increase in the share of those who are only working. These differences are quite the same for the older group as well, as Figure 12 demonstrates.

With respect to effects of household composition, Figure 13 shows that there are some differences among countries as well. While in Honduras and Costa Rica, the impact of composition on the time allocation decisions is small, in Ecuador being in an expanded family means that a child is more likely to be working as well as studying, while in Paraguay a child is more likely to be at home. Finally, as Figure 14 demonstrates, having a self-employed father increases rises the probability of studying only among 16 and 17 year-olds adolescents in Venezuela, of working and studying in Uruguay, of working only in Honduras and of doing neither in Paraguay.

7. Time Series Evidence on Brazil

7.1 – Descriptive Statistics

This section now examines the evidence about the changing time allocation decisions over a long period of time (1981-1998) for Brazil, the only country for which this information is available.

The data come from the same source utilized above for 1997, that is, the PNAD, the main Brazilian household survey conducted by the census bureau.[17]

Figure 15 reveals the evolution of time allocation decisions by Brazilian adolescents. The percentage of the younger group (12/13) attending school was about 78 percent in 1981 and evolved to around 95 percent in 1998. Much of this evolution was due to children's movement from only working to working and studying (9 percent in 1981 and 15 percent in 1998). It is important to note, however, that the evolution of school attendance in Brazil was slower than the Latin American average until the 1970 birth cohort (see Behrman, Duryea and Székely, 1999). Among the older group the same process is taking place. The percentage of youngsters "studying and working" jumped from 16 percent in 1981 to 32 percent in 1998, at the expense of the share of individuals only working. It seems therefore that the pace of education evolution has accelerated in Brazil, reverting the tendency for stabilization of the 1970s and 1980s.

The bottom of Figure 15 presents a decomposition of the evolution of school attendance in terms of parental (mother's) education. It is clear that the change in the share of children attending school has taken place among the kids with a less educated background, especially those where the mother is illiterate or has only basic writing skills (0 to 3 years of schooling). It is also impressive that the situation hardly changed between 1981 and 1990, with the rise in school attendance taking place almost entirely between 1992 and 1998. The results are similar for both age groups, though the changes are more dramatic for the older group, where the rates of school attendance among adolescents living in poorly educated families has risen from 40 percent to almost 70 percent in the space of 9 years.

As seen above, in LAC countries time allocation decisions depend quite substantially on the household relative income per capita. Figure 16 shows that the improvement in terms of school attendance among younger adolescents (12/13) occurred mainly in the bottom of the household income distribution. The proportion of those attending school jumped in the first decile from 63 percent in 1981 to about 90 percent in 1998, a dramatic improvement that took place mainly between 1992 and 1998. Among the older children (16/17) the progress in terms of school attendance took place both at the top and at the bottom of the income distribution. The proportion of individuals studying in the tenth decile rose from 78 percent in 1981 to about 95 percent in 1998, as compared to 30 percent to 52 percent in the first decile. There is no doubt that

[17] The survey was not conducted in 1991or in 1994.

the big hurdle facing Brazil in the near future is to provide even more incentives for the young adults at the bottom of the wage distribution to go to school.

7.2 Pooling Across Years

The results of the multinomial regressions with the data pooled from 1981 to 1996 are set out in Figures 17 to 20. Figure 17 shows the effect of the time dummies on the probabilities associated with each outcome and confirms that the rise in the percentage of adolescents attending school was due to the rise in the share studying and working at the same time, especially in rural areas. For example, in the 16/17 age group living in rural areas, the percentage of youngsters only working declined from 60 percent in 1981 to about 40 percent in 1998, while the share of those working and studying simultaneously rose from 10 percent to about 40 percent in the sample period.

With respect to the behavior across genders, one can see that in both cases and for both age groups, the rise in school attendance took place among those working and studying at the same time, which in the case of females seem a bit surprising. It is interesting to note that among the older males the share working full time was the largest group until 1995, when it was surpassed by the share working and studying. It also worth noting that the (conditional) share of female school attendance was about 75 percent in 1997 as compared to 65 percent among males.

As to the other determinants of time allocation decisions, one can see from Figure 19 that the effect of the number younger siblings has remained relatively stable over time, that is, it reduces substantially the probability of the "studying only" outcome. The main difference is that for the older group in 1997, the counterpart to this effect is the increase in the probability of "working only".

The effect of family income, on the other hand, is getting weaker over time (Figure 20), which is good news, since it implies that more kids are having access to education, independently of their family income, which may increase inter-generational mobility. Finally figure 21 shows that both males and females have a higher probability of being working and studying or only studying in 1997, as compared to 1981 and in both age groups.

8. Conclusions

It seems that the LAC countries are not doing too badly in terms of school attendance for young adolescents (12/13 years old). The situation deteriorates quite rapidly when we focus is on the older groups (16/17). The best situation overall can be encountered in countries like Chile and the Dominican Republic, whereas the picture can get dramatic in Ecuador, Nicaragua and Honduras, especially in rural areas. Most of the countries are in an intermediate relative position.

As established in the literature, parental education is one of the most important determinants of the time allocation decisions, even conditionally on a series of household and country level characteristics. For youngsters between 16 and 17 years old, having illiterate parents results in a probability of only 25 percent for the "study and not work" outcome, as compared to about 80 percent for the children of college graduates. This effect is relatively homogenous throughout Latin America and the Caribbean. Finally, the number of younger siblings in the family is also a very important determinant of school attendance, as opposed to gross family income, that does not seem as important as one would predict. The macro environment is also important for the understanding of the time allocation decisions, especially the countries' per capita GDP and their youth unemployment rate.

It seems therefore that most of the problems with school attendance can be linked to variables reflecting the household structure in the various countries, in particular parental education and the number of young children. Hence, it looks like that in order to advance the schooling levels in Latin America, the dissemination of information about to the economic returns to education and the provision of care for young children are necessary.

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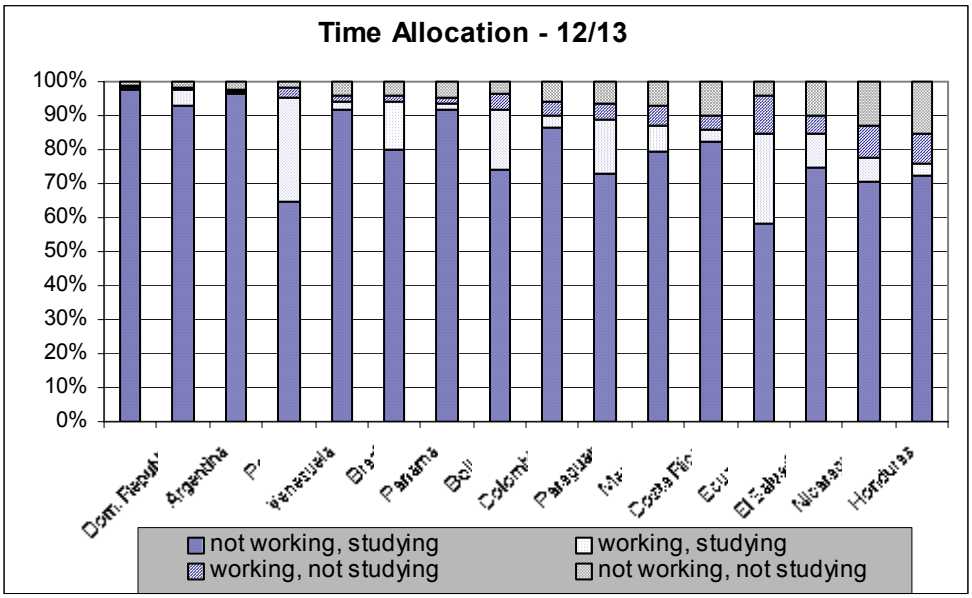
Table 1. Descriptive Statistics

Variable	Mean	Total Variance	Between countries	Within countries
Allocation				
Not working. not studying	0.10	0.087	0.001	0.086
Not working. studying	0.62	0.235	0.011	0.223
working. not studying	0.16	0.136	0.002	0.133
working. studying	0.12	0.104	0.007	0.096
Individual (12-19)				
Age	15.29	4.997	0.010	4.987
years of schooling	6.58	8.744	1.037	7.707
gender (1=male. 0=female)	0.52	0.250	0.000	0.250
Household				
Number of children	0.70	1.531	0.065	1.466
Number of adults	4.31	17.537	1.486	16.052
Family income (dollars 1995 using PPP)	1,025.56	5301708.81	257320.56	5,044,388.25
Composition (1=nuclear. 0=extended)	0.78	0.174	0.003	0.171
Parental Education*	6.97	20.801	2.184	18.617
occupation (1=independent worker or employee. 0=others)	0.34	0.224	0.005	0.219
Geographic				
urban (1=urban areas. 0=rural areas)	0.70	0.226	0.058	0.168
Aggregate Variables				
Urbanization rate (%)	74.39	161.75	161.754	-
Population size (log)	17.18	1.874	1.874	-
Youth unemployment rate	18.01	100.170	100.170	-
Dependency ratio	0.62	0.007	0.007	-
Per-capita gdp (dollars 1995 using PPP)	5704.2	7636100.31	7636100.31	-

*Maximum parental education.

Figure 1. Time Allocation



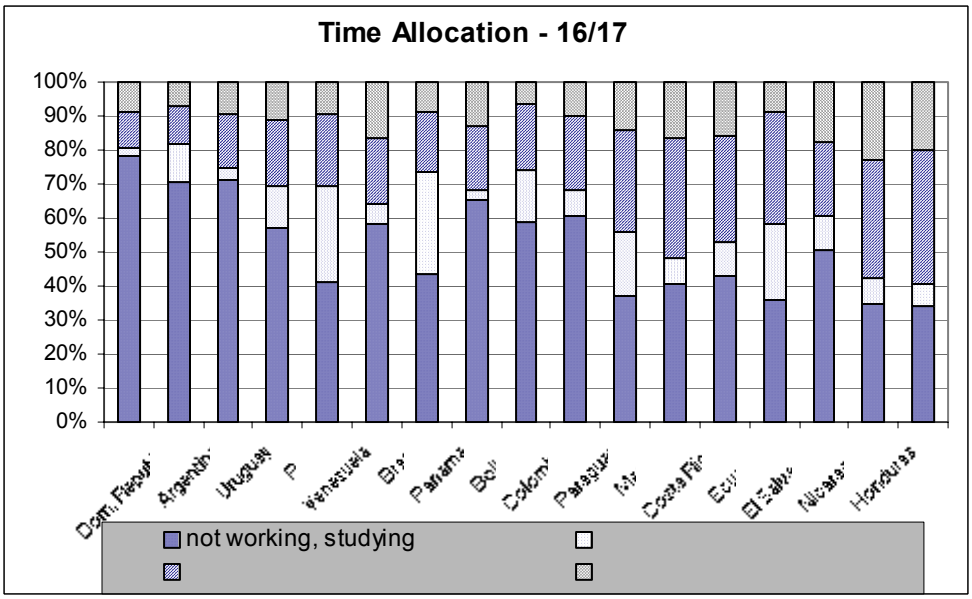
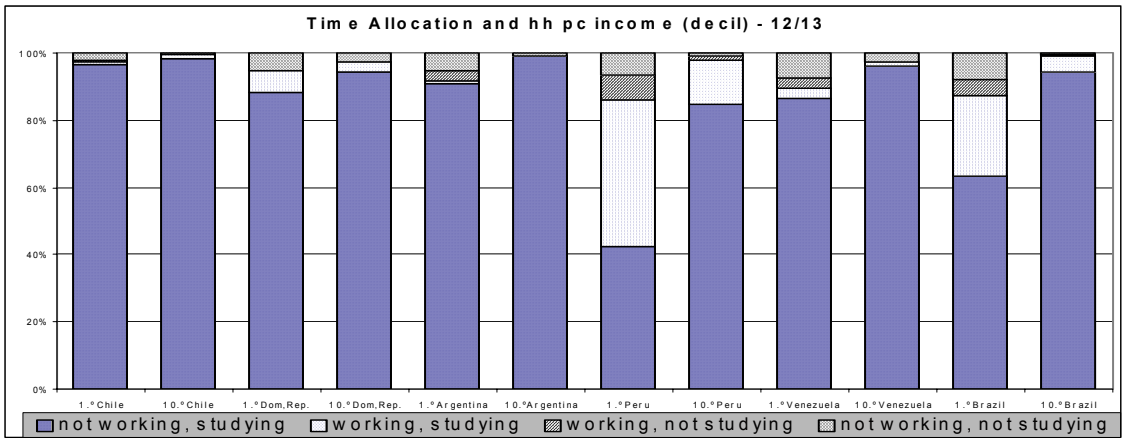
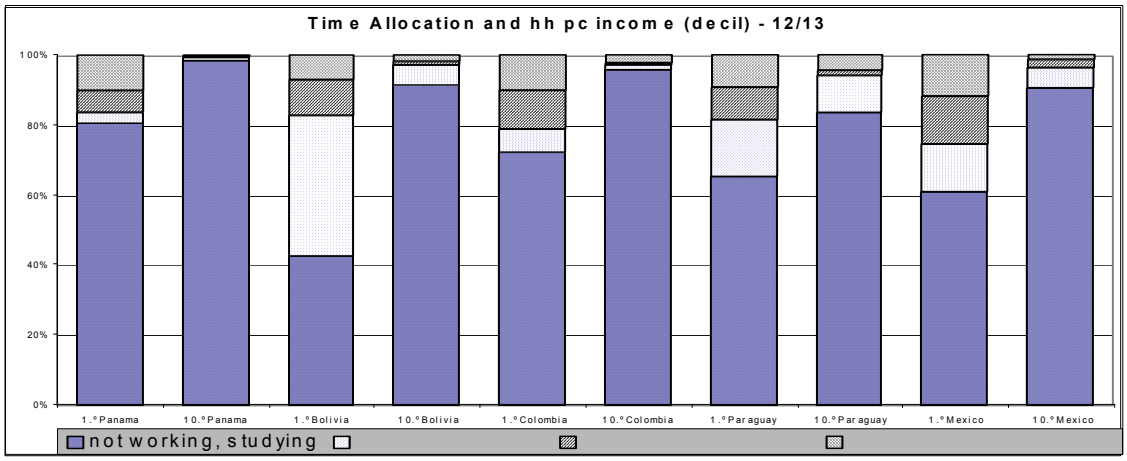


Figure 2. Time Allocation and Household per Capita Income: 12/13





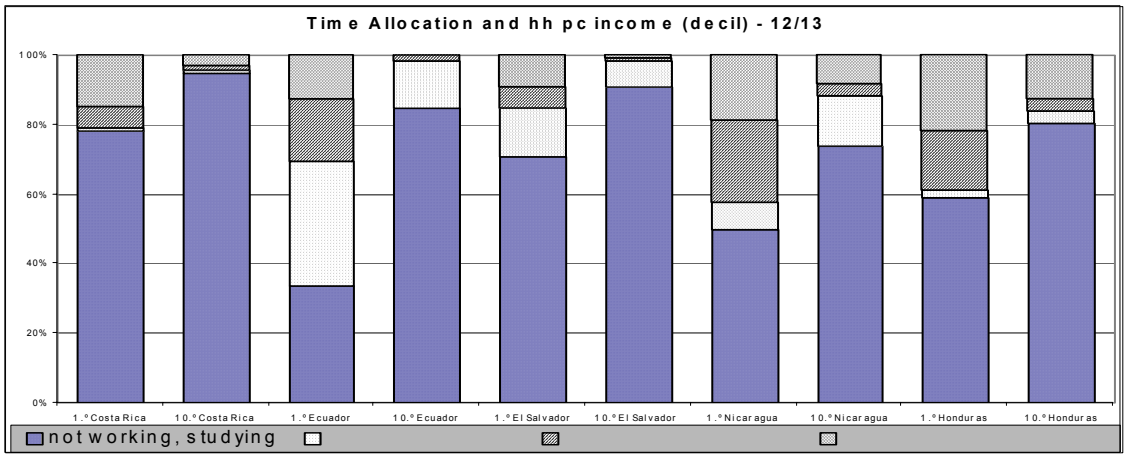
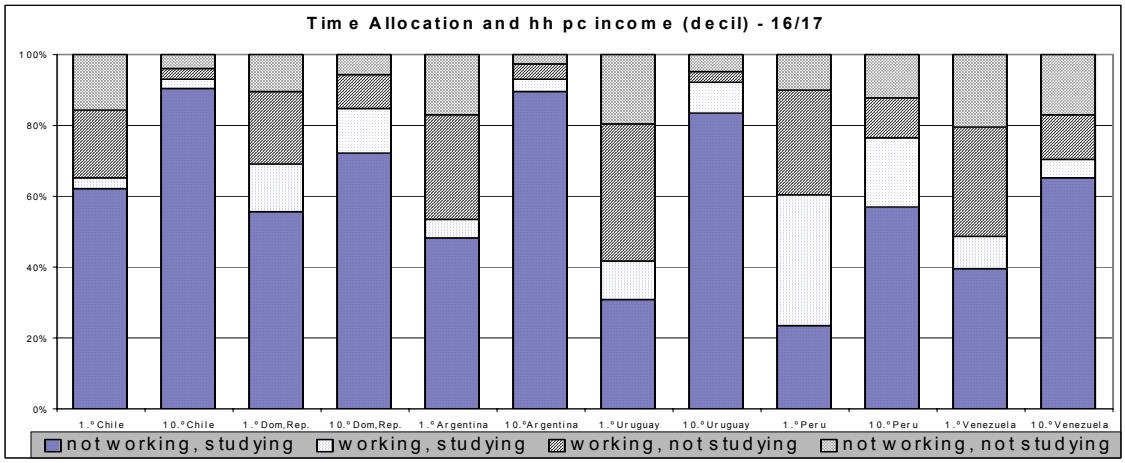
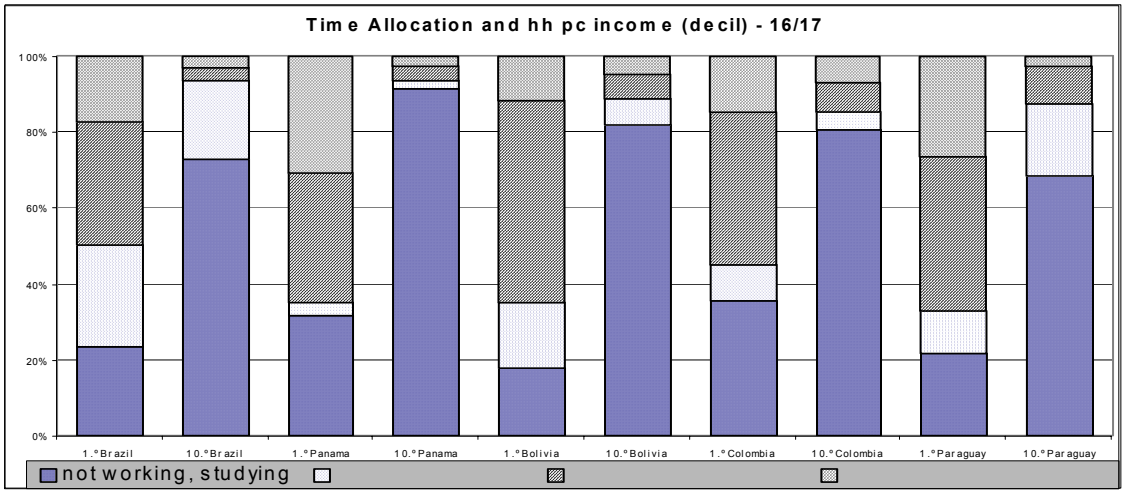


Figure 3. Time Allocation and Household per Capita Income: 16/17





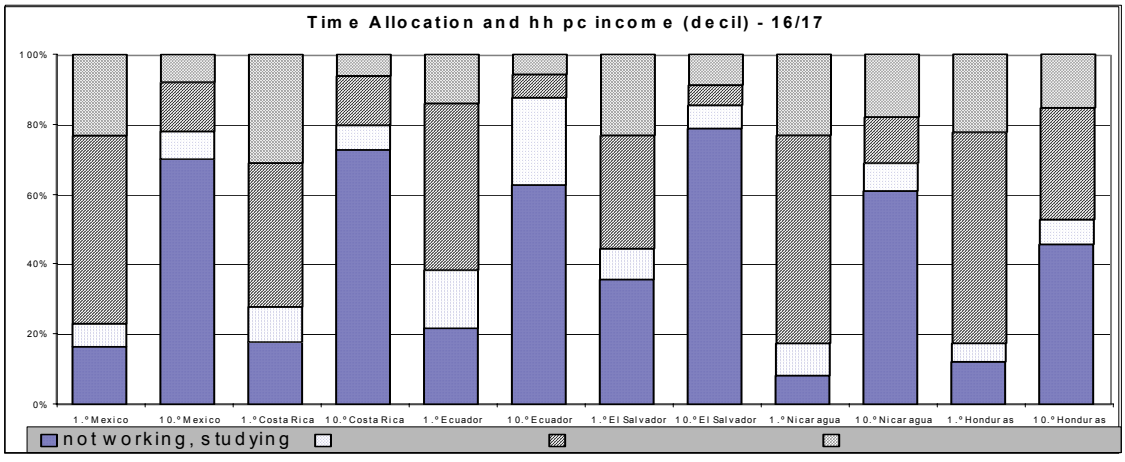


Table 2. Regression Results: 12/13

Variables	Multinomial Regression					
	not working, studying		working, not studying		working, studying	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
age13	-0.540	0.045	0.363	0.071	-0.216	0.055
Gender	0.365	0.045	1.486	0.074	1.201	0.056
Fincome (x10000)	-1.50	1.30	2.90	2.20	0.77	1.50
impyA_h	-0.208	0.085	-0.163	0.125	-0.296	0.111
Nads	0.038	0.012	-0.018	0.020	-0.020	0.014
Nchild	-0.135	0.023	0.043	0.033	-0.033	0.028
Finch (x10000)	3.00	1.30	0.93	2.30	0.94	1.50
Finads (x10000)	9.90	3.70	-26.0	8.10	2.50	4.40
finc2 (x10000000)	1.70	1.20	2.40	1.70	0.81	1.30
finch2 (x10000000)	-1.00	0.59	-1.10	1.10	-0.61	0.68
finads2 (x10000000)	-5.90	3.30	-3.20	7.70	-2.70	3.80
Educpar	0.170	0.008	-0.032	0.013	0.081	0.009
Occupation	0.152	0.048	0.508	0.073	0.878	0.058
Urban	0.498	0.050	-0.561	0.082	-0.358	0.062
Composition	-0.084	0.059	-0.068	0.089	-0.048	0.073
urbanization rate	0.024	0.004	0.029	0.006	0.083	0.006
population (log)	0.014	0.030	0.019	0.051	0.058	0.044
unemployment rate	-0.037	0.005	-0.052	0.008	-0.154	0.007
dependency ratio	-1.045	0.416	-1.821	0.690	-9.794	0.603
GDP (x10000)	1.30	0.190	-1.00	0.360	-3.00	0.290
Constant	0.320	0.640	-1.173	1.091	2.430	0.920

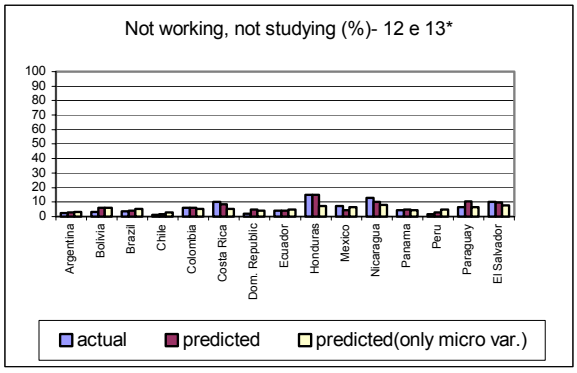
Notes: (not working, not studying) is the comparison group.
Cases = 46332 Prob > chi^2 = 0.0000 Log likelihood = -22870.521 Pseudo R^2 = 0.1908

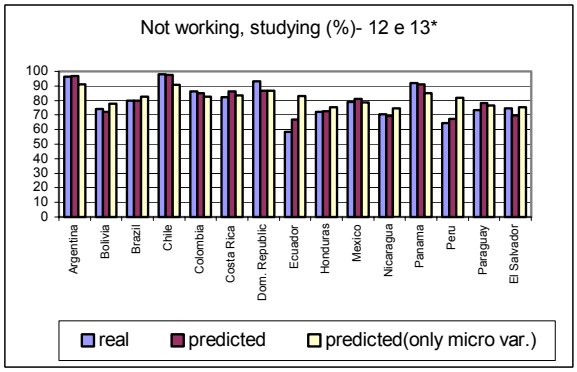
Table 3. Regression Results: 16/17

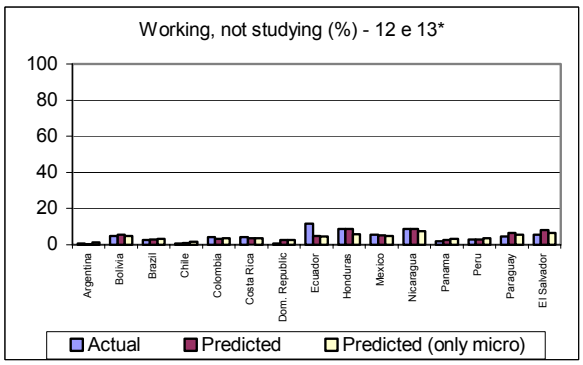
Variables	Multinomial Regression					
	not working, studying		working, not studying		working, studying	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
age17	-0.335	0.034	0.291	0.038	-0.010	0.040
gender	0.406	0.035	1.613	0.039	1.134	0.042
Fincome (x10000)	-0.730	0.760	1.100	0.860	0.830	0.960
impyA_h	-0.432	0.075	-0.230	0.079	-0.209	0.095
nads	0.007	0.006	0.016	0.006	-0.019	0.009
nchild	-0.204	0.021	-0.005	0.021	-0.112	0.026
Finch (x10000)	2.70	0.80	-1.70	0.94	0.63	0.99
Finads (x10000)	7.30	1.90	-0.45	2.30	3.00	2.20
finc2 (x1000000000)	3.70	7.00	-3.20	8.40	-3.00	9.20
finch2 (x1000000000)	-8.20	7.20	5.40	8.50	1.40	9.40
finads2 (x1000000000)	-0.18	8.80	1.70	9.90	-9.30	9.60
educpar	0.167	0.005	-0.038	0.006	0.083	0.006
occupation	0.014	0.037	0.143	0.041	0.330	0.044
urban	0.482	0.040	-0.282	0.043	0.249	0.048
composition	0.251	0.041	0.272	0.045	0.317	0.050
urbanization rate	-0.002	0.003	0.005	0.003	0.045	0.004
population (log)	0.094	0.021	0.058	0.024	0.115	0.028
unemployment rate	-0.007	0.004	0.012	0.004	-0.042	0.005
Dependency ratio	-1.023	0.334	-0.226	0.364	-8.835	0.481
GDP (x10000)	3.70	0.120	-8.60	0.140	-4.00	0.170
Constant	-0.848	0.480	-1.274	0.538	1.898	0.674

Notes (not working, not studying) is the comparison group.
Cases = 43309 Prob > chi^2 = 0.0000 Log likelihood = -42228.044 Pseudo R^2 = 0.1725

Figure 4. Fit of the Model: 12/13







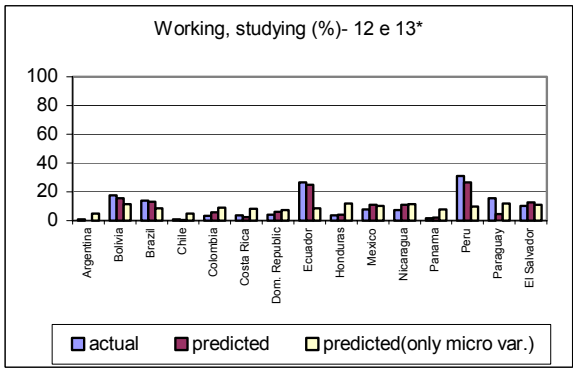


Figure 5. Fit of the Model: 16/17

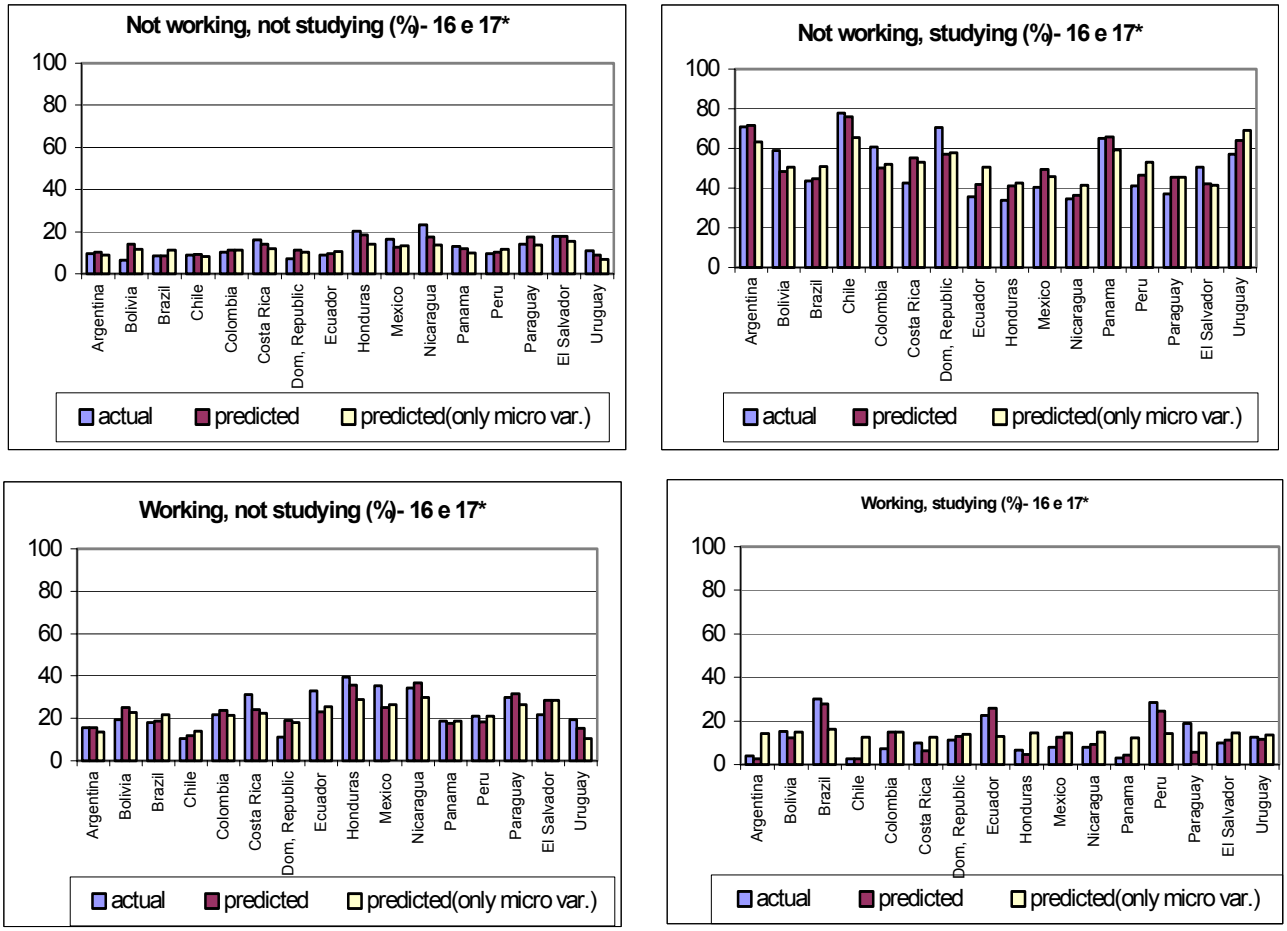
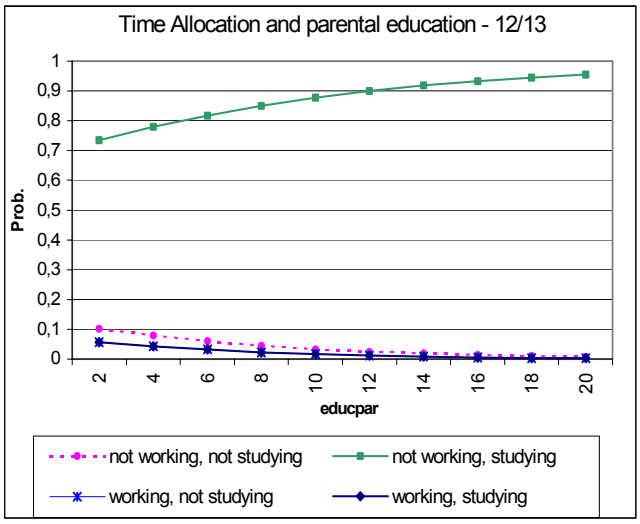
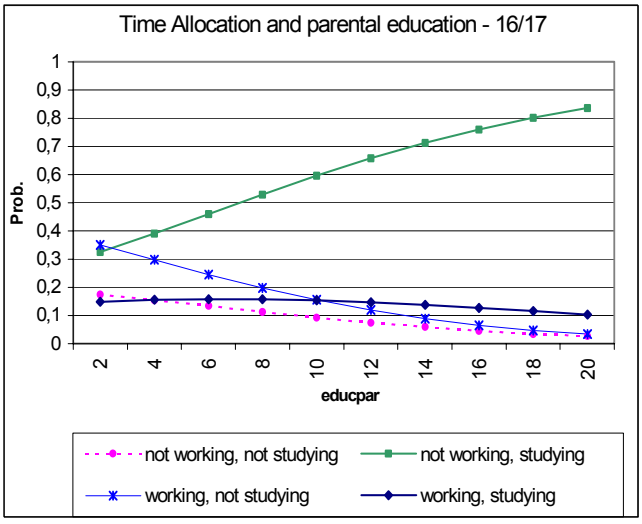
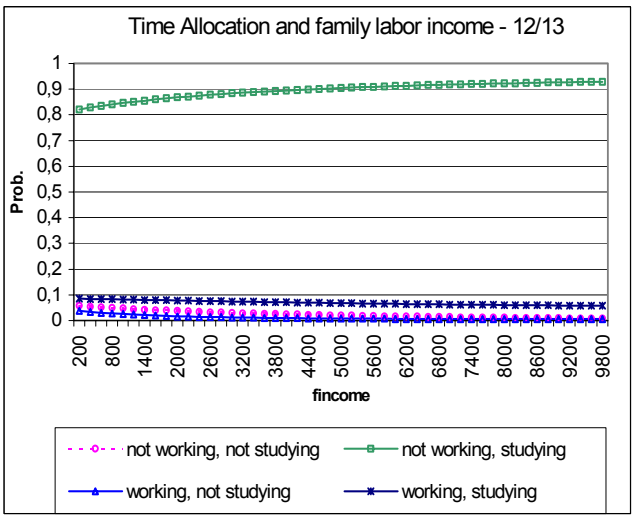


Figure 6. Regression Results: Parental Education and Household Income







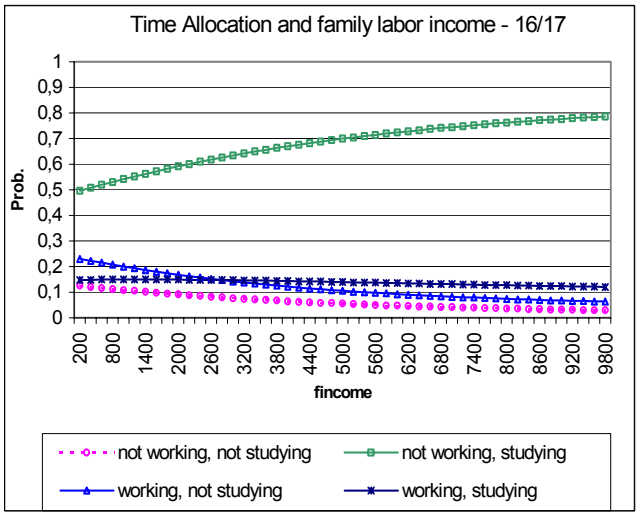
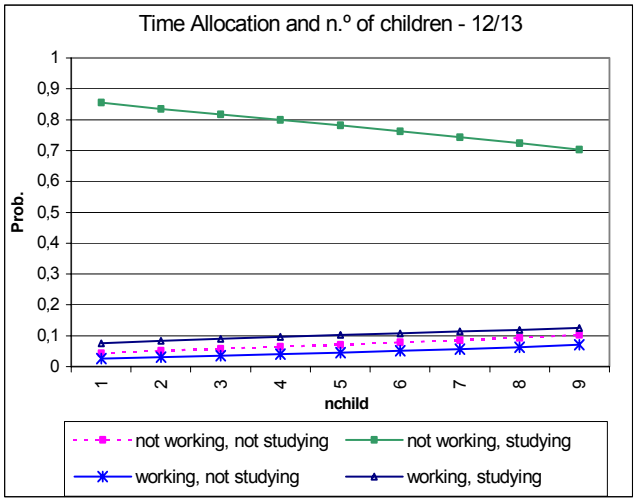
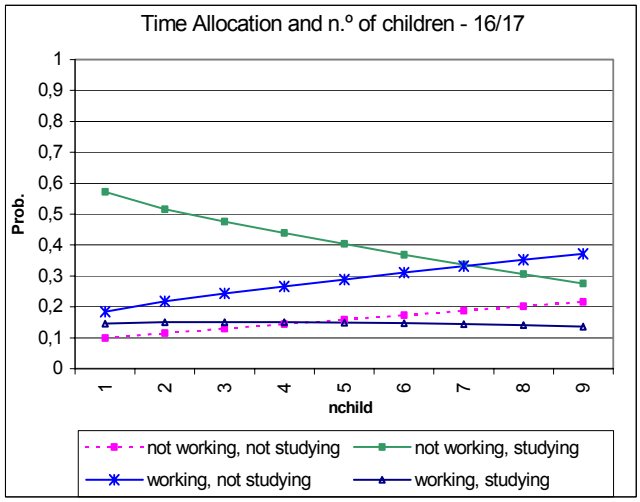
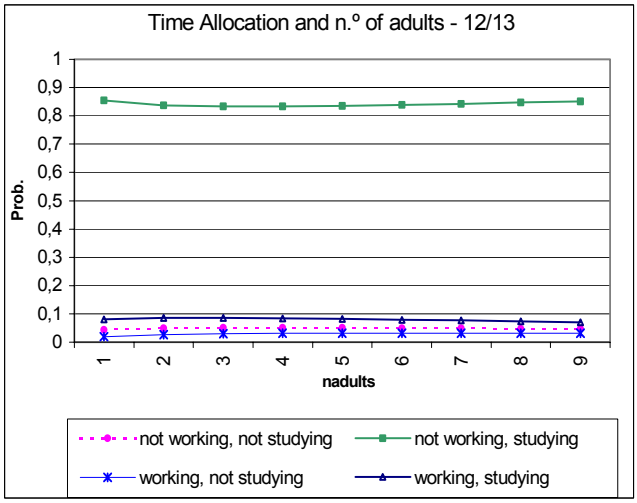


Figure 7. Regression Results: Number of Children and Number of Adults







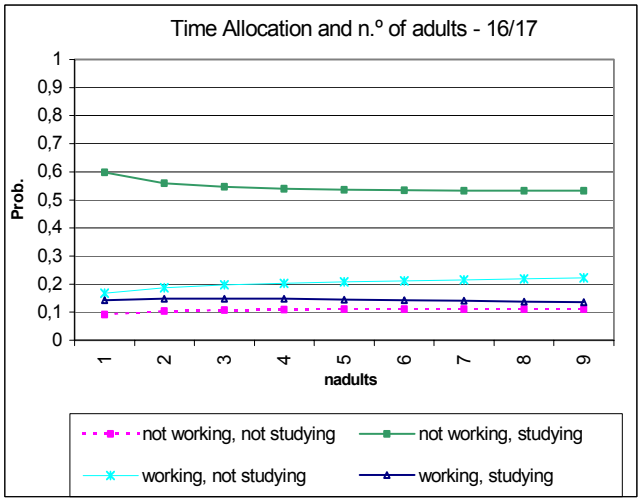
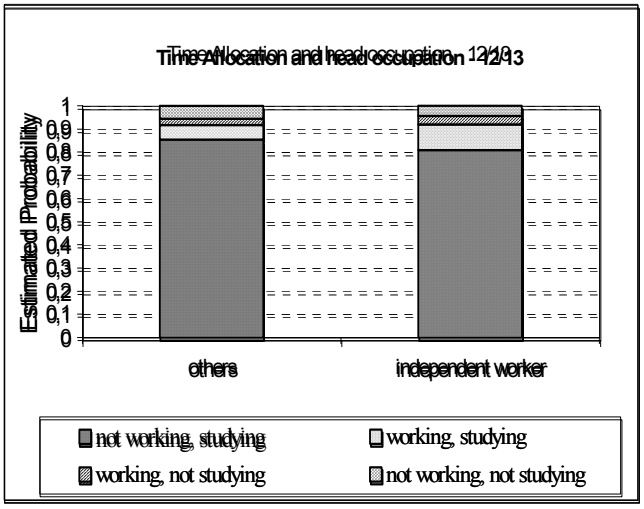
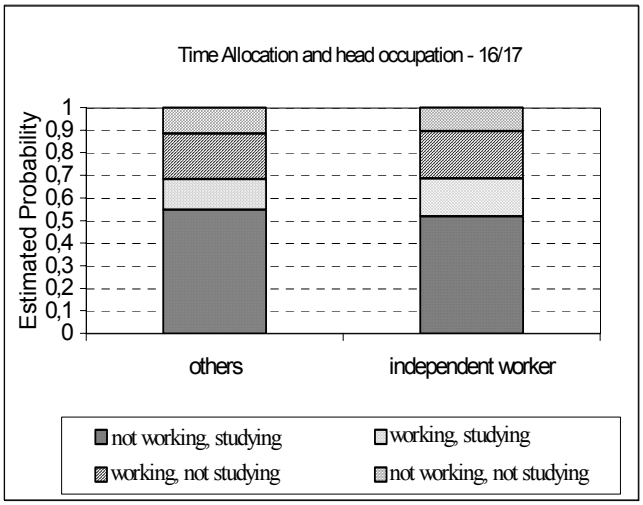
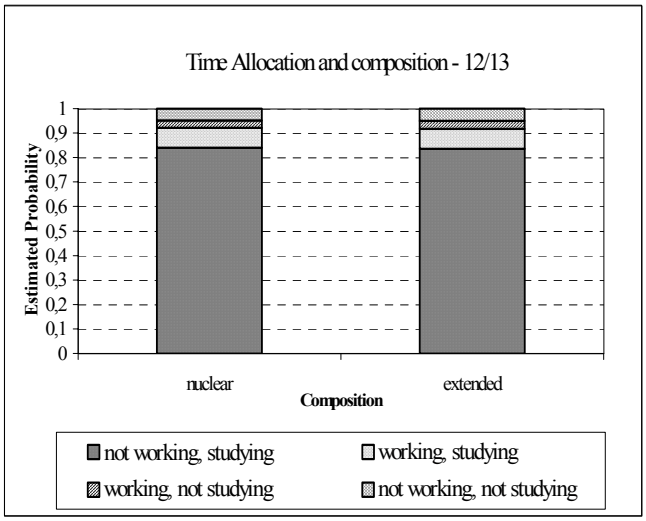


Figure 8. Regression Results: Head Occupation and Household Composition







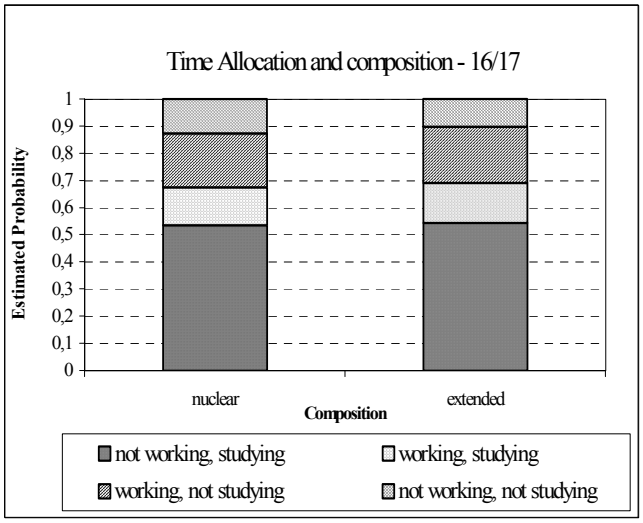


Figure 9. Regression Results: Gender and Urban Areas

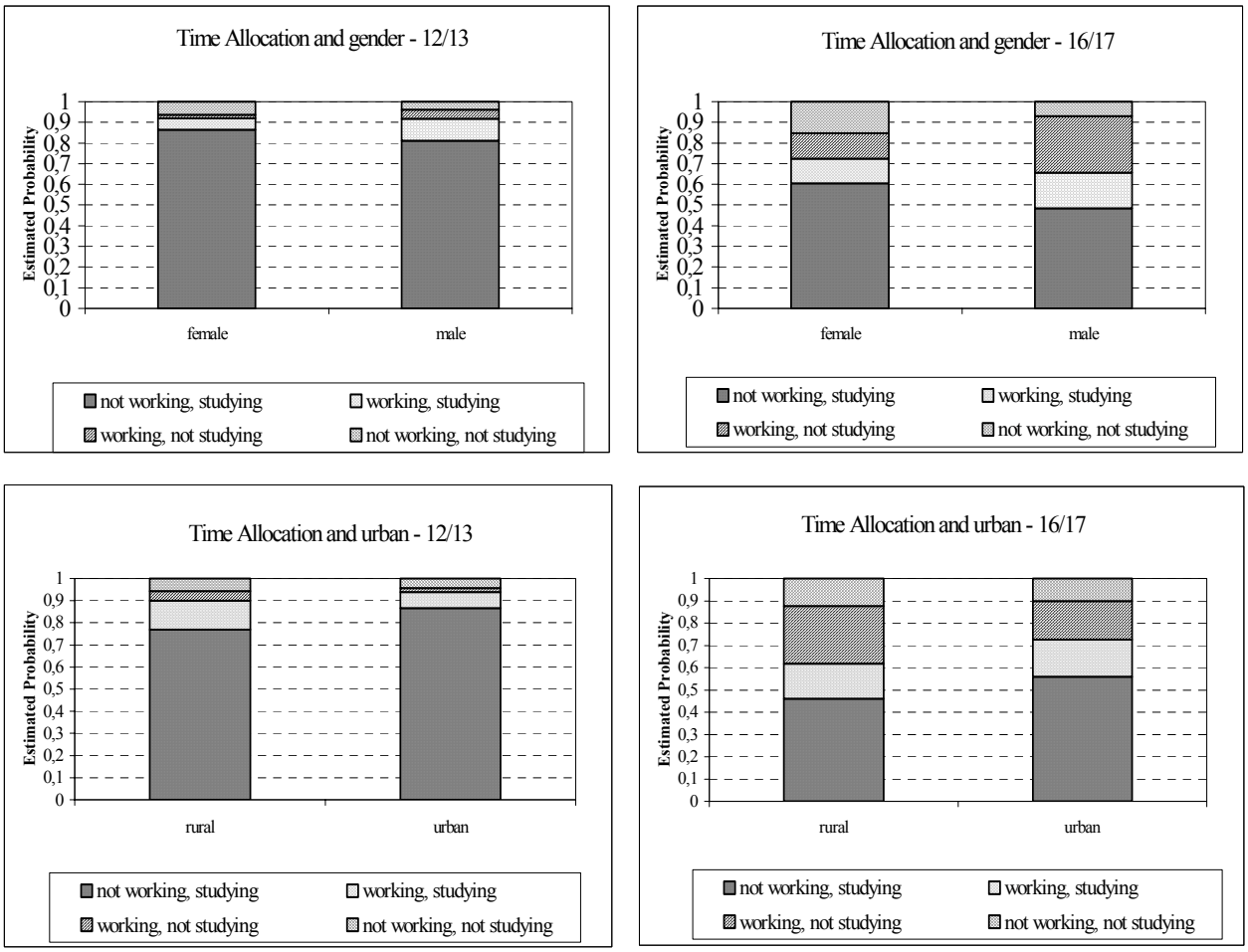
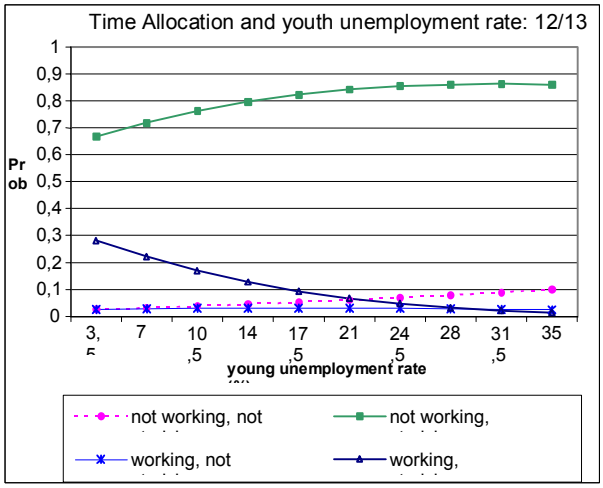
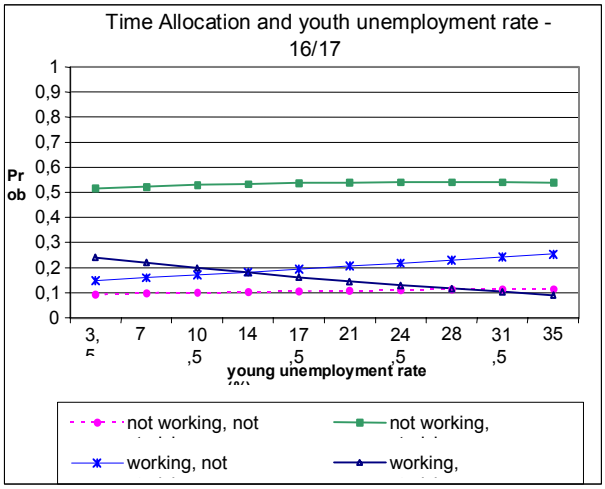
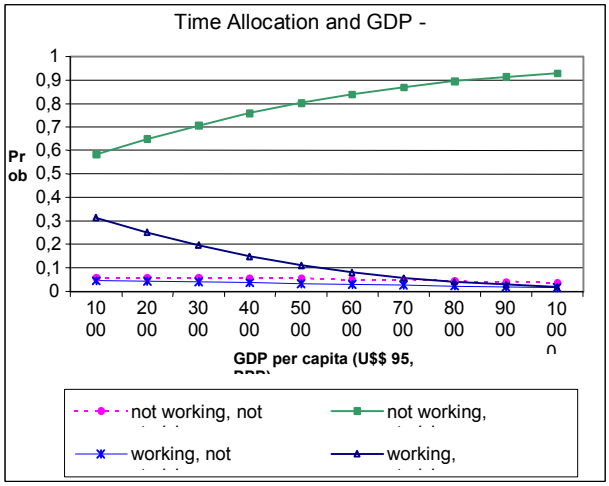


Figure 10. Regression Results: Unemployment Rate and GDP







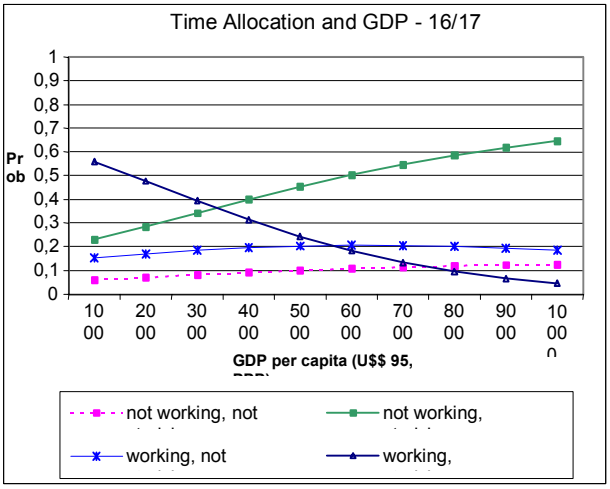


Figure 11. Country-Specific Results: Number of Children, 12/13

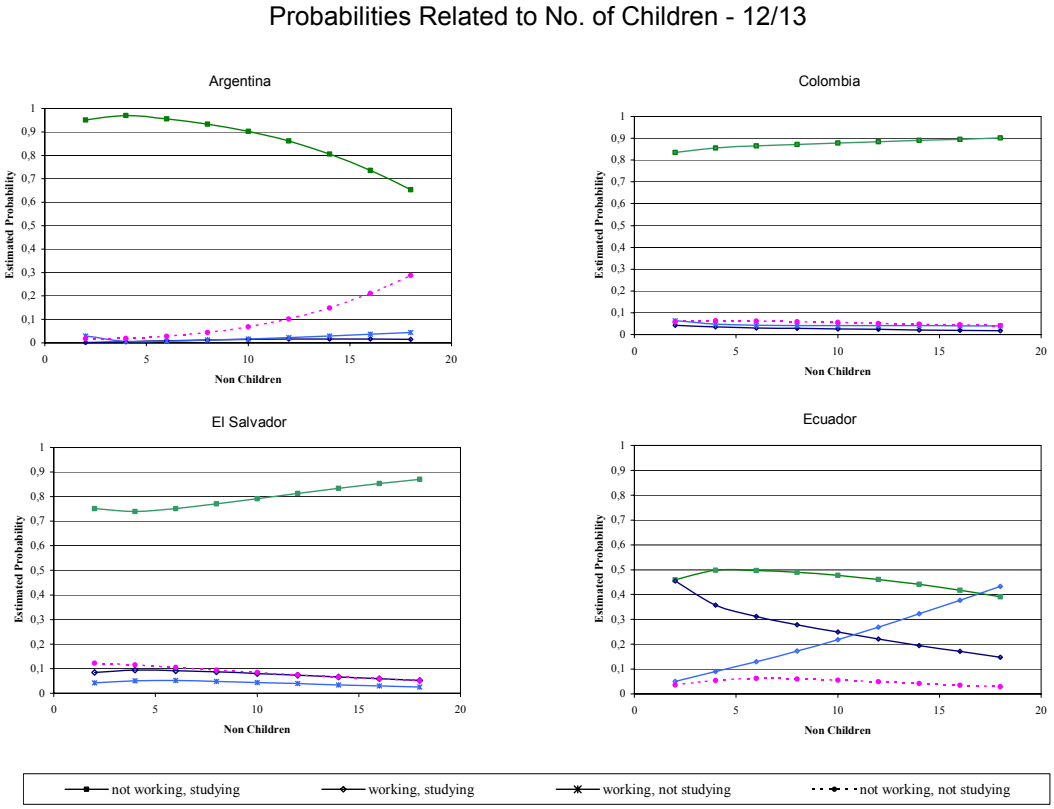


Figure 12. Country-Specific Results: Number of Children, 16-17

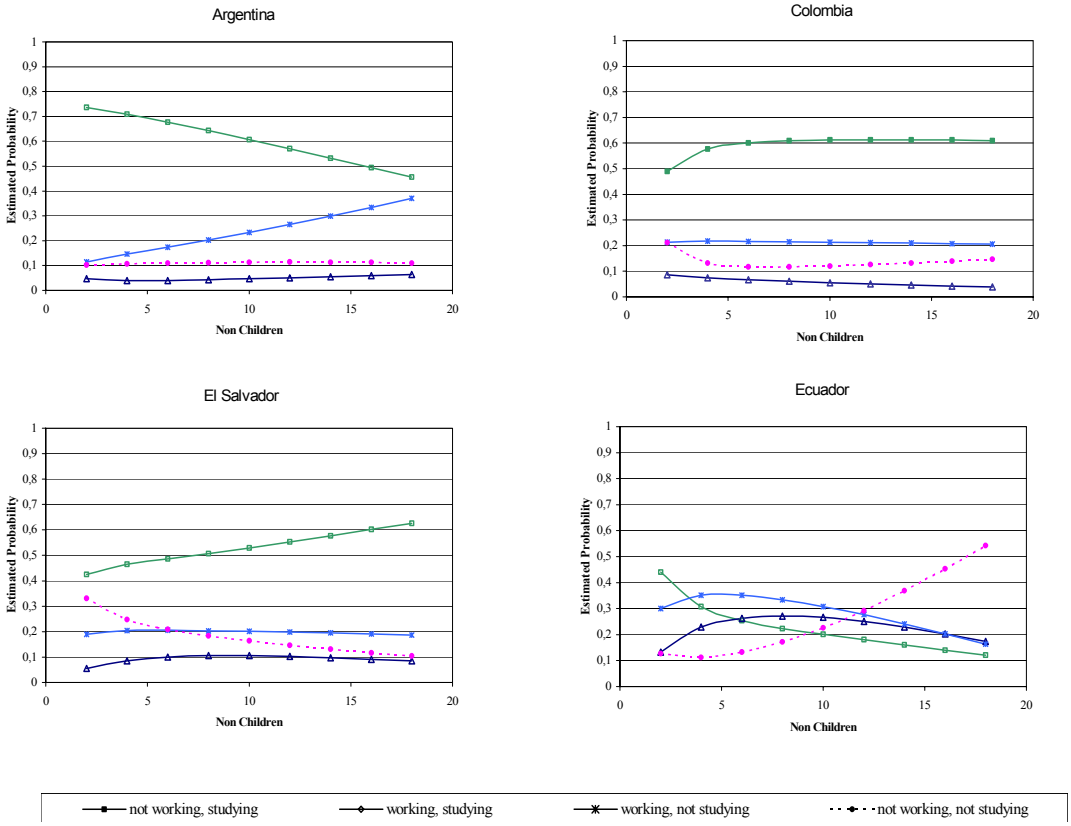


Figure 13. Country-Specific Results: Household Composition, 12/13

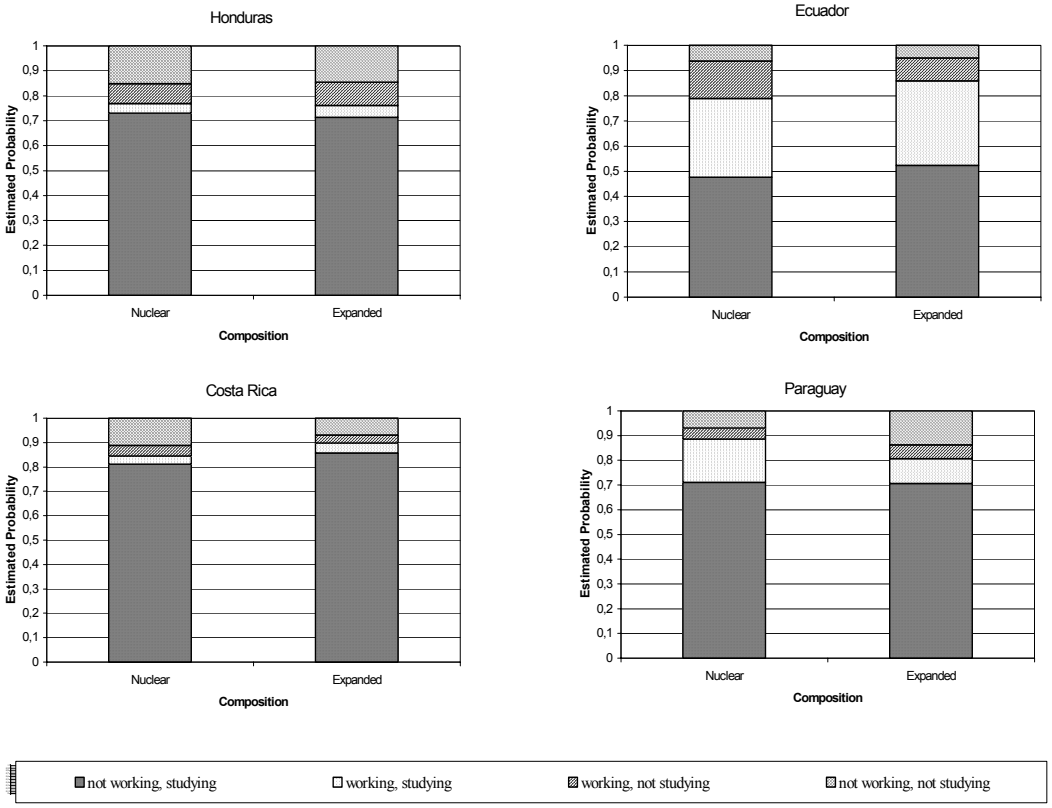


Figure 14. Country-Specific Results: Head Occupation, 16/17

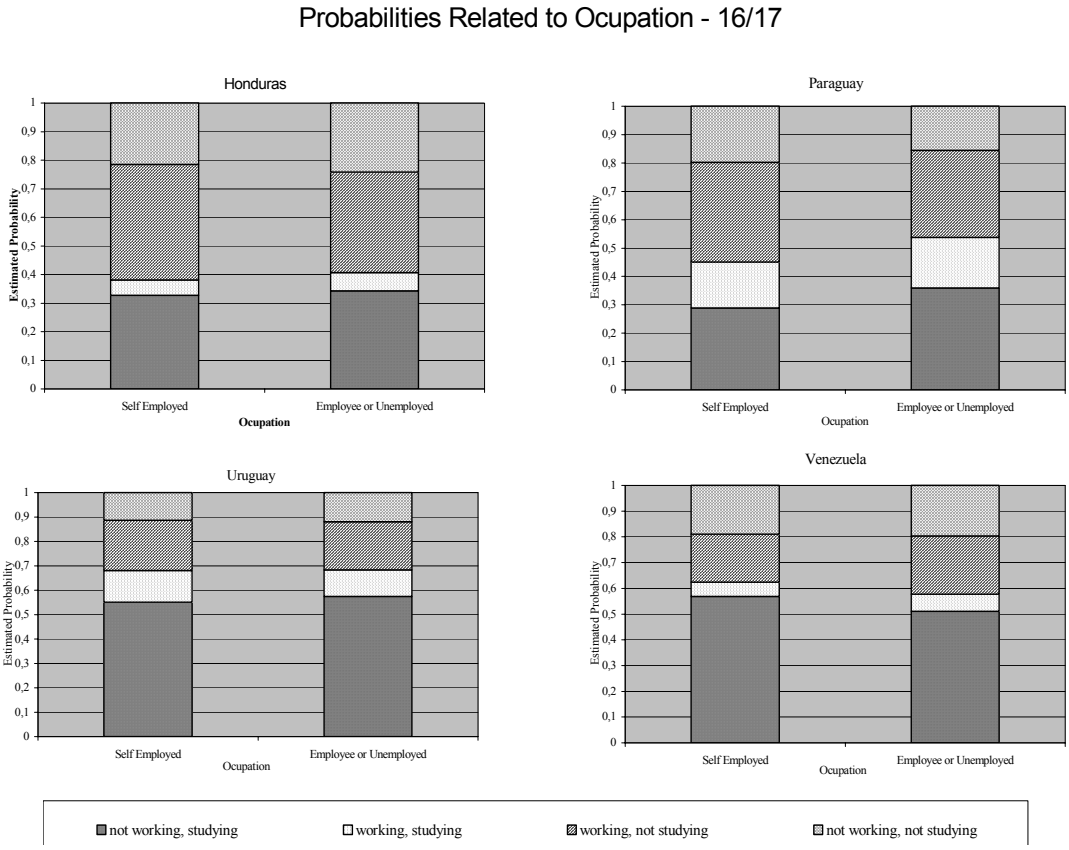
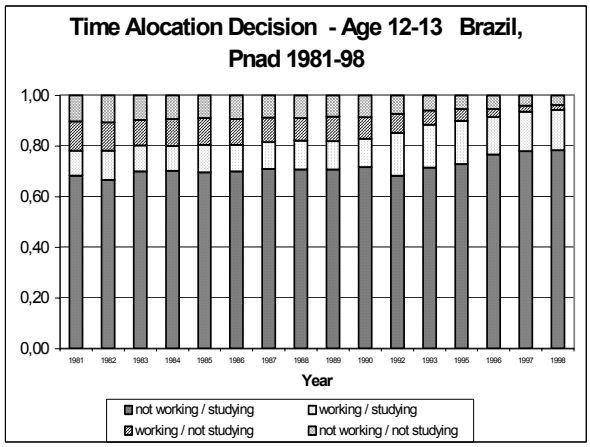
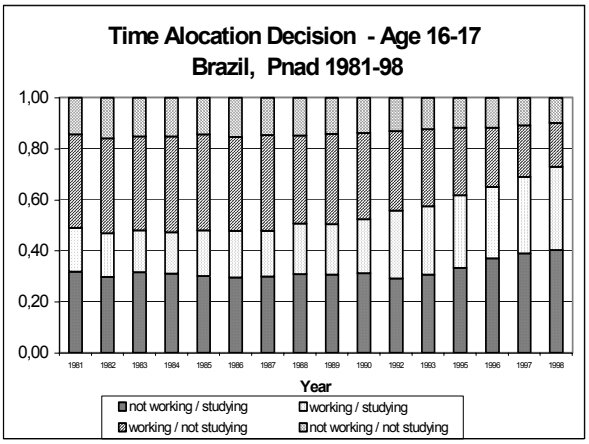
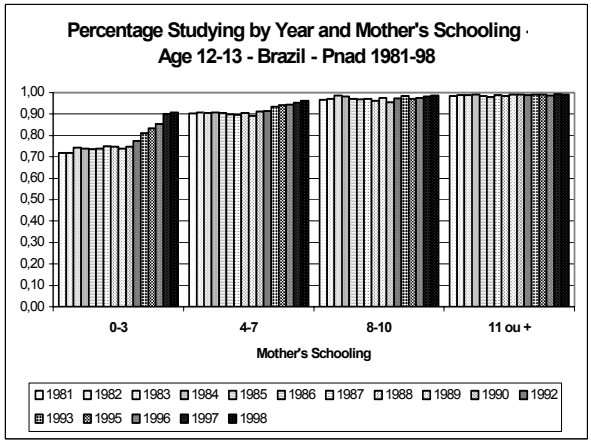


Figure 15. Brazilian Time Series: Descriptions







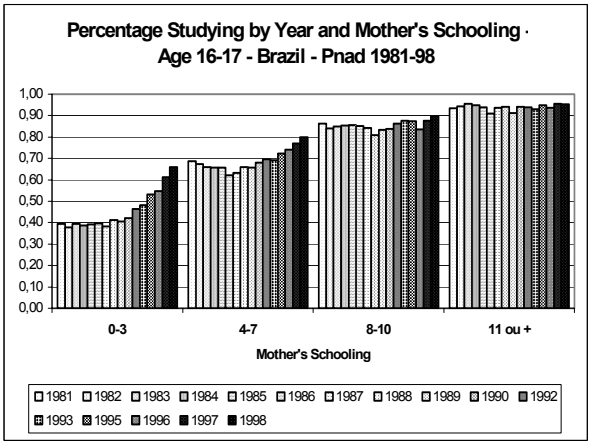
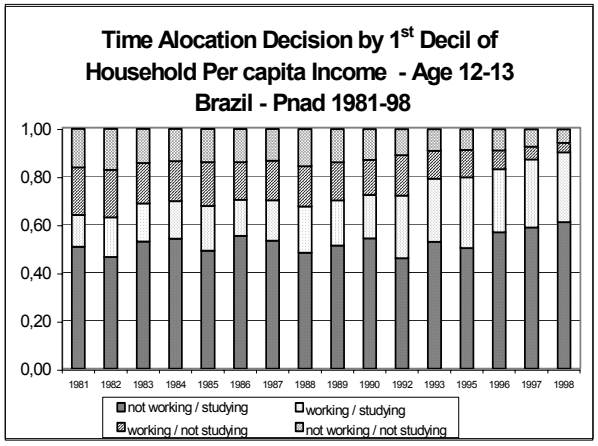
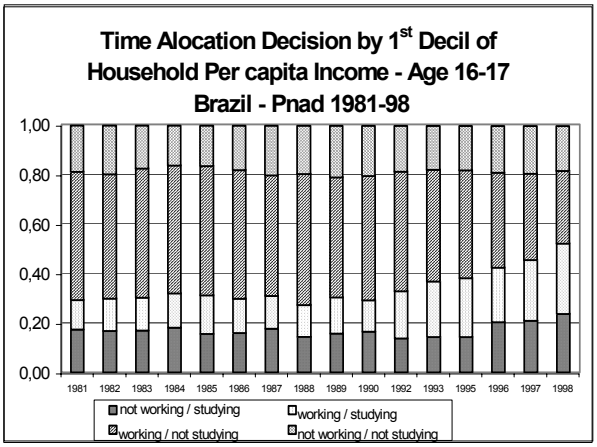
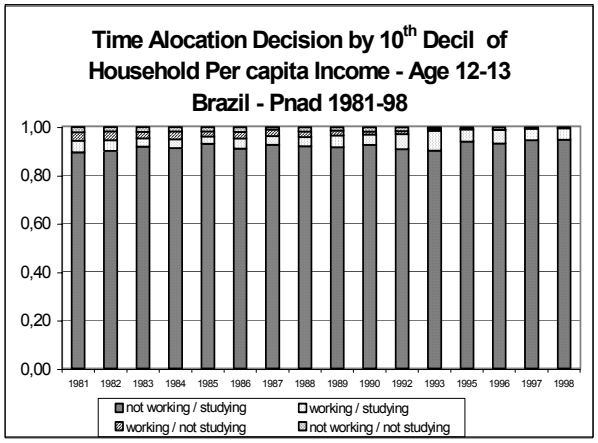


Figure 16. Brazilian Time Series: Inequality and Time Allocation







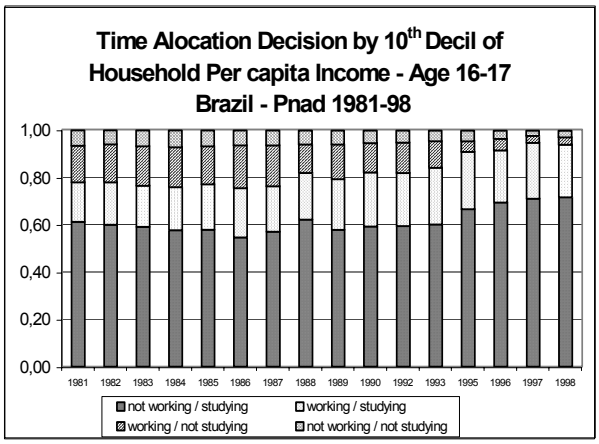
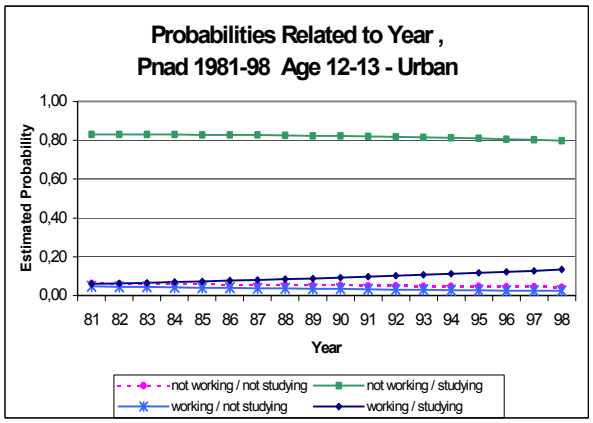
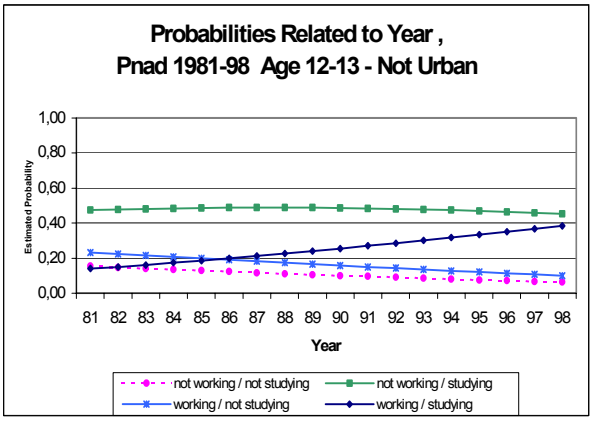
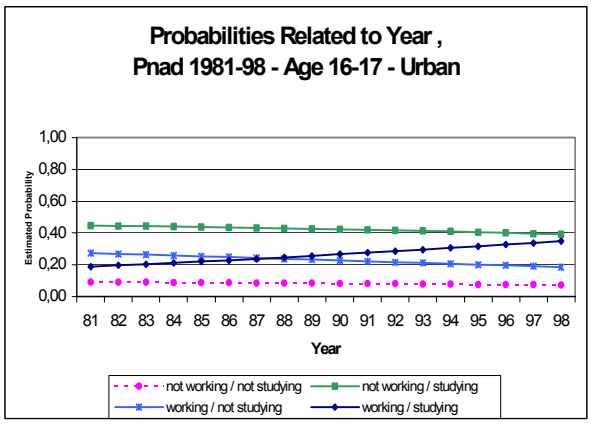


Figure 17. Brazilian Time Series Results: Urban Areas







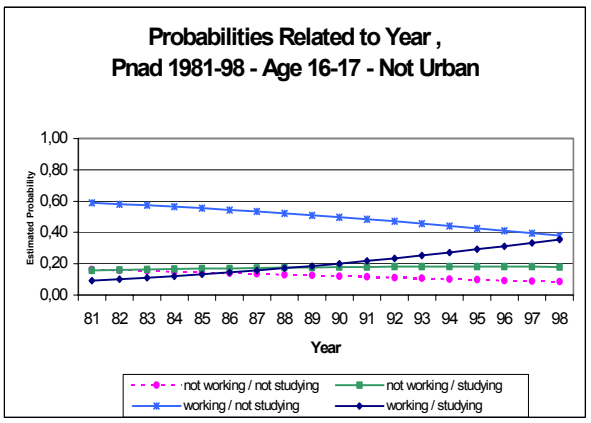
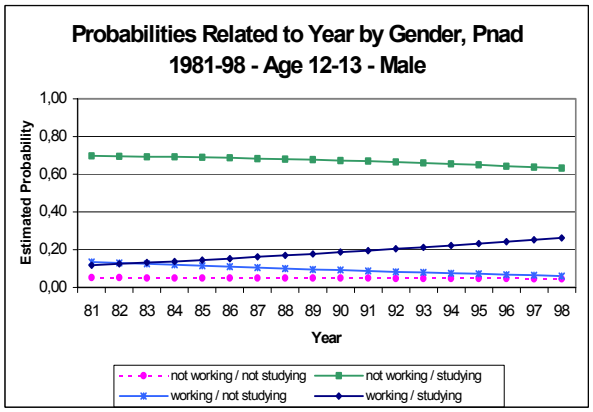
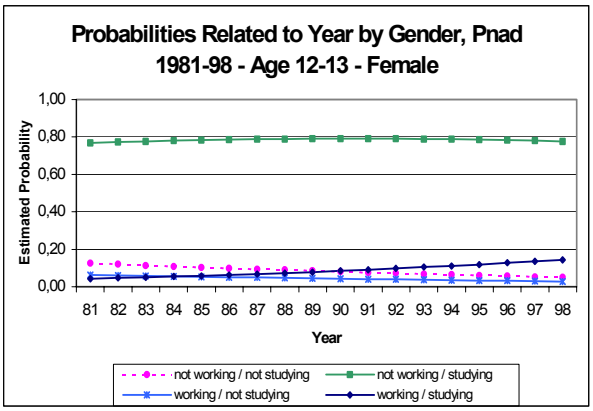
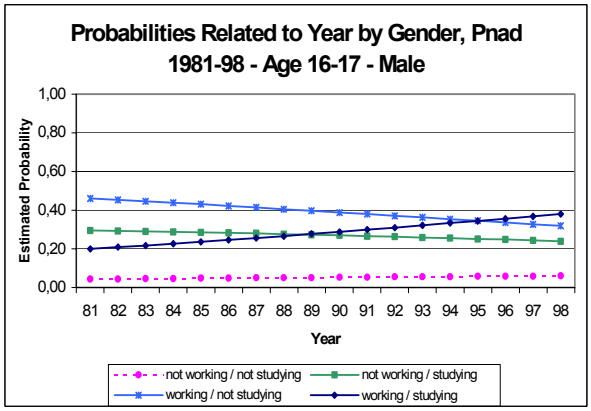


Figure 18. Brazilian Time Series Results: Gender







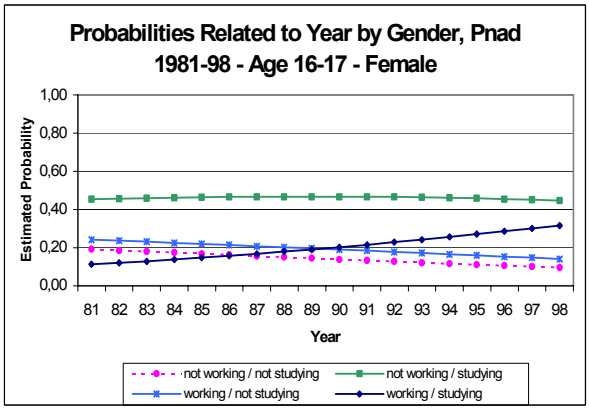
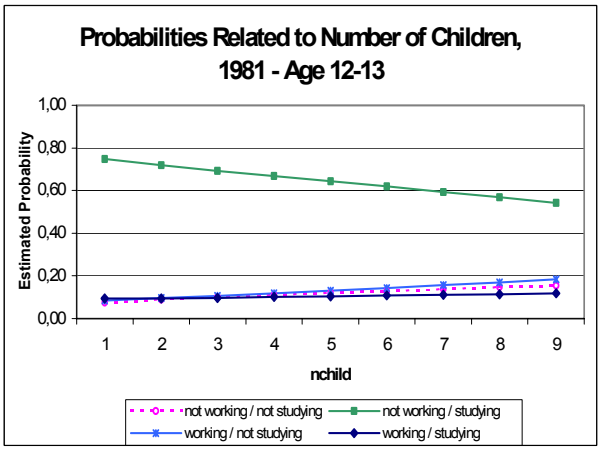
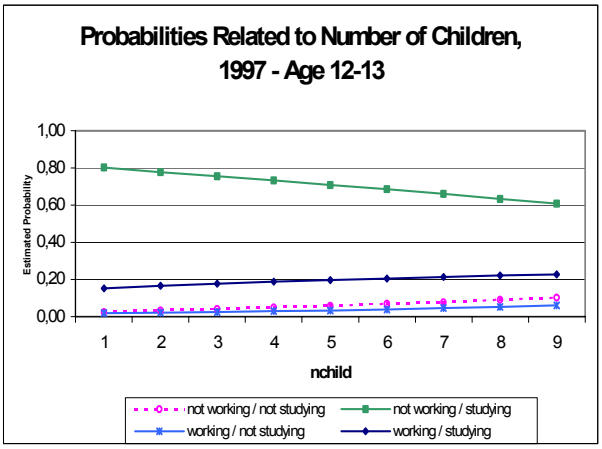
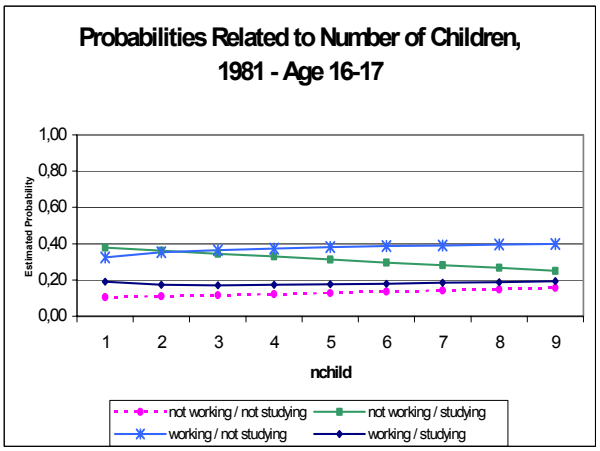


Figure 19. Brazilian Time Series Results, Number of Children







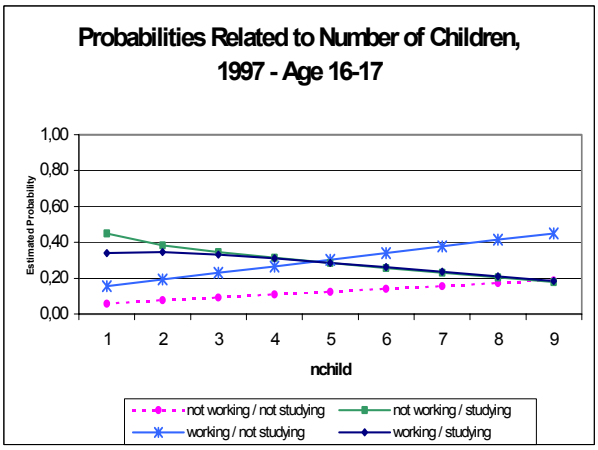
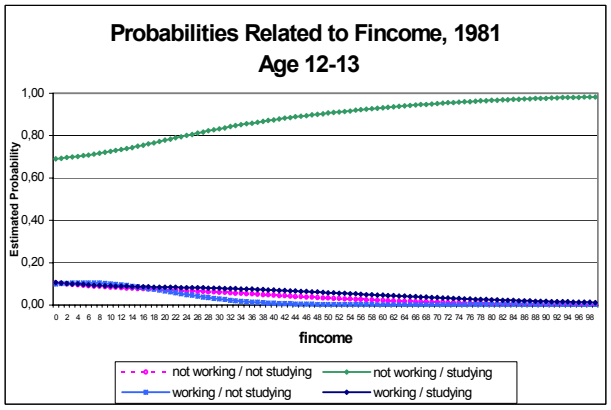
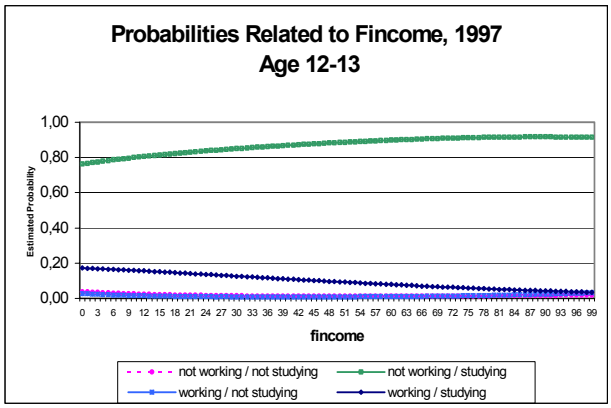
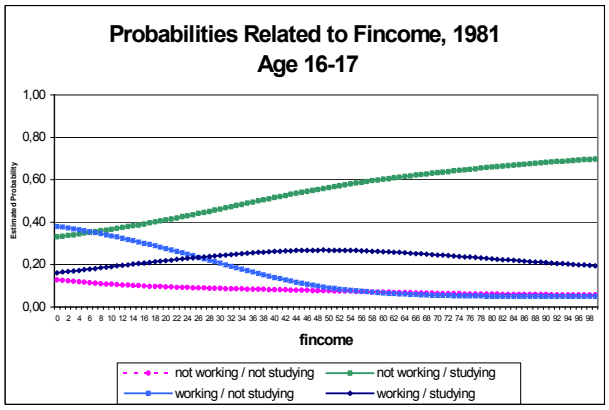


Figure 20. Brazilian Time Series Results, Family Income







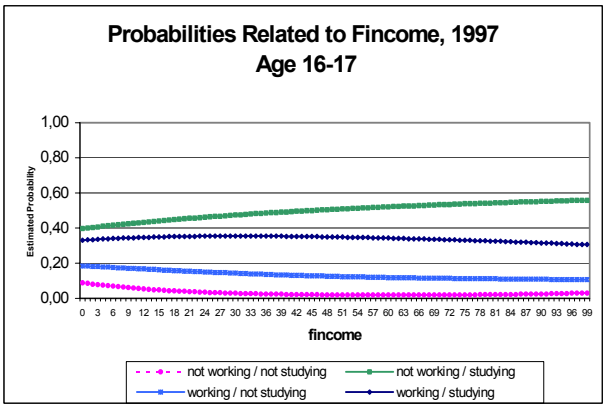


Figure 21. Brazilian Time-Series Results, Gender