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Determinants of primary school enrollment in Haiti and the Dominican Republic

Discussion Paper, Zentrum für internationale Entwicklungs- und Umweltforschung, No. 54

Provided in Cooperation with:
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Suggested Citation: Gönsch, Iris (2010) : Determinants of primary school enrollment in Haiti and the Dominican Republic, Discussion Paper, Zentrum für internationale Entwicklungs- und Umweltforschung, No. 54

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Zentrum für internationale Entwicklungs- und Umweltforschung der Justus-Liebig-Universität Gießen

Determinants of Primary School Enrollment in Haiti and the Dominican Republic

by

IRIS GÖNSCH*

No. 54

Gießen, November 2010

*Center for International Development and Environmental Research (ZEU),
Section 3
Justus Liebig University Giessen
Senckenbergstr. 3
D-35390 Giessen, Germany
e-mail: Iris.Goensch@zeu.uni-giessen.de

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Abstract

Education is considered an important means of alleviating poverty and of improving an individual's job and earnings prospects. Nevertheless, in Haiti and the Dominican Republic school enrollment is far from complete and shows notable regional variation.

This paper analyzes determinants of primary school enrollment and investigates to what extent differences in schooling are due to individual factors compared to family or community influences. Using data from the Demographic and Health Surveys (DHS) for the two countries for two years each, logistic multilevel regression techniques are applied and the heterogeneity of the data sets is quantified using the median odds ratio (MOR).

Results support earlier studies that identify the age of a child and family wealth as some of the most important explanatory variables. Combined with detailed descriptive analysis of the enrollment behavior, late enrollment is recognized as an important driver of low overall participation rates. Other influence factors do not have the same importance in both countries. The MOR indicates that educational enrollment status is determined to a relevant extent by household and community level characteristics and suggests an increase in importance of these higher levels over time.

Keywords: primary school enrollment, household-level, multilevel modeling, Caribbean, education, development
JEL-Classification: C19, I21, O12, O15

Acknowledgements

The financial support of the Fritz-Thyssen-Foundation for the project "Determinants of educational decisions in developing countries – Theory and empirical evidence from Haiti" is gratefully acknowledged. Jasmin Arnold, Steffen Gräf and Pinar Pamukci provided excellent research assistance. I would like to thank Sebastian Bredl, Evans Jadotte and participants of the ACDD conference 2010 who gave valuable comments.

1 Introduction

The importance of education for a country's development as well as for an individual's job and earning prospects is widely acknowledged and cannot be overstated. Accordingly, much effort has been made to increase educational levels worldwide and by 2006, 78 percent of the younger adults (aged 25-34) in OECD countries had attained at least upper secondary education (OECD, 2009). The developing world is still lagging behind, but since 1960 tremendous progress has been made regarding enrollment rates and years of schooling. Today, most young people are much better educated than their parents and grandparents. By the year 2000, gross enrollment rates had reached or exceeded 100 percent in all world regions except Sub-Saharan Africa (Glewwe and Kremer, 2006). However, some countries in other regions also perform weakly. Haiti and the Dominican Republic belong to this group of countries. The net primary school enrollment rate amounted to 84 percent in the Dominican Republic and roughly half of all primary age children did not attend school in Haiti in 2005 (UNESCO, 2006). Variation within the countries is notable. Therefore, one has to consider the factors that determine individual educational decisions and to investigate if spatial characteristics play a role.

Haiti is prone to natural disasters like tropical storms, but the severe earthquake in January 2010 exceeded the previous experiences. It caused several hundred thousand deaths and injuries and destroyed much of the already deficient infrastructure. However, those schools that could be reopened quickly, provide some sense of normality to the children and help them to deal with their traumatic experiences. Therefore it is important to increase school participation once schools are rebuilt and to understand previous enrollment patterns.

Besides its compulsory character, other motives drive school enrollment and attendance. Human capital theory was the first strand of literature to consider differences in education. This early research considered education as an investment in human capital which is motivated by the higher expected earnings (see e.g. Becker (1964) or Mincer (1958)). More recently, empirical research concentrated on differences of returns to education as well as on (indirect) determinants of educational attainment and enrollment (see e.g. Wilson (2001), Haveman and Wolfe (1995) and Blundell et al. (2000)) or focused on the evaluation of policies (see e.g. Schultz (2004), Behrman et al. (2005) and Bourguignon et al. (2003)). Glewwe and Kremer (2006) present a wide range of educational issues specific to developing countries and summarize the relevant literature. Klasen (2002) focuses on schooling of girls and its impact on growth. Similarly, Colclough et al. (2000) analyze the reasons for low enrollment rates and gender gaps in schooling in developing countries. From their empirical investigation of survey data from Ethiopia and Guinea, the authors conclude that low enrollment is a result of poverty, but that the lower enrollment of girls is caused by adverse cultural practice (which itself can be connected to poverty). In their cross-country comparison, Huisman and Smits (2009) study household- and district-level determinants in 30 developing countries. Most parts of the developing world are represented, but Central America and the Caribbean are missing.

In Kenya, educational access has increased impressively after independence. Bedi et al. (2004) study the factors that have led to two periods of erosion in educational participation that threatened these successes. The authors identify policy changes that increase the cost of schooling for both periods but also

consider child and family characteristics in their estimations.

Guimbert et al. (2008) combine school census and household data to analyze determinants of primary and secondary school enrollment in post-conflict Afghanistan. Their estimations take into account both supply and demand side characteristics. The results indicate that gender is the most influential factor: Girls are less likely to be enrolled than boys. Furthermore, living in a bigger household or a household without regular salary, having lost one's parents and belonging to the Pashtun nomad tribe Kuchi are significantly negatively related to enrollment.

Primary school enrollment is almost universal in Honduras, so Bedi and Marshall (2002) turn to estimating a model of school attendance using school survey data. Their results show that opportunity costs played a role, but to a smaller extent than expected human capital benefits. Additionally, the authors identify the supply side as an important factor limiting school attendance.

Regarding work related to the Dominican Republic and Haiti, Amuedo-Dorantes et al. (2008) focus on the impact of out-migration and remittances in Haiti. They find heterogeneous effects between communities: only in some communities do remittances have a positive effect on school attendance even for children that live in households affected by out-migration. Similarly, Bredl (2009) uses a Cox proportional hazards model to disentangle effects of receiving remittances and out-migration of household members. On the one hand, his results confirm the positive impact of remittances that relieve budget constraints especially for poorer households and are positively related to school enrollment. On the other hand, he finds no evidence for a negative effect of out-migration or absence of the household head.

Lunde (2008) analyzes questions related to educational decisions in Haiti and bases her findings on qualitative interviews. She states that Haitian families generally attach a high value to the education of their children. However, schooling only seems to pay off in economic terms when at least primary school is completed and some people even suggest only university degrees considerably improve job perspectives. This is out of reach for large parts of the population that struggle to keep their children in school. They often have to pay for the same grades several times as they cannot afford the final exams or their children fail due to low teaching quality, reduced tuition time, school facilities being inaccessible some time of the year or because children need to stay at home during the harvest period. According to the paper, all these factors lower the expected returns of education and contributes to the low enrollment rates. Furthermore, economically accessible schools are often too far away and geographically accessible schools are often not economically accessible.

The aim of this paper is thus not only to identify the determinants of schooling, but also to investigate to what extent differences in schooling are due to individual factors as compared to family or community influences. Multilevel regression techniques provide the adequate tools for this analysis. Being interested in educational decisions today, we will consider children that should currently be enrolled in primary school according to their age. Since household data of the standardized Demographic and Health Survey (DHS) are available for Haiti as well as for the Dominican Republic for adjacent years (most recent surveys: 2000, 2005/6 for Haiti and 2002, 2007 for the Dominican Republic) the analysis includes two surveys each for these two countries and explores whether the factors that determine enrollment differ between Haiti and the Dominican

Republic. Logistic multilevel regression techniques are applied and the heterogeneity of the data sets is quantified using the median odds ratio (MOR).

Results indicate that individual level characteristics seem to have similar effects in both countries, but household and community characteristics differ to an important extent. The MOR shows that heterogeneity between households is larger than between clusters and both are bigger in the more recent survey.

The remainder of this paper is organized as follows. The next section introduces the countries analyzed and highlights the educational systems. Section 3 provides a theoretical background on education. Section 4 introduces the data and the empirical approach before the estimation results are presented in Section 5. Section 6 concludes.

2 Background: Haiti and the Dominican Republic

Haiti and the Dominican Republic share the tropic island of Hispaniola which is the biggest island of the Greater Antilles archipelago in the Caribbean region. While the bigger Dominican Republic is a famous tourist destination with decent human development, Haiti is the poorest country of the Americas both in terms of income and of human development and in these respects comparable only to the poorest African countries (Sletten and Egset, 2003). Haiti, which comprises the western third of the island, has an estimated GDP per capita of only PPP US$ 1,155 and ranks 149th out of 182 countries on the United Nations Development Programme Human Development Index (HDI) (UNDP, 2009). However, large parts of the population do not even reach the average income levels, because inequality is very high so that 56 percent of the population live on less than one dollar per day (Sletten and Egset, 2003). It has a population of about 9.9 million. In contrast, the Dominican Republic, which has roughly the same number of inhabitants, reached a GDP per capita of PPP US$ 6,706 and ranks 90th on the HDI (UNDP, 2009).

Table 1: Country characteristics

Country Background	Haiti	Dominican Republic
Total population (*1000), 2008	9,876	9,953
GDP per cap. (PPP US$), 2007	1,155	6,706
Under-5 mortality rate, 1990	151	62
Under-5 mortality rate, 2008	72	33
Life expectancy, 2008	61	73
Adult literacy rate (%), 2003-08	62	89
Primary school net enrollment (%), 2003-08	50	84
Gini coefficient for income, 1992-2007	59.5	50
HDI rank, 2007	149	90

Note: Gini coefficient, HDI rank and GDP are taken from UNDP (2009), all other data are taken from UNICEF (2010b) and UNICEF (2010a).

In 1804 a slave rebellion against the French colonial power led to Haiti's in-

dependence which made it the second independent country in the Americas after the United States. However, France obliged Haiti to pay 150 million gold francs as indemnity for the loss of its former colony. Although later on the amount of the repayments were substantially reduced, it imposed a heavy burden on Haiti's future economic development and swallowed large shares of the national budget well into the 20th century. The history that followed was marked by inequality, recurrent political violence and rebellions. The last century was decisively influenced by 19 years of US occupation (1915-1934) and a period of dictatorial leadership by Francois Duvalier and his son Jean-Claude that lasted from 1957 to 1986 and led to increasing poverty of the Haitian people. Since 2004 and as a consequence of the coup d'etat against president Jean-Bertrand Aristide, the United Nations Stabilization Mission in Haiti, MINUSTAH, has been operating in Haiti to secure peace in the region. This had led to an increase in security and some recovery until the devastating 7.0 magnitude earthquake on January 12, 2010 which set back the country. Haiti's economy is characterized by subsistence farming, cultivation of coffee and mangoes for export, an important informal sector and low industrial production, largely limited to textiles. Aid and remittances both play an important role. Agriculture is hampered by the low soil quality and erosion caused by deforestation as well as by tropical storms (Macro International, 2007). Internal migration has led to rapid urbanization and contributes to the growth of slum areas in the capital Port-au-Prince. In the absence of pensions, social security and savings for most of the population, children are considered as security for old age and especially very poor households have many children. As a result, the population is very young, children and youth represent about 50 percent of the population (World Bank, 2006). According to the World Bank (World Bank, 2006), in 2001 almost half of all Haitian households lived in extreme poverty and the figure was even higher for Northeast and Northwest regions. Only in metropolitan areas the prevalence of extreme poverty is markedly lower, at 20 percent of the households. In these areas, the share of households that receive remittances from expatriates is highest, at 44 percent (World Bank, 2006). As a result, the main difference in the incidence of poverty in Haiti is between the metropolitan area and the rest of the country. Outside of Port-au-Prince, a larger proportion of people is poor and poverty is more severe. These spatial disparities seem to be driven by geographical characteristics (e.g. climatic conditions, lack of infrastructure or scarcity of human capital) rather than by specific household characteristics (Sletten and Egset, 2003).

Dominican independence after the Haitian occupation (1822-1844) did not last long since the country was annexed by Spain (1861-1865). After independence from Spain the country was independent for roughly half a century, but in the twentieth century, it was occupied by the United States twice. The second occupation in 1965 ended the Dominican civil war which followed the three decades of Rafael Trujillo's dictatorship. The subsequent authoritarian rule of Joaquín Balaguer from 1966 to 1978 ended with the first democratic election from which the government of president Antonio Guzmán emerged. After the second rule of Balaguer (1986-1996), a generally free and fair electoral process has been established.

Mining and agriculture are the biggest export sectors while the service sector (with an important part made up by tourism) is the major employer. The Dominican population is very young, the mean age is 25 (Macro International,

2008). While the Dominican Republic has been confronted with a major influx of Haitian migrants, it is also a country of emigration, especially to the US where about a million of Dominicans is estimated to live, but also to Europe (Macro International, 2008).

2.1 Schooling in Haiti

The Haitian educational system is based on the French system of the early 19th century and has a strong academic focus. This focus combined with the use of French as teaching language which most students do not master and many even do not understand has helped little to prepare the students for the reality in the country or for their professional lives. The *réforme Bernard* from 1978 recognized this, reformed the structure of the educational system and aimed at introducing more adequate teaching methods and a more adequate curriculum and also introduced Haitian Creole as teaching language. However, these ambitious reforms were hardly implemented.

The Haitian Constitution envisions free and compulsory primary education which lasts nine years and is started at the age of six. However, compulsory schooling is not enforced or facilitated because of the weak role of the state in the field of education. The number of schools run by the public sector is insufficient and the private sector has expanded rapidly to fill the gap, but without much coordination. As a result, 82 percent of all primary and secondary students attend private schools that charge tuition fees. The quality of private schools is very heterogenous: A very small number of mostly religious elite private schools that are affordable and accessible to a small share of the (urban) population, constitutes the top segment of the education sector. Most public schools are situated in the (upper) middle of the quality scale. The vast majority of private schools follows at the bottom (World Bank, 2006). Access to education thus depends partly on the income or wealth level of parents. Yet, private schools run by NGOs or communities do not charge tuition fees and present a possibility for children from poor families to attend school (Sletten and Egset, 2003).

The nine years of fundamental schooling (*enseignement fondamental*) are subdivided into three cycles with standardized exams at the end of the second and third cycle (i.e. after the sixth and the ninth grades). After passing the *diplôme de fin d'études fondamentals*, students can choose from different types of upper secondary education and either study at a classical or technical oriented *lycée* for four years which qualifies for university attendance if the *bac* exam is passed. Otherwise, students can attend professional formation for three years and learn a certain profession.[1] Key problems besides but also partly connected to the low enrollment rates are the limited amount and capacity of schools, school fees, late school entry, high repetition rates and low quality of schooling.[2] The school year includes less days of schooling than in most other countries (UNESCO, 2006). As a result of late enrollment and high repetition rates, three quarters of primary students are two or more years older than their grade

[1] The nine years of fundamental schooling are thus organized in three cycles of four, two and three years, respectively. Ministère de l'éducation nationale, de la jeunesse et des sports (2004) provides more details on the structure of the Haitian schooling system and also points out the weaknesses.

[2] Salmi (2000) mentions several quality problems such as low teacher qualification and poor facilities.

level would indicate and only two thirds of all sixth grade students pass the national exam. This low internal efficiency of the schooling system is related to extensively overcrowded classrooms, precarious physical conditions and the low qualification of most teachers: Nearly 80 percent of primary teachers hold no official teaching certificate (Wolff, 2008).

2.2 Schooling in the Dominican Republic

In the Dominican Republic nine years of schooling are compulsory: The last year of preschool education and eight years of primary education. After the eighth grade students write a standardized exam that opens up the way to secondary education. Secondary education is also free but it is not compulsory. It is organized in two cycles, a general one of two years for all students and a second two-year cycle that allows the students to choose an academic, technical-professional or artistic option. The school year lasts 42 to 43 weeks. While progress has been achieved regarding enrollment rates, dropout and grade repetition remain important problems (UNESCO, 2006). In 2002, school enrollment of children aged six to 13 reached 85 percent and unlike in many other countries, the enrollment rate of girls is slightly higher than that of boys (Comisión Presidencial Objetivos del Milenio, 2004). Nevertheless, only 53 percent of school beginners finish grade 8 and thus complete primary education. While this represents a massive improvement considering that the percentage was only 22 percent in the early 1990s, internal efficiency of the schooling system is still insufficient. In 2001, 23.8 percent of all grade 4 students were three or more years over age. This problem is particularly severe in rural and marginalized areas and becomes worse after grade 4: 80 percent of students in urban areas, but only 60 percent of students in rural areas pass the exams that mark the end of the first cycle of primary school. As a result, the education levels vary widely by area of residence and wealth (Comisión Presidencial Objetivos del Milenio, 2004).

Furthermore, the increase in enrollment has led to problems in schools: Some classes are overcrowded, teaching is organized in up to three shifts and low-quality private schools have emerged in marginalized areas (Secretaría de Estado de Educación, 2008). From the 1970s to the mid-1990s, when public funding for education was low, the private sector grew and by 1995, it covered 25 percent of all students. Since then, it has somewhat declined and was at 21 percent in 2007 (Secretaría de Estado de Educación, 2008).

The coexistence of public and private schools is not a recent phenomenon in the Dominican Republic. When the establishment of a public education system foreseen by the constitution after independence from Haiti in 1844 was delayed, mostly private schools were built and filled the gap. In the late 19th century and several times in the 20th century, public schooling was expanded. Only in the 1970s, non-religious and for-profit schools started to operate (Mendoza, 2007). These schools generally have a very good reputation, although they are sometimes criticized for their high fees. In spite of efforts to improve quality of public schools, quality gaps between the public and the best private schools remain large especially at the primary school level. As a result, affluent families tend to prefer private schools. Good private schools are largely an urban phenomenon. Yet, not all private schools are of good quality. For a long time, the state ignored private schools, so that it did not exercise any control and did not even attempt to register all these schools. Today, the government recognizes private schools

that fulfill minimum requirements. These officially recognized schools can apply for subsidies, but usually they are financed by tuition fees. In contrast, some Catholic schools, that also charge tuition fees, are state-subsidized. Another category of private schools are demand-absorbing (Mendoza, 2007) schools organized by communities or private organizations. Since these schools usually do not meet the requirements, they are not recognized by the state and can neither apply for state subsidies nor carry out the national grade 8 exam. Unrecognized schools often end after grade 7, but some schools do have the eighth grade and their students are allowed to take the exam in a public school (Mendoza, 2007).

3 Conceptual Framework

In countries with low overall educational achievements, school enrollment is a good proxy for educational participation. In contrast to attendance decisions, enrollment decisions are usually made annually, in the beginning of every school year. This can lead to fuzzy results when sanctions or incentives (e.g. conditional cash transfers) encourage enrollment but do not depend on regular attendance. This argument holds true for many Latin American countries such as Brazil but seems of little importance for the Dominican Republic and Haiti. In these two countries, there are no other important incentives for enrollment than for attendance. To the contrary, annual enrollment is related to costs at most schools so that parents will not be willing to face these costs if they do not want to send their children to school on a regular basis.

Parents or households thus face the discrete choice whether or not to enroll their children in school for the upcoming school year (which means that the child will be able to do only limited (house) work if any). In order to make this decision, they consider the (expected) benefits and the (direct and indirect) costs. The utility resulting from sending their children to school and facing a situation with less resources for household consumption and the alternative utility when not sending children to school (and thereby increasing household consumption) can be expressed as utility functions. The two resulting utility levels are compared and the household chooses the option that maximizes utility.[3]

If the value attached to education and the potential benefit of schooling is not known for a specific group, one can consider factors at different levels which are decisive for enrollment. Analysis of enrollment and attainment usually starts with a comparison of benefits and costs which can be summarized as (see e.g. Guimbert et al. (2008)):

$$E = f(S, C, H, R). \tag{1}$$

In this equation, E is enrollment, S is a vector of school characteristics, C is a vector of child characteristics, H is a vector of household characteristics and R is a vector of community or regional characteristics.[4] Since our data do not provide specific information on the school a child may attend, Equation (1) reduces to:

$$E = f(C, H, R), \tag{2}$$

[3]For more details on these utility functions and a formal framework see e.g. Bedi and Marshall (2002) and Bedi et al. (2004).

[4]Glewwe and Kremer (2006) present various specifications of this type.

where school characteristics are partly captured by the vector for community characteristics, R, and the remainder is part of the error term. A similar conceptual framework is applied by Huisman and Smits (2009) who specify household and district level determinants of educational enrollment in developing countries, but do not specifically include an individual level. To stress intra-household differences and to account for the possibility that a child has some decision power, we modify their approach and include individual (child) characteristics as a distinct level.

4 Data and Empirical Strategy

4.1 Data

For the empirical analysis, we use data from the Demographic and Health Surveys (DHS) which have been conducted under the coordination of ORC Macro International in Haiti (2000, 2005/6) and in the Dominican Republic (2002 and 2007). These DHS surveys use nationally representative samples of households and collect a broad range of information on all household members regarding health, education, wealth/ socioeconomic status, but also on family planning, gender/ domestic violence, HIV prevalence, infant and child mortality and nutrition. The samples are based on a stratified two-stage cluster design, where enumeration areas are drawn from Census files and in each of the selected enumeration areas, a sample of households is drawn randomly. The first row of

Table 2: Number of observations

	Haiti		Dominican Repub.	
	2000	2005/6	2002	2007
no. of observations	46,787	46,677	93,851	120,889
obs. age 6-11	7,906	7,769	15,086	17,254
complete obs. age 6-11	7,814	7,686	14,907	16,978

Table 2 shows the number of observations included in each of the four data sets. For this paper we consider children aged six to eleven, so we have at least 7,906 observations for each year and country. Because of some missing values for enrollment and the explanatory variables some observations have to be dropped. The bottom row shows how many observations are actually used for the empirical analysis. The incomplete observations do not show any systematic patterns.

4.2 Empirical Strategy

Multilevel regression models assume a hierarchical structure of the data set, which is found in many different contexts: For example, students are nested in schools or individuals are nested in industrial organizations.[5] Characteristics of these individuals are not independent, but depend on the social context which

[5]Hox (2002) illustrates these and other examples. DiPrete and Forristal (1994) provide examples from sociology including studies on education and criminology.

is partly reflected by the attendance of the same school or working in the same company. Although the social context is particularly important in social sciences and health studies, multilevel analysis can also yield interesting insights into economic problems and has repeatedly been applied in development economics.[6] Considering different aspects and aggregation levels of individuals and their surrounding systems, these systems can be interpreted as hierarchical levels. A multilevel model has one single outcome or response variable that is measured at the lowest level, and explanatory variables at all existing levels can be included. These explanatory variables can either be measured at their natural level or moved to another level by aggregation and disaggregation. An example for disaggregation is the assignment of characteristics of the industrial organization to all its employees. Although careful analysis is required when variables are moved from one level to another, it does not alter the estimation procedure. Instead, the structure of the random part of the model that includes error terms at different levels, requires special procedures to obtain efficient parameter estimates.

In this study, we analyze enrollment behavior of children. In this case, it seems apparent that children within households and communities are more similar to each other than to children from other households or communities. Put differently, one can think of child i being nested within household j which is nested within community k.[7] To account for the resulting dependence of error terms, a multilevel model with three levels is set up. Before including covariates, the model reads:

$$logit(Pr(y_{ijk} = 1|u_{0jk}, v_{00k})) = \gamma_{000} + u_{0jk} + v_{00k}, \tag{3}$$

where y_{ijk} is the binary outcome variable indicating whether a child is enrolled or not. γ_{000} is the general intercept, while u_{0jk} and v_{00k} are the household- and community-specific intercepts. After adding covariates at the three levels, i.e. P covariates X_{pijk} at the individual level, Q covariates C_{qjk} at the household level and R covariates P_{rk} at the community level, Equation (3) becomes

$$logit(Pr(y_{ijk} = 1)) = (\gamma_{000} + \sum_{p=1}^{P} \beta_{1p} X_{pijk} + \sum_{q=1}^{Q} \beta_{2q} C_{qjk} + \sum_{r=1}^{R} \beta_{3r} P_{rk}) + (U_{0jk} + V_{00k}), \tag{4}$$

where the household- and community-specific intercepts are now U_{0jk} and V_{00k}.

So far, multilevel regression techniques provide efficient estimates for the fixed effects parameters. Furthermore, they yield additional information on the heterogeneity within the dataset as well as on the extent and structure of clustering of the outcomes. While partitioning of variance and intraclass correlations are typically used for the investigation of heterogeneity in linear multilevel regression, these measures do not have the same intuitive interpretation for binary outcomes. Larsen et al. (2000) and Larsen and Merlo (2005) suggest a different measure of heterogeneity specifically for logistic multilevel models with normally distributed random intercepts, the median odds ratio (MOR). To calculate the

[6] See e.g. Madise et al. (1999), Griffiths et al. (2004), Gräb and Grimm (2008) and Huisman and Smits (2009).

[7] This similarity does not alter the estimation process if it is completely captured by the explanatory variables. In practice, however, this is rarely the case because of unobservable and unobserved characteristics.

MOR, they sample two individuals with identical covariate values from different higher-level units (e.g. clusters f and f') and compare the individual with the larger (cluster) random intercept (v_{00f}) to the one with the smaller (cluster) random intercept ($v_{00f'}$). The odds ratio then is $exp(\mid v_{00f} - v_{00f'} \mid)$.[8] Repeating this procedure yields a distribution of odds ratios with its median being referred to as median odds ratio (MOR). This median as well as all other percentiles a (with $a > 0$) of the distribution can be obtained from the cumulative distribution function:

$$\begin{aligned} \widehat{Pr}\{exp(\mid v_{00f} - v_{00f'} \mid) \leq a\} &= \widehat{Pr}\left(\frac{\mid v_{00f} - v_{00f'} \mid}{\sqrt{2\hat{\sigma}_v^2}} \leq \frac{ln(a)}{\sqrt{2\hat{\sigma}_v^2}}\right) \\ &= 2\Phi\left(\frac{ln(a)}{\sqrt{2\hat{\sigma}_v^2}}\right) - 1, \end{aligned} \tag{5}$$

where $\Phi(\cdot)$ is the cumulative distribution function of the normal distribution with mean 0 and variance 1 and where σ_v^2 is the variance of the random effect (here: at cluster level). Since the median marks the number that divides the lower half of the observations and the upper half, taking fifty percent of the probability distribution identifies the median. Setting the cumulative probability in Equation (5) equal to 0.5, a is the 50th percentile or the median odds ratio:

$$2\Phi\left(\frac{ln(MOR)}{\sqrt{2\hat{\sigma}_v^2}}\right) - 1 = 0.5. \tag{6}$$

Solving Equation (6) for MOR yields:

$$\begin{aligned} MOR &= exp(\sqrt{2\hat{\sigma}_v^2} \times \Phi^{-1}(0.75)) \\ &= exp(\sqrt{2\hat{\sigma}_v^2} \times 0.6745), \end{aligned} \tag{7}$$

The measure is always greater than or equal to 1, with a larger value indicating a higher degree of between-cluster variation (see e.g. Merlo et al. (2006)). Similarly, the importance of between-household variation can be assessed replacing $\hat{\sigma}_v^2$ by $\hat{\sigma}_u^2$ in Equation (7).

Comparing the MORs of different years allows us to assess whether the impact of household and community affiliation decreased over time i.e. if individual child characteristics gained in importance in determining whether or not a child was enrolled at school.

4.3 Explanatory Variables

Individual Factors

The literature notes a gender bias in enrollment in many countries (see e.g. Klasen (2002)), so we include the binary variable *male* into the model. Since parents might favor their own children compared to other children living in the

[8] The same exercise can be done for any higher level. In this paper, the MOR will be calculated for clusters and for households.

household (extended relatives, children of friends or – in Haiti – *restaveks*[9]), a dummy for biological children of the household head is included (*biological_child*). To capture a problem common especially in Haiti, namely late enrollment, we also include *age*. According to Huisman and Smits (2009) children may have to replace the work usually carried out by a missing parent. In the Caribbean context absent parents might also work abroad and send remittances which can have a positive effect on the school perspectives of children, so we rather include a dummy variable that indicates if the parents are alive (*parents_alive*).

Table 3: Variables in the model

VARIABLES Name	 Label
individual level	
age	Child age (6-11)
male	Child is male
biological_child	Child is a biological child of the household head
parents_alive	Both parents are alive
oldest_child	Child is the oldest child in the household
younger_siblings	Number of younger siblings
household level	
agehead	Age of the household head
female_head	Household head is female
hhsize	No. of household members
toilet	Household has a toilet
firewood	Firewood is the main cooking fuel
wealth_ind	Wealth index
educ_head	Education of household head in years
female_educ	Education of most educated female hh member (in years)
old_children	Share of old children in household
community level	
urban	Urban community
cl_fmidage	Share of women in age group 40-69
cl_wealth	Mean wealth index in the cluster
cl_educ_head	Mean years of education of household heads

The birth order might matter for both financial and time constraints that influence the enrollment status of a child. The direction of the impact, however is less clear: While resources might be concentrated on the first child, Buchmann and Hannum (2001) argue that later-born children might benefit from economic

[9] *Restaveks* are children that are sent to another family where they help with the household chores and hope to have the chance to get an education. Many of these children are treated like slaves and abused by their host families (Lunde, 2008).

resources provided by older siblings. Similarly, older children in a household can decrease the number of chores a primary school age child has to do. This impact is captured by the dummy variable *oldest_child*. Since the effect of siblings is not clear in the literature, we include another variable, *younger_siblings*, because younger children might cause rivalry about household resources and need the time of parents and older siblings. The variables are defined as shown by Table 3.

Household Factors

On the household level, the number of household members (*hhsize*) is included. To have a better picture of who the household members are, we include the share of household members that is between six and 14 years old *(old_children)*. The age and sex of the household head is also controlled for (*agehead* and *female_head*). Parents who have reached a certain educational level themselves might attach a higher importance to the education of their children and might also be better connected to relevant people when it comes to the provision of access to school or to lifting credit constraints. The number of years of schooling of the household head, *educ_head*, captures this. The education of the mother or other female household members (*female_educ*) might matter for all children, but especially for girls.

One of the central hypotheses of this paper is that opportunity costs present a major barrier to school enrollments. For children of primary school age, these opportunity costs typically derive from household chores, sometimes also from work outside the household. Apart from looking after siblings, which would be captured by the child-level variables, another relevant task is the collection of firewood, especially in Haiti where firewood is the most important cooking fuel for about 60 percent of the households. The data only allow to proxy this source of opportunity costs by including the dummy variable *firewood*. To capture income and wealth, an asset index, *wealth_ind* is introduced. Whether or not a household has a toilet (*toilet*) is clearly linked to economic wealth but also stands for the hygienic conditions within a household which is important for a healthy childhood.

Community Factors

Urban areas generally show a better infrastructure and have more institutions. Accessing a school might also be easier than in rural areas, so the dummy *urban* is included. The average wealth of the households *(cl_wealth)* might also have an impact on enrollment. Following Huisman and Smits (2009) we include the share of women in the 40-69 age group, because a lower share of women stands for disadvantage of women in the community. The education of household heads within a community (*cl_educ_head*) stands for the acknowledgement of the importance of education.

5 Results

5.1 Descriptive Statistics

Descriptive statistics show that the enrollment rate, *enrolled*, has increased from the first to the second survey. While the progress is modest in the Dominican

Republic (from 83.12 in 2002 to 85.43 in 2007), it is substantial in Haiti (from 39.20 in the year 2000 to 54.79 in 2005/6) – though at a much lower level. This increase might be due to the expansion of community schools of rather low quality. Unfortunately, the data do not include information on the type of school. These enrollment rates are roughly in line with official data, so the low school participation in Haiti does not come as a surprise.

Table 4: Enrollment rate by sex and place of residence

	Haiti		Dominican Repub.	
	2000	2005	2002	2007
girls	41.65	56.71	84.60	86.71
boys	36.25	52.67	81.70	84.06
urban	61.76	69.75	83.61	85.25
rural	28.84	47.05	82.26	85.60
total	39.20	54.79	83.12	85.43

Note: Weights are applied

Before looking at the full table of explanatory variables a closer look at the enrollment rates of sub-groups can give interesting insights. Table 4 shows the enrollment rates separately for girls and for boys, highlighting that girls are not per se disadvantaged regarding primary school enrollment. Quite the contrary, enrollment rates for girls consistently exceed those for boys even though the gender gap is lower in the second wave of the survey.

Less equality is found when it comes to differences between urban and rural areas: The enrollment rate among children living in urban areas is more than twice as high as the rate for rural children in Haiti in 2000. Although the gap is still very pronounced in the 2005/06 data, much of the increase in school participation within the five years seems to be attributable to progress in rural areas. In the Dominican Republic, living in an urban area does not seem to make a substantial difference.

As indicated by Table 5, belonging to a household of a higher wealth quintile is related to higher enrollment rates for all data sets. Again, the discrepancy is much higher for Haiti than for the Dominican Republic. In 2000, the enrollment rate for the highest wealth quintile was almost four times as high as for the

Table 5: Enrollment rate by wealth quintiles

	Haiti		Dominican Repub.	
wealth quintile	2000	2005	2002	2007
lowest	18.56	33.21	74.21	79.32
second	27.99	45.66	80.43	84.08
middle	35.47	58.06	86.68	87.25
fourth	54.25	69.55	87.12	89.27
highest	70.79	79.41	89.18	88.17
total	39.20	54.79	82.00	85.43

Note: Weights are applied

Table 6: Enrollment rates by child age

	Haiti		Dominican Repub.	
Age group	2000	2005	2002	2007
6	5.91	19.79	43.42	54.88
7	25.35	38.98	78.17	84.70
8	33.04	54.26	89.61	92.71
9	49.58	68.55	93.60	93.64
10	55.41	71.18	96.80	94.31
11	71.37	78.50	95.12	95.40
Total	38.94	54.66	83.10	85.36

Note: Sample weights are applied

poorest wealth quintile. Since progress has been smaller for the highest wealth quintile than for the lower and middle ones, the gap has been reduced, but it was still substantial in 2005/06. Age is another very important factor regarding enrollment differences. As shown by Table 6, in 2000 hardly any children were enrolled at age six in Haiti. With increasing age, enrollment rates constantly rose. Five years later, enrollment rates had increased for all age groups, but the pattern remained. For the Dominican Republic, a similar discrepancy exists only for six-year-old children who have a drastically lower enrollment rate than older children.

Figure 1: Enrollment rates by child age

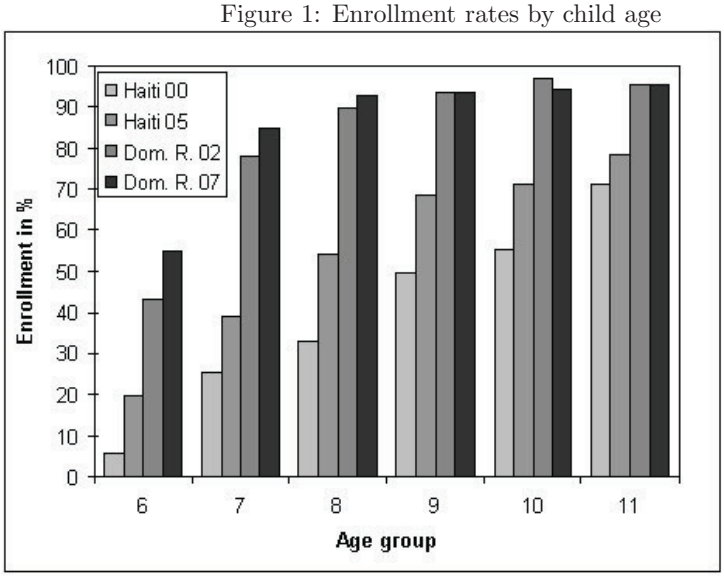

Figure 1 illustrates the enrollment-age pattern. Table 7 shows major differences in the explanatory variables, too: On average, primary school age children have more younger siblings in Haiti and the head of the household is slightly older. The mean household size is also bigger in Haiti but it decreased marginally in both countries. In the poorer country, more households

Table 7: Descriptive Statistics

	Haiti		Dominican Rep.	
Variable	2000	2005	2002	2007
individual characteristics				
enrolled	0.392	0.548	0.831	0.854
age	8.410	8.452	8.509	8.441
male	0.495	0.504	0.511	0.504
biological_child	0.679	0.655	0.666	0.669
parents_alive	0.876	0.881	0.949	0.951
oldest_child	0.264	0.278	0.368	0.380
younger_siblings	1.691	1.513	1.117	0.980
household characteristics				
agehead	45.841	45.702	43.623	43.166
female_head	0.412	0.429	0.260	0.346
hhsize	6.879	6.649	5.728	5.382
toilet	0.571	0.598	0.947	0.958
firewood	0.606	0.592	0.106	0.077
wealth_ind	-2.651	-3.736	29.197	24.677
educ_head	1.618	1.810	3.446	3.500
female_educ	1.210	1.492	2.331	2.564
old_children	0.386	0.389	0.404	0.410
community characteristics				
urban	0.307	0.337	0.622	0.673
cl_fmidage	0.519	0.537	0.496	0.503
cl_wealth	-1.151	1.238	27.421	24.879
cl_educ_head	1.642	1.850	3.404	3.416
observations	7814	7686	14907	16978

Note: Sample means, weights are applied

are headed by women, but this share also increased substantially in the Dominican Republic between the two surveys. The lower standard of toilet facilities and the higher share of children living in households that use firewood as central cooking fuel indicate the lower standards of living in Haiti. Furthermore, household heads and adult female household members have attended school for roughly twice as many years in the Dominican Republic. The share of children that live in urban areas is considerably lower in Haiti, too. Most of these variables, however, suggest an improvement of the situation in Haiti.

5.2 Multilevel Regression Results

A Likelihood Ratio Test confirms that the three-level specification is adequate for the data structure and is superior to both a two-level and a linear model. Table 8 shows that the impact of the explanatory variables varies between the two countries and changes over time, although the direction of the impact remains the same whenever coefficients are statistically significant. The odds ratio[10] of

[10]For small values of p, the odds ratio is a good approximation of the risk ratio. Norton et al. (2004) explain the risk ratio with the example of smoking with the example of men and

age is always bigger than one and statistically highly significant which means that older children are more likely to be enrolled at school. As shown by the relatively low odds ratio for *male*, girls are on average more likely to go to school than boys, especially in the Dominican Republic. The positive impact of being a biological child of the household head is bigger in Haiti, possibly because of the *restavek* issue. Still having both parents – independently of whether they live with the child or not – is clearly related to higher enrollment in all regressions and the coefficient is statistically highly significant except for Haiti 2000. Contrary to the expectations, a large number of younger siblings does not seem to substantially hamper schooling opportunities for the older siblings. Similarly, the oldest child in a household is equally likely to be enrolled, so it is neither treated preferentially by its parents nor does it have to stay out of school to look after younger siblings. An older head of the household is beneficial for enrollment, but the effect of a female household head is not unambiguous.

Many odds ratios of the household level variables are in line with the expectations: Living in a smaller household or in a household with a higher share of older children, having a toilet, household wealth, education of the household head and a female household member are positively related to higher enrollment. Using firewood as main fuel for cooking is only related to lower enrollment in the Dominican Republic in 2007.

With respect to the community characteristics, the performance of the variables is rather poor and does not show a consistent picture. The small and significant odds ratio for *urban* for the Dominican Republic might be surprising at the first glimpse, but it is important to keep in mind that this effect is conditional on the other covariates including household wealth.

5.3 The Importance of Higher Levels

Table 9 shows the random effects and median odds ratios (MOR). For all countries and years the MORs of both the household and the community are of a relevant magnitude. In all cases, the MORs of the household exceed those of the communities. This indicates that the (observable and unobservable) characteristics of the household have a higher impact on a child's chances to be enrolled in school than the characteristics of the community. The MORs increased from the first to the second survey in both countries (but much more so for in the Dominican Republic) which suggests a growing heterogeneity between households and communities. This is contrary to the assumption that an expansion of schooling automatically creates a higher equality of chances.

6 Concluding Remarks

The aim of this paper was to shed some light on educational decisions in Haiti and the Dominican Republic and thereby explore reasons for the relatively low

women who smoke. If, for example,

$$riskratio = \frac{Pr(smoke|female)}{Pr(smoke|male)} = 1.5, \tag{8}$$

women are ceteris paribus fifty percent more likely to smoke than men.

Table 8: Multilevel regression results: Odds ratios

	Haiti		Dominican Republic	
Variables	2000	2005/06	2002	2007
age	2.562***	2.449***	2.704***	2.396***
	(-0.101)	(0.090)	(0.083)	(0.070)
male	0.953	0.837**	0.646***	0.764***
	(0.075)	(0.063)	(0.040)	(0.048)
biological_child	2.433***	1.941***	1.611***	1.433***
	(0.275)	(0.197)	(0.132)	(0.125)
parents_alive	1.113	1.407***	1.769***	1.511***
	(0.140)	(0.176)	(0.239)	(0.216)
oldest_child	1.129	1.031	1.192**	1.019
	(0.129)	(0.114)	(0.106)	(0.095)
younger_siblings	1.078*	1.044	1.057	1.102**
	(0.049)	(0.048)	(0.042)	(0.049)
agehead	1.014***	1.006	1.012***	1.010***
	(0.004)	(0.004)	(0.003)	(0.003)
female_head	1.335***	0.968	0.832**	0.990
	(0.128)	(0.089)	(0.065)	(0.074)
hhsize	0.938**	0.898***	0.930***	0.887***
	(0.026)	(0.025)	(0.021)	(0.023)
toilet	1.678***	1.557***	1.741***	1.151
	(0.187)	(0.172)	(0.205)	(0.165)
firewood	0.863	0.954	1.001	0.755**
	(0.133)	(0.154)	(0.114)	(0.090)
wealth_ind	1.003**	1.004***	1.004***	1.004***
	(0.001)	(0.001)	(0.001)	(0.001)
educ_head	1.091***	1.065***	1.058***	1.016
	(0.027)	(0.026)	(0.015)	(0.014)
female_educ	2.029***	2.036***	1.350***	1.274***
	(0.114)	(0.107)	(0.038)	(0.035)
old_children	2.247**	0.905	1.977***	2.013***
	(0.774)	(0.294)	(0.513)	(0.549)
urban	1.422	1.170	0.703***	0.605***
	(0.326)	(0.252)	(0.063)	(0.065)
cl_fmidage	0.272	2.004	3.125***	0.953
	(0.221)	(1.631)	(1.146)	(0.439)
cl_wealth	1.004*	1.000	0.000***	0.998**
	(0.002)	(0.002)	(0.000)	(0.001)
cl_educ_head	1.142	1.189	1.123**	1.050
	(0.143)	(0.160)	(0.058)	(0.069)
Observations	7814	7686	14907	16978
AIC	6914.9	7566.3	10368.8	11036.9

Note: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Random effects and median odds ratios

	Haiti		Dominican Rep.	
	2000	2005/06	2002	2007
var(cluster)	0.784	0.878	0.301	0.933
var(household)	1.803	1.953	1.278	1.717
MOR (cluster)	2.327	2.444	1.688	2.513
MOR (household)	3.600	3.793	2.940	3.490

school enrollment rates. It is especially important to understand the low schooling participation in Haiti prior to the earthquake to tackle its causes in the course of reconstruction.

In addition to standard factors at individual and household levels, we also examined the impact of various community characteristics. The results support earlier studies that identify older and biological children of the household head being more likely to attend school in developing countries. Enrollment is also positively related to the household head's education and the wealth of the household in both countries. The hypothesis that many children are not enrolled in school because they have to help with household chores could not be confirmed. Either it is not the case or looking after younger siblings and collecting firewood are not good proxies for household work. Low school participation rates seem to be driven particularly by late enrollment, so future research and policy interventions should focus on young children.

In addition to the limited contextual variables included, the variance structure gives some additional information on the impact of the household and area in determining the enrollment probability of a child. According to the MOR, both levels matter and in all estimations the effect of the household exceeds the community effect. Thus, schooling perspectives of children living in disadvantaged households or families sceptical towards education are significantly lower than of those living in other families. The importance of household and community seems to increase. Policy interventions should therefore consider the household level as an important targeting level. These interventions could begin with an awareness campaign or could include financial support for families or incentives to send children to school. Further research with more detailed data sets is needed to clearly define promising interventions.

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