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Keeping Children in School: Household and District-level Determinants of School Dropout in 363 Districts of 30 Developing Countries

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Abstract

Household and district-level determinants of school dropout are studied for 130,000 children in 363 districts of 30 developing countries using multi-level discrete-time event history analysis. School dropout is influenced by socio-economic and demographic household characteristics and characteristics of the available educational facilities, like number of teachers and distance to school. Other relevant context characteristics that encourage staying in school are a higher level of development and the presence of white-collar jobs in the district. Strong indications are found that children postpone dropping out until after finishing primary education and that prolonging the duration of primary education may increase the likelihood they stay longer in school. Interaction analysis shows that many effects of household-level factors depend on the context in which the household is living.

Education is generally seen as a powerful means to reduce poverty and achieve economic growth (Mankiw *et al.*, 1992; Breton, 2004). It empowers people, improves individuals' earning potential, promotes a healthy population, is a major determinant of democracy and builds a competitive economy (UNESCO, 2007a; World Bank, 2006; Hanushek & Wössmann, 2007; Hannum & Buchmann, 2005; Castelló-Climent, 2008). Since the start of the Education For All (EFA) campaign after the World Education Forum in Jomtien in 1990, remarkable progress has been made in getting young children in developing countries into primary education. However, still hundreds of millions of children drop out of school at too young an age (UNESCO, 2007b). Data from UNESCO (2004) make it clear that in 30 developing countries the survival rate to grade five (i.e. the proportion of children enrolled in grade one who eventually reached grade five) was below 75% and in half of the sub-Saharan African countries it was even below 66%. For many developing countries, the problem has thus shifted from getting children into school to keeping them in school. Children who leave school before they have finished the curriculum do not develop their potentials to the fullest and their countries waste scarce resources sorely needed. It is therefore of prime importance to get a better understanding of the factors that drive the decision to stay in school or drop out of children in developing countries.

Most research on drop out has been conducted in the USA and other highly developed countries. About the situation in less developed countries much less is known. This is a pity because, as Buchmann and Hannum (2001) already noted, improving our understanding of the determinants of educational participation in developing countries might provide us with new insights into the roots of educational stratification beyond what we already know from Western countries. For example, there is evidence that in poorer countries school characteristics are more important for educational achievement than in richer countries (Heyneman & Loxley, 1983; Fuller & Clarke; 1994), that in sub-Saharan African countries growing up in a single mother family is less detrimental (and sometimes even beneficial) for children's education than in more developed regions (Lloyd & Blanc, 1996; Fuller & Liang, 1999; Bammeke, 2008), and that in some developing countries parents in rural areas might not enroll their children in secondary education since it is of little value for working on a farm (Nicaise *et al.*, 2000). These examples make clear that we cannot simply extrapolate conclusions based on research in rich, Western, intensely studied countries when designing policies for poor countries

This paper aims to contribute to the existing knowledge about school dropout by combining information on individual children and their households with information on the context in which these households live. In recent years a growing number of large household surveys has been conducted in developing countries. Based on these surveys we have constructed a unique database with individual and household characteristics of over 130,000 children aged 12-15 who ever went to school in 30 developing countries. Of

these children we know whether they are still in school, the highest grade they obtained, and the major socio-economic and demographic characteristics of their family background. This household-level information is combined with information about the district[1] and the country in which the children live. The district characteristics include economic and cultural indicators and information on the quantity and quality of the available educational facilities.

In this paper we use this database to identify the household and district-level determinants of school dropout of young children in the developing world. To find out which factors at which level of aggregation are most important in explaining whether children stay in school or drop out, we apply multi-level discrete-time event history analysis that makes it possible to estimate the effects of factors at household, district and national level simultaneously. To address within this framework of large-scale quantitative analysis the fact that each situation is unique -- and hence that the effects of the various relevant factors might differ depending on the circumstances --, besides direct effects of the explanatory factors also interactions between household-level factors and characteristics of the context are studied. Hence in addition to hypotheses on direct effects of household and context factors, we test hypotheses on the way in which the effects of factors at the household level may vary according to characteristics of the context. To connect our analyses with ongoing debates and topical issues, we provide a new test of the Heyneman-Loxley hypothesis that under the more difficult circumstances experienced in developing countries educational facilities are more important relative to resources at the household level (Heyneman & Loxley, 1983). We also test the idea that prolonging the duration of primary education might be an effective means to keep children and especially girls longer in school in countries with high dropout rates.

In the next sections, we first develop our hypotheses regarding the household and district characteristics that determine variation in school dropout, and regarding the way the effects of household-level factors depend on the context. After that the datasets and the operationalization of the variables are described. The results section starts with the presentation of descriptive information regarding dropping out, followed by the bivariate effects of the explanatory variables on the likelihood of staying in school versus dropping out. Then we present the outcomes of the multivariate analyses. The paper ends with a concluding section in which a summary of our findings is given and their implications for educational policy are discussed.

Theoretical Background

According to human capital theory, participation in education is an investment in human capital made because of the expected returns later in life (Becker, 1964; Mincer, 1958). In the case of young children in developing countries, parents are expected to have

a large say in this decision. They are expected to weigh off the future benefits of schooling against the immediate costs. Those benefits can be for the children themselves, but also for the parents, because in the absence of a pension system, children may provide the old-age security. The costs of schooling include direct costs of books, school fees, uniforms and travel costs as well as opportunity costs of children not being able to help at home, in the household or in the family business, or to earn money in the labor market (Basu, 1999; World Bank, 2002; Admassie, 2003).

The direct and opportunity costs of going to school and the value attached to education by parents and children are influenced by many factors, both at the level of the household and the context in which the household is situated. Parents' schooling level and work situation might influence the degree to which schooling is valued in the household. The number and gender of the children in the household might influence the distribution of scarce resources available for education among them. The quantity and quality of the local educational facilities determine whether it is possible and makes sense to go to school. The local labor market structure affects the perceived benefits of education. Cultural practices, like marriage traditions, may influence the returns to education of daughters versus sons, etc. These examples make clear that educational participation of children in developing countries might be influenced by many factors at different levels of aggregation. Because these factors are not independent of each other and may exert their influence at the same time, insight into their relative importance can only be obtained if they are studied simultaneously, as is done in this study.

[Figure 1 about here]

Figure 1 gives an overview of the different groups of factors that are included in our analytical model. In the following sections, we discuss the reasons for including them and the expected directions of their effects (indicated in Figure 1 by a + or – sign).

Socio-economic Factors

Both in developed and developing countries, children from families with more socio-economic resources are more likely to stay in school (Coleman *et al.*, 1966; Jencks *et al.*, 1972; Shavit & Blossfeld, 1993; Tansel, 2002; Glewwe & Jacoby, 2004; Mingat, 2007; Evangelista de Carvalho Filho, 2008). For wealthier families, the direct costs associated with education, such as fees, books, and uniforms, are less likely to be an obstacle. Opportunity costs of children not being able to help at home, at the family farm or by earning additional income through child labor are also likely to be less important to them (Basu, 1999). Moreover, wealthier families are less affected by credit constraints. Imperfect credit markets have been found to be a major obstacle for the education of

children from poor families (Brown & Park, 2002; Edmonds, 2006; Ersado, 2005; Thorbecke & Charumilind, 2002).

Besides household income, also the educational level and labor market position of the parents is expected to play a role. There is ample evidence that children from better educated parents more often go to school and stay in school (Shavit & Blossfeld, 1993; UNESCO, 2005; Buchmann & Brakewood, 2000; Colclough *et al.*, 2000; Tansel, 2002; Huisman & Smits, 2009; Smits, 2007; Ersado, 2005). Parents who have reached a certain educational level might want their children to achieve at least that level (Breen & Goldthorpe, 1997). For educational enrollment of girls, education of the mother might be especially important (Fuller *et al.*, 1995; Emerson & Portela Souza, 2007). Mothers who have completed a certain level of education have experienced the value of education and know that it is within the reach of girls to complete that level. Although, as Gitter and Barham (2008) concluded, there need not be a linear relation. For Nicaragua they measured the effect of women's power within the household as measured by the number of years she went to school relative to her husband's. They found that mother's educational level always has a positive effect on boys' educational outcomes, but that when mother's education passes a certain threshold, there are no increases in girls' enrollment any more.

Regarding father's labor market position, we expect fathers who are in salaried employment, especially if they work in a non-manual occupation, to be more aware of the importance of education and hence to invest more in their children's education and to be more likely to motivate them to do their best and to stay in school (Breen & Goldthorpe, 1997). Also the children of those fathers themselves may be more aware of the benefits of education. For parents who are self-employed, such as (small) farmers, the opportunity costs of keeping their children in school are believed to become more important after a certain threshold, since they are more likely to expect their older children to help out in the family business. Tansel (2002) for instance found for Turkey that children from self-employed fathers are more likely to drop out of school, and Nicaise *et al.* (2000) found for Thailand that secondary education often is of minor interest for working on the farm. Parents may also have the impression that school alienates children from farmwork, diminishing the motiviation of farmers to send their children to school.

It seems plausible that children supposed to assist in the household more often drop out of school. For example, daughters of a working mother might be expected to do the household chores and be taken out of school after they received some education. On the other hand, employment of the mother might increase her power within the household, and this may increase her children's chances to get educated. According to the resource theory of conjugal power (Blood & Wolfe, 1960; Smits, Mulder & Hooimeijer, 2004) the degree to which partners can influence important household decisions depends on the

extent to which they bring in valued resources. Lakwo (2007) for instance found for Uganda that women who, through their access to micro-credit, where engaged in daily income-generating activities, gained the power to do things social norms previously denied them. This indicates that mothers who are gainfully employed and hence contribute to the household income have more influence on family decisions than women who are not employed. It seems likely that such more independent women may be better able to create the possibility for their children and especially for their daughters to stay in school. On the other hand, when the mother is forced to work because of poverty, the daughters may have to take over her household tasks and therefore have fewer chances to stay in school. The effects of mother's employment may thus differ depending on the circumstances.

Household Structure

Besides socio-economic characteristics of the parents, also the demographic structure of the household might influence educational attainment. The number of siblings for instance has been found to be negatively correlated to educational enrollment both in the USA (Blake, 1989) and in some developing countries (e.g. Pong, 1997 for Malaysia; Knodel *et al.*, 1990 for Thailand). This is probably due to the fact that people with more children can devote less time and resources to each individual child (Downey, 1995). However, this is not the case in all situations. For example, in rural Botswana, the number of 7-14 year old children in the household was found to be positively related to enrollment (Chernichovski, 1985). The reason for this may be that with more children, there are also more helping hands at home, which increases the chance that at least some children stay in school. The same effect might be found in extended families, where relatives, especially grandparents, may help out in the household or contribute to the household income, making it easier for children to stay in school.

Hauser and Sewell (1985) found no notable effects of birth order on educational attainment in the USA. However, for developing countries there is evidence that the younger children in large families are more likely to stay in school (Chernichovsky, 1985; Buchmann & Hannum, 2001; Emerson & Portela Souza, 2002), because the older children do the household chores or contribute to the household income by earning some extra money. However, in the event of a crisis we might see the opposite effect. When there is a sudden drop in income, as happened in Indonesia during the 1998 financial crisis, parents are inclined to protect the investment already done in the schooling of older children at the expense of educating their younger children (Thomas *et al.*, 2004).

It has been well-documented that girls in developing countries often receive least education. Parish and Willis (1993) found that in families lacking the resources to give all their children a full education, girls, and especially oldest daughters, suffer most. Besides

by birth order, enrollment is influenced by sex of siblings (Ota & Moffatt, 2007). Having older sisters increases the likelihood to go to school, whereas having younger brothers decreases it. Boys tend to compete only with brothers, whereas girls face double competition; first with their brothers, then with their sisters. Consequently, older sisters are most disadvantaged.

From research in Western countries, in particular the USA, it seems a well-established fact that single parenthood has a negative effect on educational attainment (Seltzer, 1994). This effect also has been found for many developing countries, where children from single-headed households might have to (partly) replace the work done by the missing parent. However, these findings cannot be extrapolated to all developing countries. In some African countries female-headed households are associated with greater educational opportunities, probably due to a higher propensity among women than men to invest in children's education in situations of restricted resources (Fuller & Liang, 1999; Lloyd & Blanc, 1996; Bammeke, 2008).

In situations where children are required to do household chores or to contribute to the household income, it is possible that if there are adopted or foster children in the household, the parents may put a disproportionately large part of those duties on the shoulders of these children instead of on their own children (Fafchamps & Wahba, 2006). Consequently, we expect biological children to have better chances of staying in school.

Educational Facilities

Both quantity and quality of educational facilities are important for educational participation, especially of specific groups, like the poor and girls (Handa, 2002; Colclough *et al.*, 2000; Buchmann & Hannum, 2001; Ersado, 2005; Huisman & Smits, 2009). The case for quantity seems obvious: when there are no schools or teachers, children are not able to go to school. Also the distance to school is expected to play a role (Mingat, 2007). Tansel (2002) found for Turkey that longer distances to regional centers are associated with lower school attainment at the secondary level. The effects of distance are more likely to be severe for girls, partly due to parents' concern for their daughters' safety, which could become more of a hurdle once girls reach puberty. Glick & Sahn (2006) found for Madagascar and Colclough *et al.* (2000) for Ethiopia and Guinea that distance has a strong negative impact on demand for schooling.

Quality is important too. It determines to what extent children benefit from going to school. Bad school quality has been found to have a negative effect on the decision to stay in school, the so called push-out effect, in various parts of the developing world (e.g. Burkina Faso, Mali, Tanzania (Bergmann, 1996); China (Brown & Park, 2002); Bolivia (Punch, 2004)). According to Bergmann, school quality is a gradient running parallel to job opportunities, "peaking in the capital, declining through other urban areas and

reaching its minima in remote rural areas" (p. 601). Dropout, therefore, may be highest in the rural areas.

Parents often realize that their children gain less from low quality education, and might therefore be more inclined to take their children out of poorly performing schools (Colclough *et al.*, 2000; Buchmann & Brakewood, 2000). As Fuller *et al.* (1995) have shown, if mothers perceive the quality of the local school to be better, their daughters have lower dropout rates. In line with various previous studies, we expect the presence of female teachers to be especially important for girls (Colclough *et al.*, 2000; Dee, 2005; Leach, 2006; Huisman & Smits, 2009). Male teachers might not provide girls with enough support, or might even be sexually threatening to them, leading to higher drop out of female pupils.

Although it seems obvious that educational facilities are important factors in determining educational participation, their relative importance versus factors at the household level is debated. Coleman *et al.* (1966) found for the USA that family background and peer effects have more influence on educational achievement than school characteristics. This finding was contested for low-income countries by Heyneman and Loxley (1983). Their research showed that in low-income countries socio-economic status is less important for educational achievement and school and teacher quality are more important than in high-income countries. Other studies conducted in the 1980s and early 1990s generally found similar effects of school factors on educational achievement for developing countries (for an overview see Fuller (1987) and Fuller & Clarke (1994)). Later studies shed doubt on whether or not the Heyneman-Loxley effect still existed. Baker *et al.* (2002) repeated the Heyneman-Loxley study with TIMSS-data for 36 countries from the 1990s, and concluded that by then "the main part of the HL effect has vanished" (p. 302). Still, Baker *et al.* (2002) "do not rule out the probability that the HL effect is still evident among the poorest of nations" (p. 306).

Dropout rates may also be influenced by the way the educational system is organized in a country. There are indications that the duration of primary education might be a particularly important factor to explain dropout at a young age in high dropout countries (Smits & Gündüz-Hosgör, 2006). Because parents are more likely to allow their children to drop out of school after completing a specific level, the number of years of education completed in these countries might be higher if the duration of primary education is longer. For this reason, in 1997 Turkey extended the duration of primary education from six to eight years (Smits & Gündüz-Hosgör, 2006; Karakasoglu, 2007). Since that time, educational participation in Turkey has increased considerably, but because the extension was accompanied by other measures aimed at increasing participation, we do not know to what extent the increase was due to the longer duration of primary education. In this paper, we study the effectiveness of this primary extension policy in two ways. First, we

test whether children have a higher propensity to drop out directly after completing primary education. Second, we test whether in countries with longer duration of primary education dropout rates in the higher age groups are lower. In this way, we hope to be able to draw more solid conclusions regarding this policy.

Other Context Factors

When considering future rewards, parents and children might estimate future employment prospects by looking at the current local labor market situation. In districts where agriculture is a major sector, children are less likely to pursue further education since most available jobs require little education (Colclough *et al.*, 2000; Buchmann & Brakewood, 2000; Tansel, 2002; Smits & Gündüz-Hosgör, 2006). Sakwa (2006) for instance found for Kenya that students were ambivalent about education as a poverty alleviation end, because they realized that having more education does not guarantee a higher income. Since a job in the formal sector often requires secondary education, children are more likely to stay in school if formal job opportunities are realistic. On the other hand, if job opportunities for people with few qualifications are good, children might be less motivated to continue their education. If it is easier for men than for women to find a (well-paid) job, parents may also take their child's sex into account (Colclough *et al.*, 2000; Buchmann, 2000; Song *et al.*, 2006).

Labor market prospects are not the whole story however. In the absence of pension schemes, as is the case in most developing countries, children are supposed to provide for their parents when they are old. This means that, when considering the education of their children, parents may not only take future returns to their children, but also returns to themselves into account. In cultures where sons are reckoned to look after their parents in old age, parents might be more inclined to invest in their sons. This need not be limited to their sons' education, but might also include investment in their health, etc. This also means that in cultures where "a girl's allegiance after marriage is mainly to her future husband's family, the balance of perceived benefits to parents is likely to favor the education of sons over daughters" (Colclough *et al.*, 2000, p. 7). This idea is backed for instance for Turkey by Rankin and Aytaç (2006), who showed that girls from less patriarchal families are more likely to stay in school. However, other authors cast doubt on the generality of this assumption. Levine and Kevane (2003) for instance found for Indonesia that virilocality (i.e. where daughters move away from their parents upon marriage) does not influence investments in daughters' education. And Eloundou-Enyegye and Calvès (2006) found for patrilocal regions of sub-Saharan Africa, that daughters remitted substantially to their parents and that these remittances were higher if the daughter was more highly educated.

Besides labor market structure and culture, another, closely related, characteristic of the context may play a role: its degree of modernization (as indicated by the level of development or degree of urbanization). In more modern areas, there generally is more impact of globalization, including the diffusion of value patterns that stress the importance of education and equality among sexes. In urban areas, the road and transport infrastructure tend to be better and the state influence stronger and there might be more pressure on parents and children to stay in school. Families in cities may also have moved there because of the better educational opportunities there (Buchmann & Brakewood, 2000). Indeed, for Turkey Tansel (2002) and Smits and Gündüz-Hosgör (2006) found that children living in urban areas have significantly higher schooling attainments and Fafchamps and Wahba (2006) found for Nepal that children living near towns and cities are more likely to attend school. Both educational attainment in general and attainment of girls compared to boys are thus expected to be higher in more developed and urban areas.

Interactions with Context Factors

The causes underlying problems with school dropout may differ depending on the region of the developing world. This means that standard solutions to such problems often do not work and that policy measures aimed at improving attainment should be as specific as possible. In this paper, this specificity is achieved by incorporating interactions in our models. The assumption underlying this approach is that the uniqueness of a situation can be addressed by considering it as a unique combination of more general factors (compare Huisman & Smits, 2009; Smits, 2007). For situations with problems regarding school dropout, the variables discussed in the preceding sections are among the most important of these more general factors.

In our approach, we assume that these factors may play a role in any situation, but that the degree to which they are important depends on characteristics of the context. For instance, financial support might be helpful in persuading poor parents to keep their daughters in school in many parts of the developing world, but less so in some rural areas in Middle Eastern-countries, where the access of women to public places is restricted by cultural traditions (Moghadam, 2004; Kandiyoti, 1988; Gündüz-Hosgör & Smits, 2007). It also makes little sense to try to influence household-level factors (like giving financial support to parents or broadcasting programs about the importance of girls' education), if there are no good educational facilities available. And even if such facilities are available, they might remain underused in regions where there are no job opportunities for educated people. In this paper we address such conditioning effects of the context in which households live, by studying besides direct effects of the context factors also interactions among these factors and between them and the household-level variables. S ince these interactions include those between level of development and characteristics of the

educational facilities, our analyses provide a new test of the Heyneman-Loxley hypothesis.

There are indications that parental resources and demographic factors are especially important under more difficult circumstances. When there are few school places available parents with more resources or motivation might be better able to get and keep their children in school (Filmer & Pritchett, 1999; Handa, 2002; Mugisha, 2006). These parents might, for example, arrange transportation when traveling distances are longer. Huisman and Smits (2009) found distance to school to be less important for children from fathers with a non-farm job and working mothers. When schooling is of low quality, higher educated parents may be better able to help their children with their homework, to clarify things the teacher was not able to explain, or, because they know the school culture, strike the right note with the head master in case of problems. Wealthier parents might hire a tutor. Children from extended families might have grandparents or other relatives who can help with homework or accompany children to school. Whereas children from nuclear families might be worse off under more difficult educational circumstances compared to children from extended families, children whose mother or father is missing might be in an even more dismal situation. Comparative research on primary enrollment in 30 developing countries has shown that in districts where more teachers are available the occupational status of the father is less important, and that in districts with more female teacher the number of sisters is less important for girls and the presence of the father and his educational status are less important for boys (Huisman & Smits, 2009).

In line with the hypothesis that parental resources and demographic factors are more important under more difficult circumstances, we expect effects of parental resources to be stronger in rural areas, in less developed areas, when the distance to school is longer and when educational facilities are of lower quality. In line with the Heyneman-Loxley hypothesis, we also expect the effect of educational facilities to be weaker in urban and more developed areas.

Data and Method

To test our hypotheses, we use large representative household datasets from the Demographic and Health Surveys (DHS) and the Pan Arab Project for Family Health (PAPFAM) of the League of Arab States. Both DHS and PAPFAM-surveys use nationally representative samples of households and collect information on all household members, including information on whether or not children are in school and which levels of education they have completed. The datasets of Algeria, Syria and Yemen are PAPFAM-surveys; the Morocco-dataset is combined PAPFAM and DHS. All other surveys are DHS-surveys. Because the datasets for Bolivia, Colombia, India, Indonesia,

Malawi, Peru and the Philippines were disproportionately big, the sample size was reduced by taking a random sample of the households in these countries.

Besides household-level data, we use context information at the district and national level. Within the 30 countries, 363 districts could be distinguished, of which characteristics are used as context variables. The district-level variables are in part derived by aggregating from the household surveys. Because the samples are large we could create indicators for the district-level of development, labor market structure and culture, by taking the district's average of characteristics of households and individuals. Information on educational facilities at the district level was derived from other sources (statistical offices, Ministries of Education, reports). Our combined dataset contains information on 134,608 children (65,098 girls and 69,510 boys) aged 12-15, living in 363 districts in 30 countries. Detailed information on the data can be found in Appendix A. This Appendix also shows that the response rates are high, over 88% in all countries and over 95% in eighteen countries.

Methods

The effects of the family background characteristics and contextual factors on staying in school are studied using multi-level discrete-time hazard models (Omariba & Boyle, 2007; Yamaguchi, 1991). These models deal correctly with right-censoring while simultaneously taking the clustering of households within districts and countries into account (Snijders & Bosker, 1999). The children included in our analyses were aged 12-15 at the time of the interview. The upper age-limit was put at 15 because we only have parental information for children who still live with their parents. Each child was represented in the data by one or more child-grade records or spells. Children are observed up to the year of survey or the grade they dropped out. For example, a child who dropped out after completing grade five is represented five times in the database. The child-grade records were constructed on the basis of the information on the number of grades the children had completed at the time of the interview. We only included children who completed at least one grade. For children who stayed in school shorter, the reasons for dropping out are probably similar to those for children who did not enter school at all. The total number of child-grade records was 688,716.

Technically, we estimate logistic regression models on child-grade records in MlwiN (Rasbash *et al.*, 2004), where children are nested within districts and countries. The district and country differences in educational dropout are dealt with by estimating random intercepts at the district and country level. Explanatory variables are included at the household, district and national level. This can be represented by a model with a binary response y_{ijk} (staying in school or not) for child-grade i in district j of country k of the form: $\pi_{ijk} : y_{ijk} \sim$ Bernoulli (l, π_{ijk}), with π_{ijk} given by the following equation:

$$\log it(\pi_{ijk}) = \log\left(\frac{\pi_{ijk}}{(1-\pi_{ijk})}\right) = \beta_0 + \beta X + \alpha W + \gamma Z + u_{0jk} + v_{0k}$$

In this equation β_0 represents the mean log odds of staying in school versus dropping out for a specific child-grade across the sample. X, W and Z represent vectors of respectively household, district and country-level independent variables. The parameters u_{0jk} and v_{0k} represent the random differentials from the overall mean at the district and the country level. In all analyses robust standard errors (sandwich estimators) are used.

Of the children we know exactly how many grades of every level they had completed at the time of the interview. However, the age of the children in a specific grade is less precisely known, because we do not know at which age they started primary education or whether they repeated or skipped grades. Our outcomes, therefore, give a better picture of school dropout in a given grade than at a given age.

The hypothesis that with a longer duration of primary education children stay longer in school is tested in two ways: by examining whether there is an increased risk of dropping out directly after completing primary education and by including a (national-level) variable indicating the legal duration of primary education. To test whether the effects of the explanatory variables differed between boys and girls we computed interactions between all variables and sex. If the interaction was significant, separate coefficients for boys and girls were estimated.

To address the fact that the effects of the various relevant factors may differ depending on characteristics of the context, we estimated besides models with direct effects of the context factors also models with interactions among various relevant context factors (educational facilities, urbanization, level of development) and between these factors and the household-level variables. To compute the interaction terms, centered versions of the involved variables are used. The main effects therefore can be interpreted as average effects. Given the large number of possible interactions, only significant interaction effects are included in these models.

Household-Level Variables

Presence of the parents is measured with two dummies indicating whether (1) or not (0) the mother or father is missing from the household. Extended family structure is measured with three categories (0) nuclear family, (1) more than two adults in the household but no grandparents, (2) more than two adults in the household including grandparents. Whether the child is a biological child is measured by a dummy with categories (0) for foster, adopted or unrelated children and (1) for biological children. Birth order and number of sisters and brothers are measured with ratio variables. Sex of the child is measured as (0) for boys and (1) for girls. To get a rough indication of the

strength of a woman's position within the household, we use the age she got her first child, measured by a dummy showing whether (1) or not (0) the mother had her first child under age 18. To test whether dropout is higher directly after completing primary education, we included a dummy indicating whether (1) or not (0) the previous grade was the highest grade of primary education.

Father's occupation is measured with three categories: (1) farm, (2) lower non-farm, and (3) upper non-farm. Employment of the mother is measured by a dummy indicating whether (1) or not (0) she was gainfully employed. Father's education is measured with three categories: (1) none, (2) at least some primary, (3) at least some secondary. Given the very low levels of education of most mothers in the countries under study, their education is measured with a dummy indicating whether (1) or not (0) she has at least some primary education.

Because income is lacking in most surveys, household wealth is used as an alternative. Household wealth is measured by an index constructed on the basis of household assets (such as radios, cars, telephones), the possession of land, and housing characteristics (such as floor material, roofing, toilet facilities, source of drinking water). Using a method developed by Filmer and Pritchett (1999), all households within a country are ranked based on the available assets and divided into wealth deciles. For living in a rural area, a dummy is used indicating whether (1) or not (0) the area where the household lives is defined 'rural' in the surveys.

Children with a missing parent were given the mean score of the other children in the database on the variables indicating characteristics of the parents. Because there are dummies for missing mother or father in the model, this procedure leads to unbiased estimates of these variables (Allison, 2001, p. 87). For children with mothers younger than 16 or older than 49, information on occupation of the father, employment of the mother and the age at which the mother had her first child was not available in the DHS-surveys. To be able to include those children in the analyses, we gave them on these variables the average of the children for which information was available and we included a dummy indicating whether (1) or not (0) the respective variable was missing from the database. To find out whether the coefficients of the other variables were biased by this procedure, two robustness tests were performed. In the first test, the models were re-estimated after (separately) removing the variables for father's occupation, mother's employment and age at which the mother had her first child. In the second test, the models were re-estimated after removing the children with missings on these variables. Both tests showed that the way we handled these missings hardly influenced our results.

Context variables

A major step forward of our study compared to earlier research in the field is that we include explanatory variables at the sub-national (called district) level. This has the advantage that we can approach the context experienced by the household members more closely and that with 363 districts we have much more explanatory power than with 30 countries. Our model therefore includes only two variables at the national level, GDP per capita, to address the difference in level of development among the 30 countries, and the duration of primary education, which is the same for all districts within a country and hence can only be included as a national variable.

The characteristics of the local educational facilities were measured with four variables. Average distance to school was computed by dividing the number of square kilometers in a district by the number of secondary schools in that district and taking the square root of this figure divided by pi. Because distance is likely to be only a problem in the rural areas, we included an interaction between this variable and urbanization. The interaction term is defined in such a way that the coefficient of distance in our tables represents the effect of distance in rural areas. The Teacher Child Ratio is computed by taking the number of secondary school teachers per 1,000 children aged 10 to 19 in the district. Feminization of education was measured by the percentage of female secondary school teachers in the district. For the duration of primary education, we included a national-level variable indicating the legal duration of primary education in years (derived from IAU, 2009). As this variable is expected to reduce dropout only at the higher levels of primary education, we also included an interaction between this variable and the grade a child is in.

Data for schools and teachers are total (public and private) for all countries except for Benin, Bolivia, Mozambique and Senegal. For Benin only public data were available. For Bolivia the percentage of private teachers was lacking at the district level. We therefore took the average of the percentages of private pupils and private schools in the district. For Mozambique data for public schools and for Senegal data for public teachers were used since no private data were available for these countries. For six countries (Colombia, Peru, Congo Brazzaville, Madagascar, Namibia and Bangladesh) the percentage of female teachers was not available at the district level; therefore national figures were used.

For part of the countries, the year of the household survey differed from the year for which data regarding schools and teachers were available. To test whether this might influence our results, we added a variable indicating the difference between the survey year and the school characteristics year to our models. This variable proved to be non-significant in all our analyses.

The labor market opportunities in the district are indicated by the percentage of men working in a white-collar (professional, technical, managerial, clerical) occupation. District-level of development is measured by an index constructed on the basis of six variables aggregated from our household datasets: the percentages of households in the district with a fridge, car, telephone, television, electricity, or running water. Of these characteristics the mean was taken of the standardized values. National development is measured by national GDP per capita in Purchasing Power Parity (constant 2000 international dollar) derived from World Bank (2007).

As cultural characteristics of the district, two variables are used. To indicate the degree to which women are disadvantaged, we use the absolute difference between the percentages of men and women working in a white-collar job. To indicate the degree to which women in the district after their marriage come to live in the families of their husbands, we use the percentage of married couples living in a household where also parents from father's side are living.

Results

Table 1 shows the percentages of children who are in school at ages 7 to 15. A striking observation is that in almost all countries the percentage of children in school is highest around age 11. This is due to the fact that on the one hand quite a few children start school at a later than normal age and on the other hand many children drop out at a relatively young age. Hence, besides by high levels of non-enrollment and dropout, the educational situation in these countries is characterized by a very high starting age. This educational reality is not always recognized and may have important policy implications. We will come back to this later.

What further becomes clear from Table 1 is that in most countries (i.e. 16 of the 30) at age 7 a higher percentage of girls than boys is in school. As children get older, the percentage of boys in school becomes higher than that of girls in more and more countries. However, in a few countries girls still outperform boys at age 15 (i.e. in Colombia, Namibia, Bangladesh, Indonesia and the Philippines). The countries where boys do better at every age are the MENA-countries, most West African-countries (with the exceptions of Senegal and Ghana), Mozambique, India and Nepal. The percentages of children in school differ widely among countries and according to age. In some countries (e.g. South Africa) the percentage hardly diminishes as children get older; in other countries (e.g. Madagascar, Morocco, Syria) it drops sharply after age 12 or 13.

[Table 1 about here]

Bivariate Analysis

The results of the bivariate logisitic regression analyses can be found in Table 2. Both the logistic and the multiplicative versions (between brackets) of the coefficients are presented. The multiplicative coefficients are easier to understand. For example, the value of 3.48 for the effect of father's occupation being upper non-farm means that the odds of staying in school are 3.48 times (or 348 percent) higher for children (girls and boys) whose father has an upper non-farm occupation compared to children whose father has an agricultural occupation. The value of 0.44 for girls who live in a rural area indicates that these girls have a 0.44 times (or 56 percent) lower odds of staying in school than girls who live in the city. To check for significant differences between boys and girls, we computed interactions between all the main effects and sex. For those variables that interacted significantly with sex, separate coefficients for boys and girls are presented; otherwise a general coefficient is presented under 'All'.

[Table 2 about here]

The bivariate effects of the demographic and socio-economic characteristics of the household are largely in line with expectations. The sign of all significant variables is as expected. Dropout rates are higher if the mother or father is missing, if there are more brothers and if the mother got her first child below age 18. Dropout rates are lower for children in extended families (whereby the effect in extended families without grandparents is stronger for boys), biological children, and later-born children. Parental education, father's occupation, and household wealth show the expected positive effects on staying in school, with the effect of mother's education and father having at least some primary education being stronger for girls. Only the coefficients for number of sisters and mother's employment are not significant.

The grade-related variables show that dropout rates are higher in the higher grades. Children also have a lower likelihood to stay in school directly after completing primary education. Longer primary-school duration in itself has no significant effect, but the interaction coefficient with grade level shows that it does significantly reduce dropout in higher grades.

Context factors

The effects of the context characteristics are also in the expected direction. Children have a higher likelihood to stay in school if the Teacher Child Ratio or the percentage of female teachers is higher, and these effects are stronger for girls than boys. Girls in rural areas of districts with a higher average distance to school are less likely to stay in school.

Regarding the cultural factors, we see that both boys and girls are less likely to stay in school if they live in more patriarchal districts, indicated by a higher percentage of households with grandparents from father's side. The gender difference in white-collar jobs is positively related to staying in school. For girls this effect seems somewhat puzzling. However, this variable is highly correlated (.78) with the percentage of men with a white-collar job and may take over its effect. The economic indicators at the district level have the expected effect. Staying in school is more likely in districts where more men work in white-collar jobs, in districts with higher levels of development, in countries with a higher GDP per capita and in urban areas. Both GDP per capita and urbanization have stronger effects on girls' than on boys' chances to stay in school.

Multivariate Analysis

Table 3 presents coefficients of two multivariate models. Model 1 contains only coefficients of the main effects. Model 2 is similar to Model 1, but with the significant interaction effects. To keep the table readable, the interaction coefficients are presented separately in Table 4.

[Table 3 about here]

Table 3 shows that the coefficients of the household-level variables do not change much compared to the bivariate ones in Table 2. They tend to be somewhat lower, because the mutual correlations are taken into account, and some (extended family without grandparents and father with a lower non-farm occupation) loose their significance, but the general picture remains largely the same. When the father or mother is missing from the household, the likelihood of staying in school is significantly reduced, whereby the negative effect of a missing mother is stronger for girls. Living in an extended family with grandparents or being a biological child significantly increases a child's chances to stay in school. A more traditional mother, indicated by a mother who had her first child young, is negative for all children.

Also the effects of the socio-economic characteristics of the household remain largely as hypothesized. Father's and mother's education, father's occupation being upper non-farm and household wealth have significant positive effects on staying in school for both boys and girls. The effect of mother's education is stronger for girls, which is in line with earlier findings (Emerson & Portela Souza, 2007). Employment of the mother has no significant effect on staying in school, but the figures indicate that existing effects are more positive for boys.

An important finding is that also in the multivariate model children have a substantial higher likelihood of dropping out after finishing the highest grade of primary school. The

odds of continuing education are reduced by 70 percent directly after completing primary education. This effect seems to be stronger than that of any other factor in the model. This provides firm support for the idea that children (and their parents) tend to wait until they have completed primary education before they stop schooling. Our other two grade-related factors point in the same direction. Children have a significantly higher chance to drop out in higher grades, but this effect is reduced when the duration of primary education is longer. Hence our results provide firm support for the idea that increasing the number of years of primary education by adding the first years of secondary school keeps children longer in school.

Context factors

With respect to the educational facilities, we find that if there are more teachers available, as indicated by a higher Teacher Child Ratio, chances that children stay in school increase significantly. The effect of a higher proportion of female teachers in the district loses its significance in the multivariate model (although its effect remains more positive for girls). Apparently, districts with a higher percentage of female teachers also have other characteristics that are favorable for children's chances to stay in school. In earlier research (Huisman & Smits, 2009) a higher percentage of female teachers has been found to promote girls participation in primary education. Hence it seems that female teachers are more important for getting young girls into school than for keeping them there. With regard to the average distance to school in rural areas, we find a significantly negative effect on the likelihood for girls to stay in school. For boys distance is insignificant and thus seems to be less of a problem.

As could be expected, girls tend to stay in school less in districts where the gender difference in the higher echelon of the labor market is wider, but this effect is not significant. Living in a patriarchal culture, as indicated by a higher percentage of households with parents of the father, also loses its significance in the multivariate model. Hence, more patriarchal districts tend to differ with regard to other factors in the model that affect children's chances to stay in school.

The availability of white-collar jobs, as indicated by the percentage of men with such an occupation, significantly increases both boys' and girls' likelihood of staying in school. Also two of the three other indicators of level of development, urbanization and national GDP per capita, show significant effects in the expected direction. The odds of staying in school are higher in countries with higher levels of GDP per capita and – for girls – also in urban areas (Model 2). However, the effect of the district development index is opposite to what was expected. Its effect is significantly negative. This may seem counterintuitive at first glance. However, given that the bivariate effect of this variable was positive we should consider it in light of the fact that there are other indicators of

development in the model that show the expected effect. Hence it must be caused by an aspect of this variable that is not caught by these other indicators. It is for instance possible that in countries with similar levels of GDP there may be better opportunities to earn an income for children in the more developed districts. Kruger (2007) found for Brazil that parents take children out of school to take advantage of improved economic conditions which are deemed temporarily. What could also be the case is that it is more difficult for children who work for an employer to combine school with work, than it is for children who work at the family farm, as was found by Fuller *et al.* (1995).

Interaction Effects

The coefficients of the significant interaction effects are presented in Table 4. The likelihood of staying in school directly after finishing primary school is increased for boys from extended families with grandparents. Hence it seems that these grandparents consider secondary education for their grandsons important and may be prepared to take over tasks at home or help with homework to make that possible. We further see that directly after completing primary education the effects of father's occupation and education are significantly reduced. Hence, at that time, the decision to drop out is less influenced by socio-economic differences than at other points in the school career.

[Table 4 about here]

The Teacher Child Ratio we find one significant interaction; the positive effect of this factor is stronger in countries with higher GDP per capita. This findings runs opposite to the hypothesis of Heyneman and Loxley (1983) that in less developed countries the impact of school and teachers is stronger. The interaction between the percentage of female teachers and living in a rural area, on the other hand, seems in line with this hypothesis; the effect of this factor is significantly positive in rural areas. Hence, increasing the number of female teachers might help to reduce school dropout in rural areas (which is especially strong for girls).

The other interaction effects with the percentage of female teachers are more peculiar. We would have expected fewer differences among children with different characteristics if there are more female teachers, but in fact there seem to be more. If the percentage of female teachers in the district is higher, the tendency to drop out in the higher grades increases, the positive effects of father's occupation and household wealth are higher and the negative effect of having more brothers -- pointing towards competition within the household – is stronger for boys. Hence older children and children from households with less occupational and financial resources and more competition profit less from the presence of female teachers.

With respect to urbanization, the interaction effects are mostly in line with expectations. In rural areas children from extended families with grandparents and girls who are biological children are more likely to stay in school. This indicates that, compared to children living in cities, children in rural areas have more duties at home, which can be taken over by grandparents and which may unevenly be put on the shoulders of foster daughters. The negative effects of having more siblings and a mother who got her first child at a young age are stronger in rural areas. This is in line with the idea that in urban areas educational facilities are more accessible so that children from more difficult or competitive backgrounds have more possibilities to go to school. The negative effect of the presence of (more) sisters for boys in rural areas seems at first glance difficult to interpret, but it might as well mean that boys in cities may profit from the presence of sisters.

In districts with a higher level of development, the negative effect of a missing father becomes less severe, whereas for boys the positive effect of a father with an upper non-farm job becomes less positive. The greater importance of human capital in more developed regions is reflected in the more positive effect of having a father with primary education there. This finding is in line with the Heyneman-Loxley hypothesis. Regarding national GDP per capita, a higher level of development reduces the role of having an extended family with grandparents.

Conclusions

We studied effects of household and district-level factors on staying in school or dropping out for over 130,000 secondary school-age children in 363 districts of 30 countries from all regions of the developing world. Our data revealed high dropout rates after age 11 for many of the developing countries studied. Interestingly, age 11 turned out to be also the age at which in most countries educational enrollment was highest, thus implying that in these countries many children start education at a too high age.

To gain insight into the determinants of school dropout in these countries, we used multi-level discrete-time event history analysis. At the household level, socio-economic and demographic characteristics were included in the model as well as factors related to the grade a child is in. At the district level, we included characteristics of the available educational facilities, indicators of the local economic situation and culture. Besides direct effects of the household and district-level variables, also interactions between variables at both levels were analyzed.

The analyses made clear that socio-economic characteristics of the family background still make a big difference for the likelihood that children in these countries stay in school when they reach puberty. If the parents have more education, if the household is wealthier and if the father has a higher-level job, children's likelihood of staying in

school is substantially increased. Parental education and household wealth are most important. If the father has more than primary education, the odds of staying in school for both girls and boys are 168 percent higher than if the father has no education, and if the household is in a one-step higher wealth decile this odds increases by 20 percent. Mother's education is also important, especially for girls. Having a mother with at least some education increases the odds of staying in school for girls by 79 and for boys by 39 percent.

Regarding demographic factors, we find children with more siblings and earlier-born children to be significantly less likely to stay in school. The odds of staying in school are also smaller for children whose mother or father is missing from the household, whereby the negative effect of a missing mother is stronger for girls. Living in an extended family with grandparents increases the likelihood children stay in school. Non-biological children and children whose mother got her first child at a young age have a smaller likelihood of staying in school. These findings are largely in line with expectations.

Regarding the characteristics of the educational system, we found the odds of continuing schooling to be strongly reduced (by 70%) directly after finishing primary education. Combined with the finding that the odds of dropping out in higher grades is significantly reduced in countries where the duration of primary education is longer, this provides strong evidence in favor of the idea that for countries with high dropout rates of young children, prolonging the duration of primary education (as was done in Turkey in 1998) might be a good policy to keep children longer in school.

Living in a district with more teachers (as indicated by a higher Teacher Child Ratio) has a significantly positive effect on a child's likelihood to stay in school. A longer average distance to school in rural areas is negative for girls. The percentage of female teachers was found to have no significant average effect on staying in school, but its effect turned out to be significantly positive in rural areas. This indicates that female teachers might be particularly important under more difficult circumstances.

Our district-level cultural indicators (gender difference on the labor market and tendency for girls to marry into the family of their husband) showed significant effects in the bivariate analysis, which however disappeared after controlling for the other variables. This suggests that variation in school dropout between more and less traditional districts may be largely due to variation in other characteristics.

Of our four indicators of level of development, three showed the expected effect. A higher chance of finding a white-collar job after school (as indicated by the percentage of men with such an occupation in the district) and a higher national GDP per capita were both positively associated with staying in school, and living in a rural area negatively for girls. However, the effect of our district development index (constructed on the basis of assets of the households in the district), which was positive in the bivariate analysis,

became significantly negative in the multivariate analysis. This could mean that developed districts have better income-earning opportunities for children or that it is more difficult to combine work with schooling there.

To make the analysis more situation-specific, we tested besides the direct effects of our explanatory variables also several relevant interaction effects between context and household factors. The outcomes of this interaction analysis indicate that it is mainly the children which were already in a more favorable situation (higher wealth group, a father with a higher education, extended families, biological daughters, fewer siblings, a mother who did not have her first child at a young age) and children in the lower grades who profit from more female teachers and are less affected by living in a rural or less developed area. At the same time we found evidence that in better developed districts the differences in school dropout between children with a missing father or a father with an upper non-farm job are less important.

Right after finishing primary education the advantage of children from a father with an upper non-farm job or a father with at least some primary education diminishes compared to fathers with a lower-level job or education. However, children from an extended family with grandparents are still advantaged, since they are less likely to drop out of school after finishing primary education.

A higher percentage of female teachers is more important in rural areas, giving some support to the Heyneman-Loxley hypothesis that educational facilities make more of a difference at lower levels of development. This hypothesis is also supported by the finding that father's education is more important in more developed districts. However, we also find a stronger effect of the Teacher Child Ratio in higher GDPc countries, which seems to contradict this hypothesis.

Some words of caution are needed regarding our findings. First, although the use of context factors at the district level is a major step forward compared to research using such factors at the national level, the degree to which they represent the local context remains restricted, because the districts are still rather big. As a result, our coefficients may underestimate the true effects. Second, some additional measurement error might be expected in the in the district-level characteristics of the educational facilities, because they had to be collected from other sources, which for developing countries are not always of good quality. The other district characteristics are more reliable, because we created them ourselves by aggregating from our representative household surveys. Third, a disadvantage of our data is that for the children who dropped out of school, we do not have reliable information on the age at which this happened. Due to starting late and grade retention, the children dropping out in a specific grade are on average older than would be the case in more developed countries. Hence our conclusions are mainly valid for dropping out in specific grades. Fourth, the substantial number of significant cross-

level interactions found in our analyses confirms our idea that the processes underlying the decision to drop out of school may differ substantially according to the context in which the children live. At the same time it is not always easy to give clear interpretations to the huge amount of information derived from the interaction analysis, which does not always point clearly into one direction. New theories are therefore needed in this field, the development of which constitutes a great challenge to the educational research community.

Policy recommendations

The outcomes of our study may have major implications for educational policies in developing countries. First and foremost, they indicate that countries with high dropout rates of children around puberty should consider increasing the duration of primary education, by integrating the first years of secondary education into it. School dropout directly after completing primary education turned out to be much higher than after completing other grades -- an effect which was independent of the number of grades the child had completed by that time (no significant interaction). In addition, we found dropout in the higher grades to be significantly reduced when the duration of primary education is longer. Both results are in line with the idea that children will stay in school longer if the duration of primary education is prolonged.

Second, our study reemphasizes the importance of socio-economic factors, especially wealth and parental education, for keeping children in school. Children from households with few economic and educational resources were found to have a clearly higher chance to drop out of school. Because it is not easy to change the level of parental education, reducing financial barriers remains an important instrument for preventing school dropout in developing countries.

Third, the substantial positive effect of mother's education, which is independent of all other factors and circumstances studied, indicates that mothers with more knowledge are in a better position to keep their children in school. This knowledge probably needs not be very extensive; our measure of mother's education only distinguished between mothers with none and mothers with at least some education. Given the substantial difference in school dropout found with this simple variable, it seems that basic skills like being able to read and write play a role of importance. If we combine these findings with outcomes of other studies (e.g. Lloyd & Blanc, 1996; Bammeke, 2008) suggesting that under difficult circumstances mothers are prepared to spend more of their resources on their children's education than fathers, we can conclude that campaigns targeted at educating and empowering illiterate mothers might be a major way of reducing dropout rates in high dropout areas.

Fourth, our finding of positive effects of the Teacher Child Ratio and a negative effect of distance to school for girls in rural areas make clear that lack of adequate schooling infrastructure is still a major source of school dropout. This means that building new schools and increasing the number of teachers in districts with high dropout rates might be a good policy to keep children and especially girls in school (Huisman & Smits, 2009). If this is not possible, due to low population density in certain areas, an alternative might be to lower the costs of traveling, or to make traveling easier, by establishing some sort of school bus system and/or boarding schools. When training and hiring new teachers in rural areas, women should be considered first; given the positive effect female teachers have on children in the countryside.

Fifth, it is possible that inadequate infrastructure is also the cause of another striking finding of this study, the high age of starting primary education in many of the countries (documented also by e.g. EPDC, 2007; UNESCO, 2007c). If so, this may have important policy implications. Children who start schooling late tend to drop out more easily and complete less education for at least three reasons: (1) they reach the age at which possible barriers on school participation arise (such as pressure to work or to get married) after fewer years of education; (2) later mastery of basic cognitive skills means a weaker foundation for further learning; (3) if many children start primary school late, classes may be overloaded with late enrollers and there may be a mixture of age groups within the same grade (Wils, 2004; EPDC, 2007; UNESCO, 2004, 2008). Given the adverse consequences of this phenomenon, both for the children themselves and for educational quality in the schools they attend, priority should be given to policy measures leading to a lower starting age and hence a more even age-distribution over the grades. To develop those measures, new research into the causes of starting primary education late is required.

Notes

1. The words used to refer to this sub-national level differ per country. Some countries have provinces, others districts, counties, states, governorates or walayas. In this paper we will use the word "district" to refer to the sub-national units within the 30 countries.

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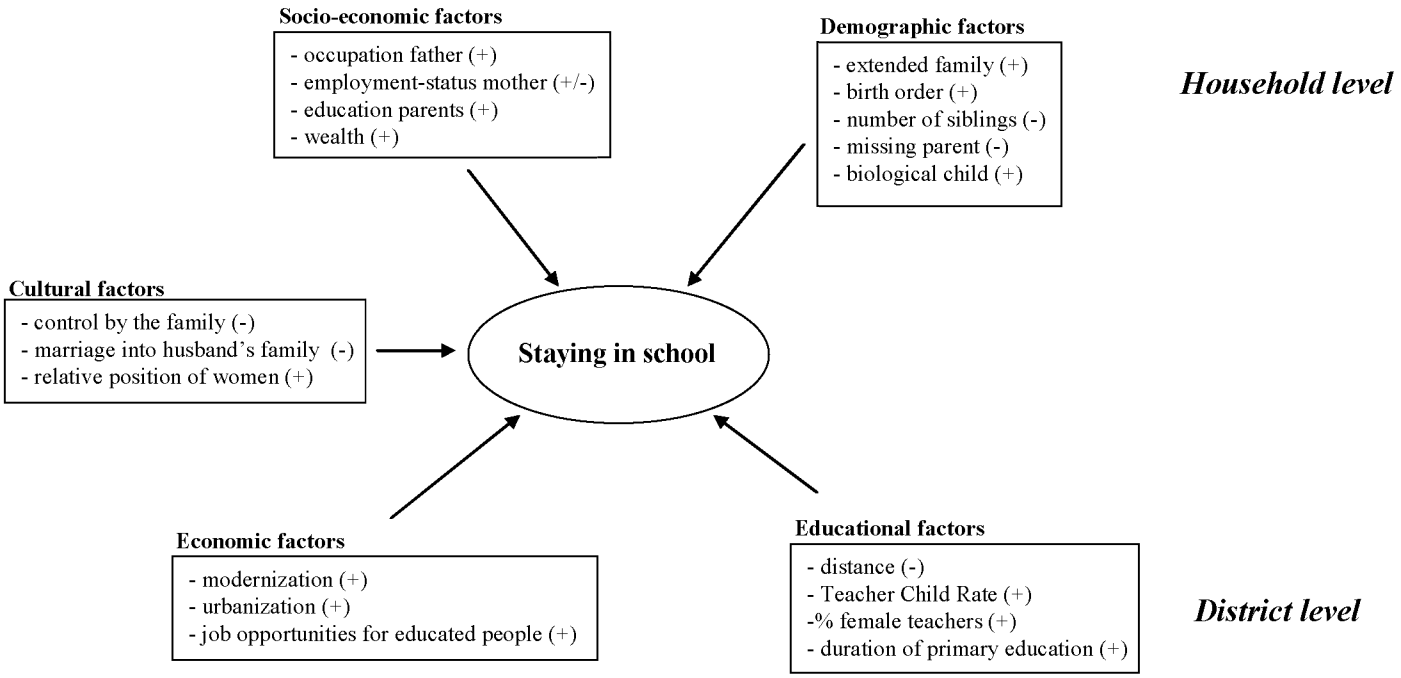

Figure 1. Theoretical model of educational attainment

Table1: Percentage of boys and girls aged 7-15 who are in school

Boys

		7	8	9	10	11	12	13	14	15
Latin America	Bolivia	76.4	94.2	97.5	97.9	96.3	97.4	93.6	90.6	85.6
	Colombia	74.1	84.8	90.7	92.2	91.8	91.4	88.0	83.6	76.3
	Peru	71.4	91.5	95.7	96.6	98.0	96.0	94.4	90.0	85.9
West Africa	Benin	52.7	63.3	72.9	71.2	76.7	67.2	63.9	67.1	61.3
	Cameroon	75.1	82.9	87.5	88.0	90.4	88.3	89.3	88.9	80.8
	Ghana	43.9	62.9	73.9	70.2	82.1	78.2	74.0	78.8	69.6
	Guinea	35.8	47.0	59.6	58.7	64.3	60.3	61.9	61.5	58.0
	Mali	34.0	45.3	48.8	47.4	52.0	41.5	44.1	40.4	33.7
	Nigeria	53.0	65.2	76.1	74.4	85.7	77.9	77.3	80.4	74.0
	Senegal	47.7	57.8	64.2	60.8	65.3	58.1	61.0	57.5	49.0
East Africa	Kenya	49.0	62.4	78.0	83.2	88.8	87.6	89.1	83.6	82.1
	Rwanda	56.8	75.2	84.6	86.0	86.8	86.8	83.9	72.3	62.1
	Uganda	67.9	80.8	87.3	90.1	91.8	91.3	91.5	88.3	80.4
Southern Africa	Congo Brazzaville	86.4	92.9	94.0	93.6	96.0	93.0	90.8	87.8	85.5
	Madagascar	77.2	83.4	86.7	82.5	87.1	80.6	80.1	65.5	58.8
	Malawi	73.6	81.2	86.8	88.8	90.7	88.3	85.4	83.8	76.2
	Mozambique	53.3	65.9	76.5	77.6	84.6	78.9	83.5	78.8	74.5
	Namibia	33.8	67.7	82.4	84.5	88.1	87.8	85.8	81.6	77.0
	South Africa	64.9	87.3	89.4	92.4	95.7	93.5	95.3	92.6	93.6
	Tanzania	27.0	53.6	75.8	80.7	86.9	85.4	82.1	79.0	67.4
	Zambia	33.8	49.0	67.5	73.5	80.1	75.7	79.1	77.7	74.6
Middle East & North Africa (MENA)	Algeria	97.1	97.7	98.3	97.6	97.8	95.4	91.8	88.0	78.3
	Morocco	91.8	94.1	94.1	90.8	88.8	82.2	77.7	67.2	57.6
	Syria	98.8	98.3	98.7	96.5	95.5	88.6	74.6	63.1	51.0
	Yemen	67.0	79.7	85.8	84.6	88.9	86.5	83.4	80.0	72.5
South & East Asia	Bangladesh	83.5	87.3	89.4	83.2	80.7	71.1	65.5	56.1	46.0
	India	76.1	84.2	90.0	89.2	91.9	87.3	83.9	78.6	72.6
	Indonesia	89.3	94.7	95.5	94.7	94.7	90.4	82.6	75.5	66.0
	Nepal	88.3	93.0	95.1	94.8	95.1	92.4	90.8	86.4	81.1
	Philippines	46.6	78.1	90.3	92.3	92.1	89.3	86.0	80.5	70.0

Girls

		7	8	9	10	11	12	13	14	15
Latin America	Bolivia	77.8	95.3	96.7	97.7	96.5	94.9	92.1	85.0	84.1
	Colombia	77.4	90.2	93.7	94.0	94.4	93.8	90.6	87.0	82.4
	Peru	74.9	91.8	95.7	95.5	96.1	94.9	90.8	83.7	82.9
West Africa	Benin	43.0	51.8	57.7	51.2	55.0	45.7	40.2	43.1	38.1
	Cameroon	74.4	80.7	86.4	82.9	87.4	84.8	80.8	83.5	70.2
	Ghana	45.9	62.1	73.3	77.5	78.6	78.9	76.0	75.0	64.8
	Guinea	31.1	42.6	52.2	50.1	53.1	49.9	48.0	56.7	46.6
	Mali	28.1	32.3	40.6	33.4	37.1	31.4	28.7	29.2	27.5
	Nigeria	46.4	62.3	67.7	64.4	77.8	71.0	72.7	77.3	61.5
	Senegal	48.5	59.7	64.4	62.0	66.0	59.9	52.3	51.0	34.3
East Africa	Kenya	55.1	65.7	84.1	80.1	87.9	85.8	80.6	78.6	75.9
	Rwanda	57.0	77.8	84.3	89.3	90.4	89.7	82.1	75.5	60.9
	Uganda	67.5	79.8	87.1	90.7	91.2	89.9	88.5	85.3	80.0
Southern Africa	Congo Brazzaville	85.2	93.3	95.6	96.0	92.1	92.8	91.3	86.4	78.0
	Madagascar	79.9	83.8	89.4	83.5	89.7	78.8	75.5	66.5	57.3
	Malawi	75.2	84.7	90.9	89.9	89.3	88.6	86.4	81.0	74.0
	Mozambique	49.3	61.8	72.1	71.9	77.0	75.6	75.9	73.8	61.5
	Namibia	36.7	70.0	85.9	86.3	90.8	90.2	89.8	87.3	84.7
	South Africa	72.6	87.9	91.8	94.4	96.3	95.9	96.6	94.7	90.9
	Tanzania	32.0	62.7	81.5	83.8	87.7	85.5	82.8	73.7	54.1
	Zambia	34.0	51.3	69.5	73.6	75.6	79.1	74.3	70.1	61.8
Middle East & North Africa (MENA)	Algeria	96.9	96.3	96.2	95.8	96.0	90.8	84.5	79.2	68.1
	Morocco	87.6	89.5	89.9	84.7	84.3	73.7	62.6	57.8	46.7
	Syria	97.2	97.4	97.0	94.6	91.2	81.3	71.4	57.4	49.8
	Yemen	52.2	59.7	62.9	63.1	65.4	58.0	47.8	43.1	32.8
South & East Asia	Bangladesh	83.9	91.6	89.6	88.8	87.2	82.4	74.6	59.9	49.1
	India	74.7	82.5	88.2	85.6	88.9	82.0	78.8	76.6	64.5
	Indonesia	90.9	94.6	96.6	96.7	96.2	90.8	85.9	75.2	67.8
	Nepal	84.6	86.3	88.2	88.5	88.6	84.5	78.5	76.4	67.7
	Philippines	54.3	87.2	92.2	93.7	96.2	93.2	91.9	86.5	85.7

Source: computations based on the data used in this study

Table 2: Logistic and multiplicative (between brackets) coefficients of bivariate multi-level logistic regression analyses for children aged 12-15 with the odds of staying in school as dependent variable

	Girls	All	Boys
Household-level variables			
Demographic factors			
Mother missing		-0.53 (0.59) **	
Father missing		-0.32 (0.73) **	
Family structure			
Nuclear family			
Extended family without grandparents	0.08 (1.09) **		0.15 (1.17) **
Extended family with grandparents		0.13 (1.14) **	
Biological child		0.51 (1.67) **	
Birth order child		0.07 (1.07) **	
Number of sisters		-0.01 (0.99)	
Number of brothers		-0.06 (0.94) **	
Mother had 1st child under age 18		-0.26 (0.77) **	
Socio-economic factors			
Occupation father			
Farm			
Lower non-farm		0.43 (1.54) **	
Upper non-farm		1.25 (3.48) **	
Mother employed		-0.02 (0.98)	
Education father			
None			
At least some primary	0.48 (1.62) **		0.31 (1.37) **
At least some secondary		1.48 (4.39) **	
Education mother at least some primary	1.11 (3.03) **		0.73 (2.08) **
Household wealth		0.22 (1.25) **	
Grade related factors			
Grade		-0.23 (0.79) **	
Recently finished primary education		-1.12 (0.33) **	
Effect of national primary school duration			
National primary school duration	0.00 (1.00)		0.14 (1.16)
*National primary school duration * grade*		0.04 (1.04) *	
Contextual variables			
Educational factors			
Average distance to school in rural areas (in km)	-0.35 (0.71) **		-0.06 (0.94)
Teacher Child Ratio	0.71 (2.04) **		0.53 (1.70) **
Percentage of female teachers	0.02 (1.02) **		0.01 (1.01) **
Cultural factors			
Gender difference in perc. white collar jobs	0.02 (1.02) **		0.04 (1.04) **
Perc. of households with grandparents from father's side		-0.03 (0.98) *	
Economic factors			
Living in rural area	-0.81 (0.44) **		-0.59 (0.55) **
Percentage of men with a white collar job		0.04 (1.04) **	
District development index		0.43 (1.53) **	
National GDP per capita	0.23 (1.26) **		0.16 (1.17) **
N	65,098	134,608	69,510

**P<0.01; *P<0.05

Table 3: Logistic and multiplicative (between brackets) coefficients of multi-level logistic regression analysis for children aged 12-15 with the odds of starting school as dependent variable

	Model 1			Model 2		
	Girls	All	Boys	Girls	All	Boys
Intercepts						
Country level variance		0.23 (1.26) **			0.27 (1.31) **	
Regional level variance		0.15 (1.16) **			0.13 (1.14) **	
Intercept	2.03 (7.61) **		1.26 (3.51) *	2.08 (8.00) **		0.86 (2.36)
Household-level variables						
Demographic factors						
Sex is girl		-0.13 (0.88) *			-0.16 (0.85) **	
Mother missing	-0.56 (0.57) **		-0.37 (0.69) **	-0.54 (0.58) **		-0.36 (0.70) **
Father missing		-0.25 (0.78) **			-0.26 (0.77) **	
Family structure						
Nuclear family						
Extended family without grandparents	-0.04 (0.96)		0.06 (1.06)		-0.04 (0.96)	
Extended family with grandparents		0.11 (1.12) **			0.09 (1.09)	
Biological child		0.35 (1.42) **		0.05 (1.06)		0.40 (1.49) **
Birth order child	0.15 (1.16) **		0.10 (1.11) **		0.14 (1.15) **	
Number of sisters		-0.03 (0.97) **			-0.03 (0.97) *	
Number of brothers		-0.09 (0.91) **			-0.07 (0.93) **	
Mother had 1st child under age 18		-0.15 (0.86) **			-0.07 (0.93)	
Socio-economic factors						
Occupation father						
Farm						
Lower non-farm		0.05 (1.05)			0.05 (1.05)	
Upper non-farm		0.31 (1.36) *			0.42 (1.52) **	
Mother employed	-0.05 (0.95)		0.09 (1.09)	-0.07 (0.94)		0.07 (1.07)
Education father						
None						
At least some primary		0.16 (1.17) **			0.26 (1.29) **	
At least some secondary		0.98 (2.68) **			0.94 (2.57) **	
Education mother at least some primary	0.58 (1.79) **		0.33 (1.39) **	0.57 (1.77) **		0.33 (1.39) **
Household wealth		0.18 (1.19) **			0.18 (1.20) **	
Grade related factors						
Grade	-0.26 (0.77) **		-0.23 (0.80) **	-0.26 (0.77) **		-0.23 (0.79) **
Recently finished primary education		-1.16 (0.31) **			-1.16 (0.31) **	
Effect of national primary school duration						
National primary school duration		0.07 (1.07)			0.03 (1.03)	
*National primary school duration * grade*		0.06 (1.06) **			0.05 (1.05) **	
Contextual variables						
Educational factors						
Average distance to school in rural areas in km	-0.21 (0.81) *		0.06 (1.06)	-0.27 (0.77) **		-0.02 (0.98)
Teacher Child Ratio		0.21 (1.24) *			0.37 (1.45) **	
Percentage of female teachers	0.00 (1.00)		-0.01 (0.99)	0.00 (1.00)		-0.01 (0.99)
Cultural factors						
Gender difference in perc. white collar jobs	-0.02 (0.98)		0.00 (1.00)	-0.02 (0.98)		0.01 (1.01)
Perc. of hh with grandparents from father's side		-0.01 (0.99)			0.00 (1.00)	
Economic factors						
Living in rural area	-0.11 (0.89)		0.11 (1.11)	-0.16 (0.85) *		0.12 (1.12)
Percentage of men with a white collar job		0.03 (1.03) *			0.03 (1.03) **	
District development index		-0.24 (0.78) **			-0.32 (0.73) **	
National GDP per capita		0.24 (1.27) **			0.18 (1.19) **	
N	65,098	134,608	69,510	65,098	134,608	69,510

**P<0.01; *P<0.05

Table 4: Logistic and multiplicative (between brackets) interaction coefficients of multi-level logistic regression analyses for children aged 12-15 with the odds of staying in school as dependent variable (Model 2 of Table 3 continued)

	Girls	All	Boys
Recently finished primary education			
Family structure			
Extended family with grandparents	0.13 (1.14)		0.43 (1.54) **
Occupation father			
Upper non-farm		-0.60 (0.55) *	
Education father			
At least some primary		-0.49 (0.61) **	
Teacher Child Ratio			
National GDP per capita		0.37 (1.45) **	
Percentage of female teachers			
Living in rural area		0.09 (1.10) **	
Number of brothers	-0.02 (0.98)		-0.05 (0.95) **
Occupation father			
Lower non-farm		0.09 (1.09) **	
Household wealth		0.04 (1.04) **	
Grade		-0.04 (0.96) **	
Living in rural area			
Family structure			
Extended family without grandparents		0.09 (1.09) *	
Biological child	0.61 (1.85) **		-0.12 (0.89)
Number of sisters	-0.01 (0.99)		-0.09 (0.92) **
Number of brothers		-0.07 (0.93) **	
Mother had 1st child under age 18		-0.27 (0.77) **	
District development index			
Father missing		0.10 (1.10) **	
Occupation father			
Upper non-farm	0.05 (1.05)		-0.23 (0.79) **
Education father			
At least some primary		0.05 (1.05) *	
National GDP per capita			
Family structure			
Extended family with grandparents		-0.07 (0.93) **	

**P<0.01; *P<0.05

APPENDIX A

World region	Country	Number of districts	Household survey Source and year	Response rate: Household survey	Response rate: Women's survey	Educational facilities: year of data: Schools	Educational facilities: year of data: Teachers	Educational facilities: year of data: Female teachers	Source of data: Schools	Source of data: Teachers
Latin America	Bolivia	9	DHS, 2003	98.9	95.5	2003	2003 (public)	2003 (public)	1	1
	Colombia	13	DHS, 2005	88.4	92.4	2005	2005	2000 (national)	2	2
	Peru	25	DHS, 2000	98.1	94.6	2000	2000	2000 (national)	1	1
West Africa	Benin	6	DHS, 2001	97.0	96.4	2003 (public)	2003 (public)	2003 (public)	1	1
	Cameroon	10	DHS, 2004	97.6	94.3	2002	2002	2002	2	2
	Ghana	10	DHS, 2003	98.7	95.7	2003	2003	2003	1	1
	Guinea	8	DHS, 2005	99.2	97.2	2004	2004	2004	1	1
	Mali	9	DHS, 2001	97.9	94.9	2001	2001	2001	1	1
	Nigeria	6	DHS, 2003	98.6	95.4	2003	1995	1995	2	2
	Senegal	11	DHS, 2005	98.5	93.7	2002	2002 (public)	2002 (public)	1	1
East Africa	Kenya	8	DHS, 2003	96.3	94.0	2003	2003	2003	1	1
	Rwanda	12	DHS, 2005	99.7	98.1	2002	2002	2002	1	1
	Uganda	9	DHS, 2006	97.5	94.7	2002	2000	2000	1	1
Southern Africa	Congo Brazzaville	9	DHS, 2005	99.2	94.8	2004	2004	2004 (national)	2	2
	Madagascar	6	DHS, 2004	98.2	95.3	2003	2003	1999 (national)	3	3
	Malawi	13	DHS, 2004	97.8	95.7	2005	2005	2005	1	1
	Mozambique	11	DHS, 2003	90.1	90.9	2003 (public)	2004	2004	2	2
	Namibia	13	DHS, 2000	96.9	92.4	2001	2001	2001 (national)	1	1
	South Africa	9	DHS, 1998	96.9	95.2	2000	2001	2001	3	3
	Tanzania	11	DHS, 2004	98.8	97.3	2003	2003	2003	1	1
	Zambia	9	DHS, 2002	98.2	96.4	2004	2004	2004	1	1
Middle East & North Africa (MENA)	Algeria	17	PAPFAM, 2002	93.5	97.4	2004	2004	2004	1	1
	Morocco	14	PAPFAM/DHS, 2003	98.8	96.3	2003	2003	2003	2	2
	Syria	12	PAPFAM, 2001	95.0	98.9	2001	2001	2001	2	2
	Yemen	15	PAPFAM, 2003	91.7	91.6	2003	2003	2003	2	2
South & East Asia	Bangladesh	6	DHS, 2004	99.8	98.6	2005	2005	2002 (national)	1	1
	India	26	DHS, 2006	97.7	94.5	2002	2002	2002	1	1
	Indonesia	26	DHS, 2003	99.0	98.3	2003	2003	2003	2	2
	Nepal	13	DHS, 2006	99.6	98.4	2000	2000	2000	2	2
	Philippines	17	DHS, 2003	99.1	97.8	2003	2003	2003	2	2
Total	30	363								

1: national Ministry of Education

2: national Bureau of Statistics

3: Education Policy & Data Centre (www.epdc.org)