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## Can family involvement improve educational outcomes in developing countries?

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# Can family involvement improve educational outcomes in developing countries?

Anke Weber<sup>a)</sup>

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**Abstract:** Low-income countries struggle to provide their populations with universal primary education, albeit lack of the required financial resources. Strategies are sought after to more efficiently use existing educational equipment in these countries. In particular, the role of families and their involvement in schooling to improve educational outcomes has gained increased scholarly attention. While evidence from the developed world proposes strong beneficial effects of family involvement, applications to low-income countries are surprisingly scarce. This paper provides a first test of the impact of three family involvement components, namely monitoring school attendance, improving family-school relationship, and providing school-lunch, on educational outcomes in the representative low-income country Tanzania. Results from the unique school mapping dataset on over 600 communities in Tanzania confirm the relevance of family involvement to increase enrolment and the quality of education. These effects are particularly relevant for poor and less educated parents.

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*JEL classification:* H41, I20, O10

*Keywords:* Parental involvement, primary education, socioeconomic status, ethnicity, developing countries

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## 1. Introduction

Most developing countries committed to achieve universal primary education by 2015 in the Millennium Development Goal 2. However, increasing enrolment rates and the quality of primary education requires substantial additional financial resources currently lacking in most developing countries. Hence, other strategies, which might help to increase educational outcomes and spare the countries' finances, are sought for. In particular, existing equipment and input factors should be used more efficiently to spur educational outcomes.

One strategy might be to increase involvement of families in their children's education, for example helping with homework, becoming engaged in school functions and communicating with the school. Extensive literature, mostly from the U.S., demonstrates that higher involvement of families in schooling is beneficial for children's educational outcomes (cf. Walberg, 1984; Topping, 1992; Epstein, 1992; Henderson & Berla, 1996; Sui-Chu & Willms, 1996; Sheldon, 2003). Indeed, family involvement was found to generate positive effects even for less educated and poor parents. Hence, family involvement might be particularly useful to increase education in developing countries, where most parents suffer from insufficient income and where illiteracy rates of adults are high.

Despite the perceived relevance of family involvement activities for developing countries, scholars have so far neglected this mechanism in studies on education in low-income countries.<sup>1</sup> Moreover, even international agencies focused primarily on the role of families in the management of financial resources and thereby neglected potential beneficial effects of the involvement of families in their children's education.

This paper will therefore contribute to the scholarly debate by first testing the impact of family involvement on their children's educational outcomes in low-income countries. In particular, this paper develops a theoretical framework on family involvement as a component of social capital that helps to overcome collective action failure and increases public good provision. Three most relevant components of family involvement in low-income countries are identified and tested using a unique dataset from the representative developing country Tanzania. More precisely, the effect of monitoring school attendance by the parents, increasing the family-school relationship, and providing lunch at school on enrolment rates and the quality of education is

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<sup>1</sup> A notable exception is O'Toole's (1989) analysis of parental involvement programs with handicapped children in Guyana.

estimated in a panel model for Tanzanian villages, and conclusions are derived for low-income countries in general.

Following this introduction, section 2 presents the theoretical framework on public good provision, social capital and family involvement (2.1) and specific hypotheses for the low-income countries (2.2). The unique dataset and variables used for the econometric analysis are discussed in section 3. Section 4 presents the estimation strategy (4.1) and the econometric results for primary enrolment rates (4.2) and the quality of education (4.3). The discussion of the econometric results is presented in section 5, and conclusion in section 6.

## **2. Theoretical framework**

### ***2.1 Public good provision, social capital, and family involvement***

The relevance of family involvement in children's education is intuitively derived from the extensive literature on the provision of public goods and the role of social capital to overcome collective action failure.

Which factors determine education provision in the first place is a natural question to pose when analyzing the impact of family involvement on educational outcomes. More general, one can ask under which conditions communities succeed in providing the public good education.<sup>2</sup> Here, the well established literature on public good provision and collective action failures provides valuable insights by relating demographic characteristics of groups to the suboptimal provision of public goods. The classical works by Olson (1965), and Buchanan (1965), ascribe such failures of collective action to the size of a group. In particular, larger groups are seen to be unable to impose sanctions to free-riders and this leads to low public good provision.

Besides the size of groups other grouping characteristics, such as income inequality and, more recently, ethnic composition, are examined. While Olson (1965) argues that income inequality has a positive impact on collective action outcomes, other scholars report no effects (Warr, 1983; and Bergstrom, Blume, & Varian, 1986) or ambiguous effects (Baland & Platteau, 1999). In addition, scholars propose deviating ethnic preferences (Alesina & La Ferrara, 2000;

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<sup>2</sup> Note that education may fail to fulfill the requirement of non-excludability for a public good, since children can be excluded from the classroom. However, education is to a large extent non-rival and generates multiple externalities.

and Vigdor, 2004) and higher ethnic diversity (Poterba, 1996; Alesina, Baqir, & Easterly, 1999; Goldin & Katz, 1999; and Miguel & Gugerty, 2005) as explanatory factors for low public good provision. Ethnically diverse communities are seen to suffer from an inability to sanction deviating members and hence under provide public goods.<sup>3</sup>

The evidence on the importance of ethnicity and kinship, and thereby the relevance of community networks, leads to another related string of literature, namely the theory of *social capital*. Growing evidence suggest that the level of social capital inherent in communities helps to overcome collective action problems and to successfully provide public goods.<sup>4</sup> Despite the decades of research, an unambiguous definition of social capital is still missing.<sup>5</sup> Drawing on Coleman's (1990) theoretical work on social capital, Ostrom and co-authors (Ostrom, 1990, 1992; Ostrom, Schroeder, & Wynne, 1993; and Ostrom, Gardner, & Walker, 1994) as well as Putnam (1993, 1995, and 2000) relate social capital to collective action and public policy. The authors define social capital primarily as *shared norms, trust, common knowledge and rules used in a community*. Social capital is viewed to improve coordinated activities and, thereby, to solve collective action problems. Evidence from small scale collective action situations (Ostrom, 1990; and Ostrom *et al.*, 1994) demonstrate that through communication and interactions of people in a community shared norms, patterns of behavior, and rules emerge. These forms of social capital are viewed to help building institutions to solve the collective action problem. In addition, Putnam (1993) shows in his seminal work that social capital fosters democratic governance and economic prosperity. The author argues that collective action failure is the key component to explain weak governance and low economic growth. Possible solutions to the collective action problem are third-party involvement (e.g. the state) or voluntary cooperation. While institutionalized monitoring and sanctioning by the state is often too costly or impossible to implement, voluntary cooperation might be able to solve the collective action problem. Most importantly, such voluntary cooperation is facilitated by social capital. In particular, Putnam (1993; 173) points to *networks of civic engagement* such as “neighborhood associations, choral societies, cooperatives, sport clubs” as an important component of social capital.

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<sup>3</sup> See Cutler and Glaeser (1997) for an argument on a *positive* impact of ethnic diversity on schooling in the US.

<sup>4</sup>Note that researchers have also argued that social capital possesses certain aspects of a public good and that social capital might suffer from underinvestment due to free-riders. For a detailed discussion see Coleman (1988; S116-118; and 1990; 315-318).

<sup>5</sup> See Durlauf and Fafchamps (2005) for a detailed discussion on the range of definitions of social capital.

The notion that social capital in the form of community associations affects collective action outcomes can be readily applied to the education sector. Important work by Coleman (1988) stresses the role of social capital for the creation of human capital. In particular, the author argues that lack of social capital in families leads to decreased human capital of the children despite parent's high level of education. According to Coleman (1988; S113), social capital subsumes the relation between children and parents, as well as the social relationships within communities among parents, and between parents and the community's institutions. Drawing on further research by Coleman (1987) and Coleman and Hoffer (1987), McNeal (1999) conceptualizes *parental involvement*, such as parent-child discussion, involvement in parent-teacher organization and monitoring, as an important form of social capital in the production of education.

The role of parental involvement in children's education has received continuous scholarly attention over the past two decades. Family involvement<sup>6</sup> encompasses a wide range of activities, such as parent's efforts at home (helping with homework, and establishing a supportive learning environment), communication between the school and the parents, and volunteering of parents in school functions (such as parent-teacher associations, school boards, or local improvement councils) (cf. Epstein, 1992; and Horn & West, 1992; 11-37). While most studies on the impact of family involvement on educational outcomes report positive effects (cf. Walberg, 1984; Topping, 1992; Epstein, 1992; Henderson & Berla, 1996; Sui-Chu & Willms, 1996; Sheldon, 2003)<sup>7</sup>, the magnitude of these effects seem to vary substantially with the population of the study. In particular, growing evidence suggests that parents' socioeconomic status (SES), which includes parents' level of education, income and occupational status, and race (or ethnicity) drives the variation of community involvement's effects.

Studies point tentatively to a positive impact of SES on the extent to which families become involved in their children's education (cf. Eagle, 1989; and Sui-Chu & Willms, 1996). Involvement of working-class families in schools is found to be substantially lower than involvement of families from the middle class (Lareau, 1987, 1989). Furthermore, higher education of parents is seen to increase participation of parents in their children's education (Lareau, 1987; Stevenson & Baker, 1987; Useem, 1992).

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<sup>6</sup> By employing the term family involvement instead of parent involvement it is acknowledged that besides parents, other family members, neighbors and friends might collectively contribute to the child's development.

<sup>7</sup> Some authors also report negative effects of parental involvement on educational outcomes but explain this phenomenon by reverse causation (cf. Milne, Myers, Rosenthal, & Ginsburg, 1986; and Horn & West, 1992). Parents are likely to get more involved in their child's education if the child is not doing well in school.

Not only do parents with high SES become more involved in their children's education the effect of this involvement tends also to be higher than the effect of involvement of low-SES families (Stevenson & Baker, 1987; Henderson & Berla, 1996, 8-12; McNeal, 1999). Parents with higher educational level and income seem to be more familiar with the proceedings at schools, are able to comply with teachers' requirements in parent-teacher relationships, and tend to have more positive personal experiences with schooling (Lareau, 1989). Through these channels, the effect of parental involvement is accelerated in high SES families.

The argument that low-SES families feel intimidated when dealing with school staff might also explain why parents from ethnically and linguistically diverse neighborhoods are less likely to become involved in schools. In particular, Delgado-Gaitan (1991) argues that parents from ethnic minorities seem to more reluctant to participate in their children's schooling. The author explains that language barriers and lack of specific cultural knowledge of the schools prevents parents to become involved. In addition, while McNeal (1999) reports significant lower effects of parental involvement for minority students than for white students, other scholars find large variations of the involvement effect for different ethnic groups depending on the type of parental involvement (Milne, Myers, Rosenthal, & Ginsburg, 1986; and Sui-Chu & Willms, 1996).

In sum, parental involvement emerges as an important component of social capital and thereby as a possible solution to local collective action problems. Increasing family involvement in schooling seems to generate positive effects on educational outcomes. In addition, socioeconomic status (SES) emerges as an important predictor for the effects of family involvement. Parents from the middle-class with high income and high education are particularly strongly involved in their children's education. This increased involvement for high SES families also translates into an accelerated effect of parental income on educational outcomes. The effect of family involvement is highest for parents with high SES and parents from the ethnic majority in the country.

## ***2.2 Family involvement in developing countries***

Despite the evidence on the high relevance of family involvement on educational outcomes, studies on the impact of family involvement in developing countries are surprisingly scarce.<sup>1</sup> Even international agencies focus primarily on the role of families and the community in the

management of financial resources in the education sector and thereby neglect potential beneficial effects of other components of family involvement, such as family-school communication, and volunteering of parents in school functions (cf. Naidoo, 2005, 73-89; and UNESCO, 2008; 153-163). Indeed, family involvement might be particularly fruitful to increase educational outcomes in environments with low financial resources. Drawing on Epstein's (1992; 1141) review of the parental involvement literature, one can argue that family involvement has the potential to compensate for the negative effect of low family income and parents' low education levels on educational outcomes. Active involvement of parents in their children's education, thus, emerges as a potential substitute for higher financial resources and might offer a mechanism through which parents might effectively increase their children's education.

One possibility for parents in developing countries to become involved in their children's education might be to actively support and monitor their children's attendance at school. While parents' monitoring of their children is reported to have positive effects on educational outcomes in the U.S. (McNeal, 1999; and Epstein & Sheldon, 2002), this involvement activity seems promising to be promoted in a developing country setting. Actively monitoring children's school attendance requires only a minimum of time and no other prerequisites are necessary. Hence, fostering monitoring activities might be readily implemented in developing countries.

A second family involvement component, which might be particularly suitable in the developing country setting, is the improvement of the relationship between the school and the community. Evidence from the U.S. indicates that enhanced family-school relationships have significantly positive effects on rates of absenteeism (Sheldon & Epstein, 2004) and on test scores (Sheldon, 2003). In developing countries, in turn, strengthening the exchange and communication between the parents and the school might enable parents to monitor their children's progress more closely and to communicate their children's needs to the teachers. Again, this involvement activity is nearly costfree and requires only limited amounts of time by the parents. In addition, policy programmes advocating stronger relations between the family and the school, e.g through parent-teacher conferences or other school activities involving the community, might be readily implementable.

A third involvement activity potentially beneficial in developing countries is the provision of lunch at school by the community. School-feeding programs are advocated by scholars and international agencies as a means to increase enrolment, cognitive performance and learning

outcomes of children (cf. Levinger, 1986; and Epstein & Sheldon, 2002). Additional nutrition intake through lunch at school might have particular beneficial effects on educational outcomes of children from poor families in low-income countries. While the first two family involvement activities involve only little time and financial resources, providing lunch at school by the families requires at least a minimum of additional income and organizational skills. However, the cooperated effort by the all parents in the community to provide lunch at school might substantially reduce the per child costs of school lunch. In addition, if all parents in the community agree to provide lunch at school, this might also have incentives for parents to enroll their children who are currently not attending school. Hence, policies advocating the provision of school-lunch might be implemented in low-income countries at only minor costs and organizational requirements and are seen to considerably increase children's educational outcomes.

From the hitherto theoretical discussion, one can deduct hypotheses on the impact of the three family involvement components on educational outcomes in developing countries. In particular, increasing the involvement of families through monitoring school attendance, improving the relation between the school and the families, and providing lunch at school, is assumed to be beneficial for educational outcomes:

*H<sub>1a-c</sub>: Increased family involvement (a-c) raises educational outcomes.*

*where a) monitoring school attendance, b) enhancing the family-school-relationship, and c) providing school lunch.*

In addition to the linear effects of the three family involvement components ( $H_{1a-c}$ ), several demographic characteristics have been identified in the parental involvement theory (section 2.1), which might influence the impact of family involvement on educational outcomes. First, the effect of family involvement is seen to be substantially higher in families with high SES, defined by high education, income and occupational status:

*H<sub>2</sub>: The effect of family involvement on educational outcomes ( $H_{1a-c}$ ) increases as SES of parents increases.*

The second influential factor on family involvement is the ethnic diversity of the community (see section 2.1). Parents from ethnic minorities are seen to be more reluctant to become involved in their children's education. This might translate into substantially lower effects of involvement on educational outcomes in ethnically diverse communities than in ethnically homogenous communities:

*H<sub>3</sub>: The effect of family involvement on educational outcomes ( $H_{1a-c}$ ) decreases as ethnic diversity of the school community increases.*

### **3. Data and operationalization**

The relevance of the family involvement components for developing countries will be examined by drawing on evidence from the low-income country Tanzania. Tanzania's economic, population, and education system's characteristics are compared to the average low-income country in Appendix 1. Indeed, Tanzania's GDP per capita and received development aid are representative for low-income countries. In addition, Tanzania's population is over-average employed in agriculture and its life-expectancy is only marginally lower than average. Furthermore, Tanzania's total population and the age structure is representative for low-income countries. Turning to the education system characteristics, Tanzania's performance in the education system averages the low-income countries. Net enrolment rates and completion rates of Tanzanian children, as well as the ratio of pupils to teachers in primary schools are representative for low-income countries. Hence, Tanzania seems suitable to examine the relationship between family involvement and educational outcomes and to draw conclusions for developing countries in general.

#### ***Dataset***

The study employs the unique *school mapping data*, which was collected in Tanzania by the Ministry of Education and Culture (MoEC) and the Japanese International Cooperation Agency (JICA) in two waves during 1999 - 2002 (MoEC/JICA, 2002A, 2002B).<sup>8</sup> The dataset contains

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<sup>8</sup> Information from earlier school mapping projects by the UNICEF could not be included in this study due to the lack of questions on family involvement and differing implementation of the school mapping study (MoEC/JICA, 2002B; 8-17).

information on over 600 wards in Tanzania. A ward is the second smallest administrative unit in Tanzania and in the dataset a ward comprises on average 6.6 villages and 8174 people.<sup>9</sup> Appendix 2 reports the districts studied during the school mapping project and Appendix 3 depicts their location. Information on all wards from 30 districts in 13 regions (out of 20) was collected. 14 out of the 30 districts in the sample are urban districts, which account for one third of the studied population. Comparing this sampling distribution with population census data from 2000 confirms the representativeness of the sample for Tanzania.<sup>10</sup>

The school mapping dataset contains detailed information on family's involvement in the school, a school's equipment and financial resources, teacher's qualifications, and general community characteristics on the ward level. Data was collected through two survey instruments – a village leader survey and a head teacher survey. In particular, village leaders and head teachers were asked to complete the questionnaires by drawing on existing data at schools or by interviewing school committees and parents (MoEC/JICA, 2002B; 25). Village leaders visited each household in the community to assess the number of children in the community, whether they are enrolled in school, and the reason for not going to school. In addition, head teachers completed questionnaires by using their own records and interviewing teachers, pupils and members of the school committee. The information from the village leaders and head teachers was corroborated by data from ward and district officers.

### ***Dependent variables***

To capture the impact of family involvement on the quantity and quality of education, two different measures of educational outcomes are employed. First, the variable **enrolment** measures the net enrolment rate of students in primary schools in Tanzania. It captures the percentage of the students in the school-age cohort that is enrolled in the school and thereby indicates how many students currently attend school. However, increased family involvement might not only raise attendances rates of students, but also the quality of schooling. Therefore, the variable **exampassrate** is used to capture the quality of primary education. Exampassrate measures the percentage of students which completed seven years of primary school and

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<sup>9</sup> Tanzania primary administrative unit is a region, the secondary is a district, and the tertiary is a ward.

<sup>10</sup> The 2002 population census reports that 23.1 % (76.9 %) of the population lives in urban (rural) areas (Tanzania National Bureau of Statistics, 2009).

successfully passed the primary school leaving exam (PSLE).<sup>11</sup> Since only successful candidates of the PSLE are eligible to attend secondary school, the exam pass rate seems a suitable measure of the quality of the primary education.

### ***Family involvement variables***

Data on the family involvement activities in the ward was drawn from the section “community related factors” of the village leader questionnaire. Village leaders were asked to select from a list of “some of the efforts” by the community “to make children [to] attend school” (MoEC/JICA, 2002B; A5-17). The list given to the village leaders included, inter alia, the three following points: “d) *Provision of lunch at school*”, “e) *Monitoring of school attendance by the community*” and “g) *Enhancement of school-community relationship*” (emphasis added).<sup>12</sup> Village leaders were expected to fill out the questionnaire by consulting the village council, parents and pupils in their village. Villages, where families generally agreed that efforts have been made, denoted this with a 1 (zero otherwise). The dataset, then, reports the number of villages in a ward where communities affirmed the existence of efforts, and the total number of villages in a ward. The respective family involvement variable on ward level is, then, calculated by dividing the number of affirmative villages by the total number of villages. The indicator, hence, reports the percentage of villages in a ward, where family involvement activities are pursued.

The first hypothesis  $H_{1a}$  postulating a positive impact of parents’ monitoring of their children is assessed by employing the indicator **monitoring**. This variable reports the percentage of villages in a ward where families confirmed that they monitor their children’s school attendance (see point e) above). The second hypothesis on the impact of stronger school community relations on educational outcomes ( $H_{1b}$ ) is, then, tested using the indicator **family-school relation**. This variable measures the percentage of villages in a ward, where families try to improve the relation between the school and the community (see point g) above). Last, the hypothesis ( $H_{1c}$ ) on the impact of the provision of school lunch is assessed by using the variable

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<sup>11</sup> Note that students need to register to take the PSLE. The variable exam pass rate measures then the percentage of registered candidates for the PSLE that successfully passed the PSLE. The registered candidates and the number of pupils are highly correlated (0.88) and on average 10 % of the pupils enrolled in the primary school register for the PSLE (results not shown).

<sup>12</sup> The complete list reads as follows: “a) Provision of accessible and safe water, b) Provision of medical/health services c) Provision of shopping facilities at school, d) Provision of lunch at school, e) Monitoring of school attendance by the community, f) Enforcement of the bye-law in respect of compulsory schooling, g) Enhancement of school-community relationship, h) Others, i) No effort has made” (MoEC/JICA, 2002B; A5-17).

**school-lunch.** This indicator measures the percentage of villages in a ward where the families affirmed that they provide lunch at school (see point d) above).

### *Socioeconomic status and ethnic diversity*

Besides the linear impact of the three components of family involvement, socioeconomic status and ethnic diversity are postulated to have an impact on the efficacy of family involvement ( $H_2$  and  $H_3$ ). The socioeconomic status of parents is captured by an indicator of parents' level of education (**parent's education**) and of parents' income (**parents' income**).<sup>13</sup> Parent's education is measured by the percentage of adults (older than 14 years) in the ward that are literate. In addition, since no direct measure of parent's income is readily available in the school mapping dataset, families' financial resources are proxied by the percentage of houses in the ward that are equipped with electricity.

Furthermore, to test hypothesis  $H_3$  on the role of ethnic diversity on the impact of involvement the indicator **ethnic diversity** is used. Since the Tanzanian government restricted collection of information on ethnic identities after 1967, and the school mapping dataset, therefore, does not include information on ethnicity, this paper draws on information of district level ethnic identity from the 1967 population census (United Republic of Tanzania, 1971). While the absolute size of the population has increased during the last decades, experts assume that the relative size of the ethnic groups and their location remained fairly constant.<sup>14</sup> Second, the data on ethnic identity from the population census is only available on the district and not on the level. However, higher ethnic diversity on the district level is assumed to proxy increased ethnic diversity on the ward level. The variable ethnic diversity is, therefore, calculated according to the widely used formula for the ethno-linguistic fractionalization indicator and measures the probability that two randomly drawn individuals in the same district are members from different ethnic group.<sup>15</sup>

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<sup>13</sup> The third dimension of the socioeconomic status, i.e. occupational status of parents (see section 2.1), is not included in the estimation due to its high correlation with parents' income (0.79) and since it was used to impute the missing values for parent's income.

<sup>14</sup> Personal communication with Sam Maghimbi, University of Dar es Salaam, Dar es Salaam, Tanzania (11/25/2008).

<sup>15</sup>  $\text{ethnic diversity}_j = 1 - \sum_{i=1}^N s_{ij}^2$ , where  $s_{ij}$  = share of ethnic group  $i$  in district  $j$  (Alesina, Devleeschauwer, Easterly, Kurlat, & Wacziarg, 2003).

### ***Control variables***

Besides family involvement and the socioeconomic status, financial resources of the school, equipment and quality of teachers are conventionally used to explain variations in educational outcomes. Therefore, variables are included to measure the financial contributions by parents and by the state (**parents' spending**, **state spending<sub>t-1</sub>**), the school equipment (**books**), and the quality of teachers (**teachers**). Parents' spending is proxied by the amount of school fees paid in a ward in the year of the survey. Information on education spending of the state is not available in the school mapping dataset but had to be drawn from the Tanzanian budget accounts (United Republic of Tanzania, 1998A, 1998B). The variable  $\text{state spending}_{t-1}$  measures the sum of recurrent and construction spending per 100 school children on district level in the previous year (see discussion in section 4.1). Both spending variables are entered in logarithmic form.

The variable equipment measures the amount of available textbooks for mathematics, Kiswahili, English, science, skills studies and social studies in a ward. The indicator teachers captures the percentage of teachers, which have a high teaching qualification (diploma or grade A) in the ward<sup>16</sup>. Data on both variables are drawn from the school mapping dataset.

In addition, various characteristics of the wards are included in the regression, such as school age population (**children**), whether children need less than 30 minutes walking to school (**distance**), number of villages (**villages**), number of schools (**schools**), and number of private schools (**private-schools**). The inclusion of these five variables is depicted by the indicator **ward controls** in the regression tables (Table 2 and 3).<sup>17</sup>

Since the school mapping dataset contains most complete information, only the variable parents' income contained missing values (ca. 26%). These were imputed with variables measuring occupational status, access to water and number of households equipped with telephones from the school mapping dataset. A detailed description of variables' definitions and sources is provided in Appendix 4 and correlation matrix in Appendix 5.

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<sup>16</sup> The survey list four categories of teachers' qualification: Diploma, Grade A, B, C. According to personal communications with the Ministry of Education and Vocational Training, Dar es Salaam, Tanzania (11/14/08), Diploma and Grade A are the highest qualifications.

<sup>17</sup> The school mapping dataset contains information on urban and rural districts. However, a dummy variable for urban districts was excluded from the regression due to its very high correlation with other ward controls (schools (-0.49), villages (0.42)) and with the explanatory variables parents' income (0.46) and ethnic diversity (0.56) (results not shown).

## 4. Econometric analysis

### 4.1 Empirical strategy

As described in section 3, the school mapping dataset contains information on wards, which are nested in districts (and districts are nested in regions). The nested structure of the dataset is accounted for by estimating a panel model and treating the wards ( $t$ ) as the repeated measurement within the same district ( $n$ ). Most variables of the dataset are on ward-level with the exception of state spending <sub>$t-1$</sub>  and ethnic diversity. While these latter two variables capture some variation on the district level, in addition, district-specific effects are included in the regression to control for unobserved heterogeneity on the district level. Due to the invariance of state spending <sub>$t-1$</sub>  and ethnic diversity in wards of the same district, a random-effects (RE) model is estimated and consistency of the RE-model is confirmed by the hausman test. In addition, potential unobserved heterogeneity on the region level is captured for by the inclusion of regional dummies (**region dummies**).

Through the insertion of district random effects and region fixed effects, variation of the dependent variable are assumed to arise only from ward level heterogeneity. Therefore, conventional explanatory variables of educational outcomes, such as financial resources by the state and by parents allocated to a school, and the school's equipment with books and the quality of teachers, are included in the regression. The variable state spending <sub>$t-1$</sub>  enters lagged by one year, since resource distribution by the state might possibly be influenced by the quality of schools. The information on parents' spending is only available for the same year as the dependent variables. However, since the amount of school fees is fixed, parents' only response to the quality of schooling is to take their child from the school and not to pay less tuition. Therefore, the variable parents' spending is assumed not to be reversely affected by educational outcomes.

In addition to the spending variables, the two input variables, books and quality of the teachers, are included. While these indicators might partially be substitutes for the financial endowment of a school, the variables are nevertheless included to account for residual effects of other financial sources and control additionally for unobserved heterogeneity on the ward level.

Besides the financial and input variables, various indicators of a ward's characteristics, such as the number of children, distance to school, number of villages and schools, and number

of private schools (depicted as **ward controls**, Table 1 and 2) are included to explain some variation of the dependent variables.

The remaining variation of educational outcomes in wards is sought to be explained by the inclusion of the three family involvement components, i.e. monitoring, family-school relation, and school-lunch, in the regression. These involvement activities are carried out by the senior members of the community, which completed their schooling years ago. While young, educated school-leavers might readily see the need to become involved in education, they are not the decision-makers in the community. Hence, the quality of to-day's schooling does not systematically affect the willingness of parents to become involved in their children and, thus, reverse causation from the dependent variables to the family involvement indicators can be excluded.

The general form of the regression is depicted in equation (1). To test hypotheses ( $H_{1a-c}$ ), the family involvement variables ( $I_{it}$ ) enter as linear terms in the regression. In addition, hypotheses  $H_2$  and  $H_3$  are tested by successively including interaction terms between the family involvement components ( $I_{it}$ ) and the SES variables and ethnic diversity ( $S_{it}$ ). The regression also includes the financial resources and school inputs ( $E_{it}$ ), the ward controls ( $W_{it}$ ) and the region fixed effects ( $R_i$ ):

$$\text{Education}_{it} = \beta_1 I_{it} + \beta_2 S_{it} + \beta_3 I_{it} S_{it} + \beta_4 E_{it} + \beta_5 W_{it} + \beta_6 R_i + (\alpha_i + \varepsilon_{it}) \quad (1)$$

where  $(\alpha_i + \varepsilon_{it})$  is the combined error  $u_{it}$  for the  $t$ -th ward in the  $i$ th district.

To assess whether the family involvement components add to the explanation of the variation of the educational outcomes variables, five succeeding models are estimated. First, a baseline model containing all variables, except the family involvement indicators, is estimated (Table 1 and 2, model 1). Next, a model, containing the linear effects of the family involvement variables, is estimated (model 2). In the three succeeding models, the interactions of all family involvement variables with parents' education (model 3), parents' income (model 4), and ethnic diversity (model 5), are estimated. The fit of the models is compared by performing two different Wald tests. First, all models including family involvement indicators and interactions are tested against the baseline model (1) which excludes the family involvement variables (Table 1 and 2, Wald

(model 1)). This test indicates whether family involvement indicators increase the explanatory power of the model. In a second step, the three models including the interaction terms between the SES and ethnic diversity and the family involvement components are tested against the linear model (2) of family involvement (Table 1 and 2, Wald (model 2)). Here the question is, whether the models including interaction terms provide a better estimation than the model with only the linear terms of the family involvement components.

Whenever models including interaction terms are found to fit the data best, consistent coefficients and standard errors of interaction terms are obtained following Brambor, Clark, and Golder's estimation approach (2006). In addition, the assumption of normality of the error terms was tested and no outliers detected.

#### ***4.2 Econometric results: Enrolment rates***

The econometric results for net enrolment rates are depicted in Table 1. Throughout the models (1) – (5), the conventionally used explanatory factors report the expected sign. Parents' financial contributions to the school turn positive, significant (or close to significance) at the 10 % level. The variable state spending<sub>t-1</sub> is positive and turns highly significant when the interaction terms are included (model 3 – 5). The coefficients for the variables teachers and books remain insignificant and, which suggests that input variables are less relevant for enrolment.

In addition, the socioeconomic status of parents emerges as a significant predictor of educational outcomes. In particular, the linear coefficients of parents' education and income are positive and significant at the 1 % level throughout the models. The ethnic diversity of wards, however, does not turn significant in the baseline and linear model, and turns slightly negatively significant (or close to significance) at the 10 % level when the interaction terms are included in model 3 and 4.

Moreover, from the ward controls, the variables children and distance emerge with significant coefficients and the expected sign (results not shown). The R-squares and the overall Wald test indicates a good general fit of all models and the hausman test confirms the consistency of the use of the random-effects estimation method.

[Table 1 about here]

Now, turning to the question whether family involvement can explain some part of the variation of the enrolment rates, model (2) including the linear terms of the family involvement variables is compared to the baseline model (1). The Wald test rejects the null hypothesis that the three family involvement coefficients are zero at the 10 % level and thereby provides some evidence for the necessity to account for family involvement in explaining enrolment rates.<sup>18</sup> A second Wald test is, then, used to compare the model with the linear terms of the family involvement variables to the three models which include the interaction terms of family involvement with SES and ethnic diversity (model 3 - 5). As depicted in Table 1 (Wald (model 2)), only the model including the interaction term with parents' income (model 4) provides a significant better fit of the data than the linear model (2). The hypothesis that the interaction terms of family involvement with parents' education and ethnic diversity are zero cannot be rejected. However, the interaction terms with parents' income in model (4) are significantly different from zero at the 5 % level. These results indicate that including not only the linear terms of family involvement but also the interaction terms with parent's income significantly improve the estimation results.

The interaction terms in model (4) are re-estimated separately using Brambor, Clark, and Golder's (2006) approach. The marginal effects of the three family involvement components, i.e. family-school relation, monitoring, and school-lunch, for varying levels of parents' income are reported in Figure 1. The marginal effect of the family involvement components on enrolment rates is depicted on the y-axes. Parents' income, which varies from low (zero) to high (100), is depicted on the x-axes. The confidence interval for the 95 % level is denoted by small dots and the marginal effect turns significant if both, the upper and the lower bound of the confidence interval are above (or below) zero.

Graph a) in Figure 1 depicts the marginal effect of family-school relation on enrolment rates. The marginal effect turns significant positive for most observations (550/612) except for parents with particularly high income (>47.5). Indeed, improving family-school relations (from zero to 100) is associated with an increase in enrolment rates by 9 %.<sup>19</sup>

[Figure 1 about here]

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<sup>18</sup> Performing a Wald test of the models including the interaction terms (model 3 - 5) against the baseline model, again, provides evidence for the inclusion of the family involvement indicators (see Table 2, Wald (model 1)).

<sup>19</sup> The maximum marginal effect of family-school relation is calculated as: (average marginal effect of family-school relation\*range of family-school relation)/range of enrolment rates =  $(0.065*(100-0)) / (98-24) = 0.088$ .

The second family involvement component, monitoring, does not emerge as a significant explanatory factor when coefficient and standard errors are re-estimated (see Graph b), Figure 1). For all levels of parent's income the upper bound of the 95 % confidence interval is above zero and the lower bound is below zero.

The marginal effect of the third family involvement variable, school-lunch, is depicted in Graph c), Figure 1. The marginal effect turns significant for only the 10 % richest parents in the sample (63 out of 612 observations). In these families, increasing school-lunch (from zero to 100) is associated with a decrease in enrolment of 10 %.<sup>20</sup> However, for the majority of the observations (549/612), the coefficient of school-lunch remains insignificant for all levels of parents' income.

#### **4.3 Econometric results: Exampassrate**

The econometric results for exampassrate are depicted in Table 2. School's financial resources and the input factors emerge with the expected signs. While parent's spending coefficient remains positive, albeit insignificant, state spending<sub>t-1</sub> emerges significantly positive at the 10 % (or close to the 10 %) significance level in models 4 and 5. In addition, teachers and books emerge as strong predictors of the exampassrate. The coefficient of teachers turns significant positive at the 1 % level and the variable books turns significant positive at the 5 % (or 10 % for model 4 and 5) level.

While the linear term of parents' education appear mostly insignificant (except model 1), parent's income emerges as a significant predictor of variations in the exampassrate. The coefficient of parents' income is significant positive on the 1 % level (or 5 % level in model 4). The variable ethnic diversity, however, does not turn significant in the baseline and linear model, and turns slightly positive significant at the 10 % level when the interaction terms are included in model 3 and 4.

In addition, from the ward controls, the variables distance, villages and privateschools emerge with significant coefficients and the expected sign (results not shown). For all models, the R-squares and the overall Wald test indicates a good general fit and the hausman test confirms the consistency of the use of the random-effects estimation model.

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<sup>20</sup> The maximum marginal effect of school-lunch is calculated as: (average marginal effect of school-lunch\*range of school-lunch)/range of enrolment rates =  $(-0.077*(100-0)) / (98-24) = -0.104$ .

[Table 2 about here]

In the next step, the five different models estimated are compared by performing the Wald tests. Comparing all models against the baseline model (1) provides some indication whether the inclusion of the family involvement variables (and their interaction terms) significantly increase the fit of the model. However, the inclusion of the linear terms of the family involvement variables does not provide a better fit of the model than the baseline model ( $\text{Prob} > \chi^2 = 0.176$ ). In addition, the inclusion of the interaction terms between the family involvement variables and parent's income (model 4) and ethnic diversity (model 5), again, are rejected by the Wald test. Only, the inclusion of the interaction terms between the family involvement components and parents' education significantly increase the fit of the model ( $\text{Prob} > \chi^2 = 0.018$ ). Comparing this model (3) to model (2) with only the linear terms of family involvement, again, confirms the inclusion of the interaction terms with parents' education ( $\text{Prob} > \chi^2 = 0.007$ ).

The interaction terms in model (3) are re-estimated separately using Brambor, Clark, and Golder's (2006) approach and marginal effects are depicted in Figure 2. On the y-axis, the marginal effect of the family involvement component on exampassrate is depicted. Parents' education, which varies from low (zero) to high (77), is depicted on the x-axis. Graph a) in Figure 2 depicts the marginal effect of family-school relation and Graph b) depicts the marginal effect of monitoring on exampassrates as parent's income increases. In both graphs, the upper bound of the 95 % confidence interval is above zero and the lower bound is below zero for all levels of parents' education. Hence, family-school relation and monitoring do not emerge as significant predictors of variations in exampassrate.

[Figure 2 about here]

Graph c) in Figure 2 depicts the marginal effect of school-lunch on exampassrate. The marginal effect turns significantly positive for parents with education levels below average ( $< 76$ ; 140/612 observations). For least educated parents, increasing school-lunch (from zero to 100) is

associated with an increase in exampassrate by 26 %.<sup>21</sup> In addition, the marginal effect of school-lunch turns negative for parents with very high levels of education (>94; 131/612 observations). For highest educated parents, increasing school-lunch (from zero to 100) is associated with a decrease in enrolment rates by 9 %.<sup>22</sup>

## 5. Discussion

In sum, the econometric results confirm the relevance of the family involvement variables and their interactions with parents' socioeconomic status to increases children's educational outcomes. In particular, the results support hypotheses H<sub>1a</sub> and H<sub>1c</sub>, and reject hypotheses H<sub>1b</sub>, H<sub>2</sub> and H<sub>3</sub>.

Hypothesis H<sub>1a</sub> was supported for enrolment rates by the positive significant coefficient of family-school relation in Table 1 (model 4). For the exampassrate, however, the family-school relation variable does not turn significant (see Table 2, model 3). Hence, these results provide some indication for the potential of enhancing the relations between the school and the families to increase enrolment. The increased enrolment, in turn, does not seem to translate immediately into improved quality of schooling. However, communities' efforts to increase the family-school relation and thereby to increase attendance might translate in the long run into improved educational quality. Therefore, policies advocating enhanced relations between families and the school might be, indeed, beneficial in developing countries.

Hypothesis H<sub>1b</sub> concerning the impact of the monitoring variable on educational outcomes could not be supported by the econometric results. Neither for enrolment rates nor for exampassrates did monitoring emerge as a significant explanatory variable (see Table 1, model 4; and Table 2, model 3). Monitoring of the school attendance by parents does neither seem to increase attendance at school nor improve the quality of education. This provides some indication that parents' behavior at home has only a marginal effect on their children's schooling and cannot alter education outcomes substantially.

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<sup>21</sup> The maximum marginal effect of school-lunch for least educated parents is calculated as: (max. marginal effect of school-lunch\*range of school-lunch)/range of enrolment rates =  $(0.2*(100-0)) / (77-0) = 0.259$ .

<sup>22</sup> The maximum marginal effect of school-lunch for highest educated parents is calculated as: (max. marginal effect of school-lunch\*range of school-lunch)/range of enrolment rates =  $(-0.072*(100-0)) / (77-0) = -0.093$ .

The third hypothesis ( $H_{1c}$ ) on the effect of school-lunch on educational outcomes can be tentatively confirmed by the econometric results (see Table 1, model 4; and Table 2, model 3). While providing school lunch seems not to influence enrolment rates for most parents (except the richest 10 %), it increases the exam pass rate by over 26 % for least educated parents. Whether children perform well at school seems to depend critically on their nutritional intake during the day. Increasing the nutritional status of children by offering school lunch seems to translate into accelerated pass rates at the primary school leaving exam. Note that the effect of providing school lunch turns negative for the richest and most educated parents. One argument could be that these parents already provide their children with sufficient nutrition and hence the children do not benefit from the school lunch provided by the community. In addition, parents with highest socioeconomic status might have other possibilities to increase their children's educational outcomes and hence might depend to a lesser degree on this involvement strategy. These results lend strong support for policies targeted at providing school lunch in particularly poor environments to increase the quality of education. Children from low-SES families benefit substantially from the provision of additional food at school and the higher nutritional intake is translated into accelerated exam pass rates. Hence, policies advocating the provision of lunch at school by parents are seen to be very valuable.

In addition, hypothesis  $H_2$  concerning a positive impact of parents' socioeconomic status on the effect of the family involvement components is rejected by the econometric results. While parents' income seem to drive some of the effects of family involvement on enrolment rates (see Graphs a-c, Figure 1), for exam pass rate the educational level of parents seem more important (see Table 2, model 3). Improving the family-school relation is particularly beneficial on enrolment rates for parents with low incomes. In addition, while for the majority of parents, school-lunch remains insignificant, for the richest parents, it has a negative effect (see Graph c, Figure 1). A similar pattern emerges for exam pass rate. Here, providing school lunch has a substantial positive impact for less educated parents and a negative effect for parents' with very high levels of education (see Graph c, Figure 2). As discussed above, parents with higher income and education might increase their children's educational outcomes through other mechanisms than providing school lunch or improving the family-school relation. In general, however, the econometric results suggest that parents with lower socioeconomic status, i.e. low education level or low income, are the main beneficiaries of enhanced involvement in their children's education. These

results provide strong support for the implementation of family involvement activities in particularly poor countries to increase educational outcomes.

Last, the econometric results reject a significant relation between ethnic diversity and family involvement components. The model including the interaction of ethnic diversity and the family involvement variables does not provide a better fit of the data than the model with the linear terms of family involvement for enrolment rates (see Table 1, model 5, Wald(model2)), and the base line model for exampassrate (see Table 2, model 5, Wald(model1)). Hence, the results suggest that a community's ethnic diversity does not influence whether parents become involved in their children's education. These results provide some counterevidence to recent studies which point to a negative impact of ethnic diversity on public good provision (cf. Alesina, Baqir, & Easterly, 1999; and Miguel & Gugerty, 2005).

## **6. Conclusion**

A developing country's inability to ensure universal primary education and to substantially increase the quality of primary schooling is often attributed to its limited financial resources. Hence, other activities that might improve educational outcomes without requiring additional funding, such as family involvement, might solve the developing country's dilemma. However, while over two decades of evidence from industrialized countries propose beneficial effects of family involvement on children's educational outcomes, studies focusing specifically on the impact of family involvement on education in developing countries are surprisingly scarce.

This paper contributes to the literature on development and family involvement by testing the family involvement theory in a low-income country setting. In particular, the effect of three different family involvement components, i.e. improved family-school relation, monitoring of school attendance, and provision of school lunch, on the quantity and quality of education in Tanzania are examined. Indeed, in the econometric analysis, family involvement activities emerge as important factors driving enrolment rates and the quality of education in Tanzania. In particular enhanced relation between the families and the school, and the provision of lunch at school by the parents are seen to increase enrolment rates and the quality of education. While strengthening the family-school relationships is particularly important for enrolment rates, providing lunch at school substantially increases the pass rates at the primary exams. Hence,

policies advocating these two family involvement activities would substantially increase the quantity and quality of education low-income countries.

In addition, a third family component, monitoring children's school attendance, does not emerge as a significant explanatory factor for educational outcomes. Parents' behavior at home does neither appear to significantly increase enrolment nor the quality of education. Further research should, therefore, investigate whether other dimensions of family involvement at home currently not included in this paper, such as helping with homework, or establishing a supportive learning environment, help to explain variations in educational outcomes.

Furthermore, the econometric results point to a strong impact of parents' socioeconomic status, i.e. education and income, on the effects of family involvement activities. The effect of family involvement activities seems particularly strong for poor and less educated families. This suggests that parents might be able to overcome their disadvantaged situation (low education, low income) and increase their children's educational outcomes by becoming strongly involved in educational activities. Generally, these results suggest that low-income countries are the main beneficiaries from implementing policies targeted at promoting family involvement activities. Increasing family involvement might, hence, help developing countries to substantially increase educational outcomes.

*Table 1: Results for enrolment*

	(1) Baseline	(2) $I_{it}$	(3) $I_{it}S_{it}$ $S_{it}$ : parents' education	(4) $I_{it}S_{it}$ $S_{it}$ : parents' income	(5) $I_{it}S_{it}$ $S_{it}$ : ethnic diversity
parents' education	0.338*** (<0.01)	0.335*** (<0.01)	0.450*** (<0.01)	0.328*** (<0.01)	0.331*** (<0.01)
parents' income	0.127*** (<0.01)	0.130*** (<0.01)	0.119*** (<0.01)	0.318*** (<0.01)	0.126*** (<0.01)
ethnic diversity	-0.111 (0.148)	-0.096 (0.192)	-0.073* (0.063)	-0.063 (0.108)	-0.040 (0.647)
family-school relation		0.052** (0.011)	0.088 (0.356)	0.071*** (<0.01)	0.042 (0.391)
monitoring		-0.012 (0.472)	0.096 (0.246)	0.018 (0.375)	0.018 (0.640)
school-lunch		-0.002 (0.920)	0.045 (0.564)	0.012 (0.543)	0.043 (0.271)
$S_{it}$ *family-school relation			-0.0003 (0.797)	-0.0004 (0.636)	0.0003 (0.652)
$S_{it}$ *monitor			-0.001 (0.204)	-0.001** (0.029)	-0.0004 (0.477)
$S_{it}$ *school-lunch			-0.001 (0.433)	-0.002** (0.013)	-0.001 (0.118)
parents' spending	0.611* (0.093)	0.580 (0.110)	0.595 (0.102)	0.603* (0.096)	0.583 (0.111)
state spending <sub>t-1</sub>	9.291 (0.160)	10.035 (0.114)	11.556*** (<0.01)	11.126*** (<0.01)	11.587*** (<0.01)
teachers	-0.008 (0.848)	-0.019 (0.641)	-0.048 (0.228)	-0.050 (0.205)	-0.043 (0.281)
books	0.001 (0.281)	0.001 (0.317)	0.001 (0.136)	0.001 (0.159)	0.001 (0.160)
ward controls	Yes	Yes	Yes	Yes	Yes
region dummies	Yes	Yes	Yes	Yes	Yes
Wald (overall)	chi2(25)= 238.75	chi2 (28)= 253.64	chi2 (31) = 547.51	chi2 (31) = 560.98	chi2 (31) = 549.81
Prob > chi2	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
R-sq (within)	0.235	0.242	0.241	0.250	0.238
(between)	0.854	0.873	0.884	0.886	0.896
(overall)	0.469	0.480	0.486	0.492	0.487
Hausman	Prob > chi2 = 0.893	Prob > chi2 = 0.868	Prob > chi2 = 0.249	Prob > chi2 = 0.994	a)
Wald (model 1) <sup>b)</sup>	-	Prob > chi2 = 0.074	Prob > chi2 = 0.020	Prob > chi2 < 0.01	Prob > chi2 = 0.012
Wald (model 2) <sup>c)</sup>	-	-	Prob > chi2 = 0.557	Prob > chi2 = 0.028	Prob > chi2 = 0.353
Number of wards	612	612	612	612	612
Number of districts	30	30	30	30	30

Constant term not reported; p values in parentheses; \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

a) Ethnic diversity does not vary over wards. Hence neither the fixed-effects estimation nor hausman test is performed.

b) Wald test of the respective model against model 1.

c) Wald test of the respective model against model 2.

For an overview of variable definitions and sources, see Appendix 4

**Table 2: Results for exampassrate**

	(1) Baseline	(2) $I_{it}$	(3) $I_{it}S_{it}$ $S_{it}$ : parents' education	(4) $I_{it}S_{it}$ $S_{it}$ : parents' income	(5) $I_{it}S_{it}$ $S_{it}$ : ethnic diversity
parents' education	0.077* (0.090)	0.071 (0.113)	0.175 (0.167)	0.055 (0.253)	0.058 (0.231)
parents' income	0.268*** ( $<0.01$ )	0.270*** ( $<0.01$ )	0.251*** ( $<0.01$ )	0.220** (0.038)	0.242*** ( $<0.01$ )
ethnic diversity	0.082 (0.443)	0.079 (0.688)	0.083* (0.063)	0.081* (0.072)	0.028 (0.781)
family-school relation		0.001 (0.948)	-0.014 (0.895)	0.002 (0.956)	-0.032 (0.571)
monitoring		0.023 (0.191)	0.046 (0.623)	0.019 (0.399)	0.035 (0.420)
school-lunch		0.039** (0.047)	0.286*** ( $<0.01$ )	0.026 (0.258)	0.025 (0.576)
$S_{it}$ *family-school relation			0.0003 (0.771)	0.001 (0.376)	0.001 (0.352)
$S_{it}$ *monitor			-0.0002 (0.830)	0.001 (0.513)	-0.0001 (0.850)
$S_{it}$ *school-lunch			-0.004*** ( $<0.01$ )	-0.001* (0.090)	-0.0003 (0.635)
parents' spending	0.280 (0.474)	0.255 (0.512)	0.167 (0.685)	0.150 (0.718)	0.131 (0.755)
state spending <sub>t-1</sub>	8.540 (0.348)	8.253 (0.620)	5.354 (0.180)	6.299 (0.114)	7.336* (0.066)
teachers	0.144*** ( $<0.01$ )	0.147*** ( $<0.01$ )	0.149*** ( $<0.01$ )	0.157*** ( $<0.01$ )	0.159*** ( $<0.01$ )
books	0.001** (0.032)	0.001** (0.028)	0.001** (0.032)	0.001* (0.080)	0.001* (0.054)
ward controls	Yes	Yes	Yes	Yes	Yes
region dummies	Yes	Yes	Yes	Yes	Yes
Wald (overall) Prob > chi2	chi2(25) = 237.63 ( $<0.01$ )	chi2(28) = 206.93 ( $<0.01$ )	chi2 (31) = 592.28 ( $<0.01$ )	chi2 (31) = 582.53 ( $<0.01$ )	chi2 (31) = 571.41 ( $<0.01$ )
R-sq (within) (between) (overall)	0.242 0.791 0.479	0.249 0.774 0.473	0.241 0.828 0.506	0.235 0.827 0.502	0.228 0.824 0.497
Hausman	Prob>chi2 = 0.320	Prob > chi2 =0.194	Prob > chi2 = 0.814	Prob > chi2 = 0.298	a)
Wald (model 1) <sup>b)</sup>	-	Prob > chi2 =0.176	Prob > chi2 = 0.018	Prob > chi2 =0.112	Prob > chi2 =0.588
Wald (model 2) <sup>c)</sup>	-	-	Prob > chi2 = 0.007	Prob > chi2 = 0.071	Prob > chi2 =0.704
Number of wards	612	612	612	612	612
Number of districts	30	30	30	30	30

Constant term not reported; p values in parentheses; \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

a) Ethnic diversity does not vary over wards. Hence neither the fixed-effects estimation nor hausman test is performed.

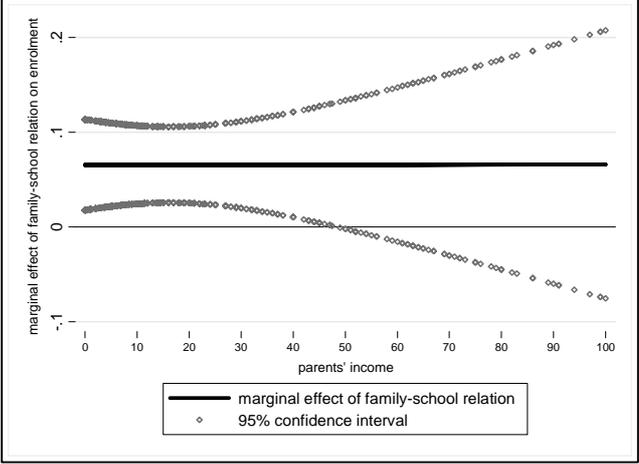
b) Wald test of the respective model against model 1.

c) Wald test of the respective model against model 2.

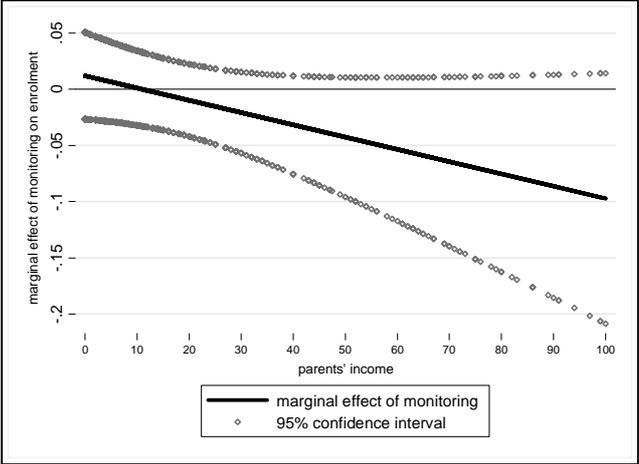
For an overview of variable definitions and sources, see Appendix 4.

**Figure 1: Marginal effects for enrolment**

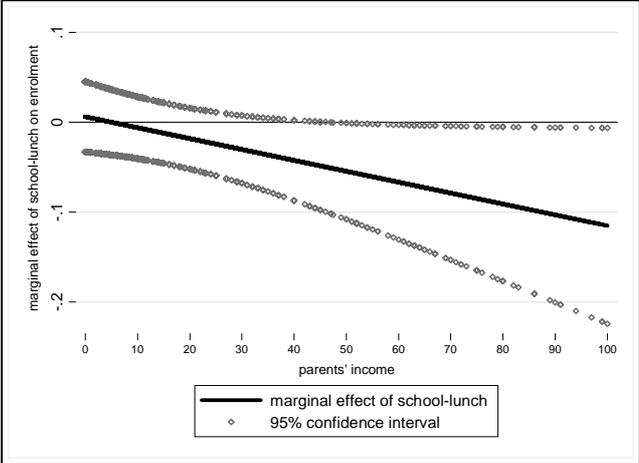
**a) Marginal effect of family-school relation by parents' income level**



**b) Marginal effect of monitoring by parents' income level**



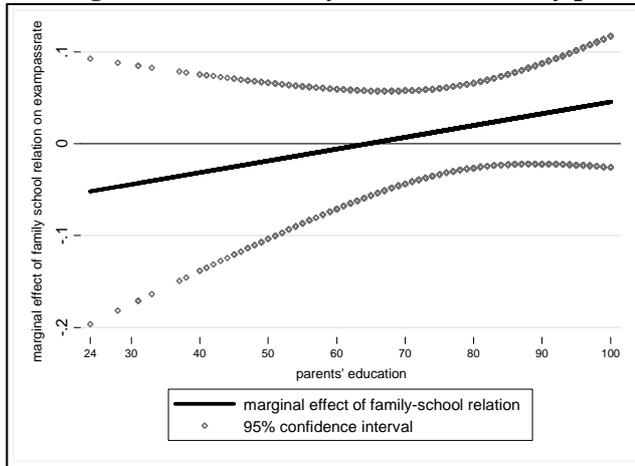
**c) Marginal effect of school-lunch by parents' income level**



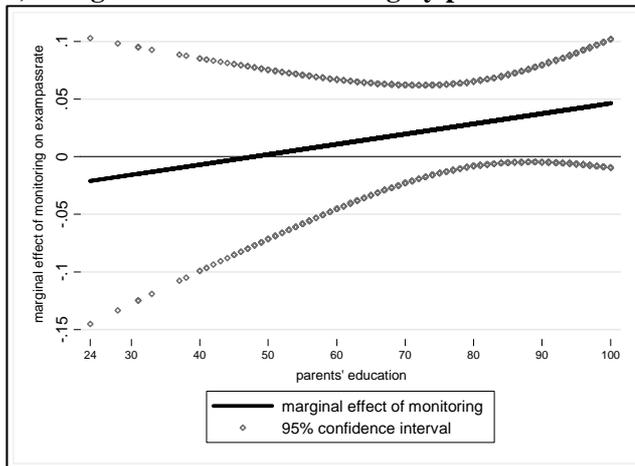
Notes: For specification, see Table 1, model 4.

**Figure 2: Marginal effects for exampassrate**

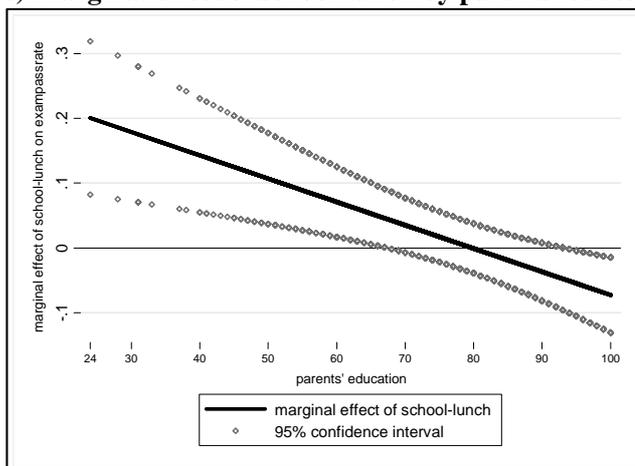
**a) Marginal effect of family-school relation by parents' education level**



**b) Marginal effect of monitoring by parents' education level**



**c) Marginal effect of school-lunch by parents' education level**



Notes: For specification, see Table 2, model 3.

### Appendix 1: Tanzania's and low-income countries' characteristics in comparison

Country's characteristics	Low-income countries mean	Tanzania
GDP per capita (in 2000 USD)	322.68 [278.41 - 366.96]	268.23
Aid per capita (in 2000 USD)	39.66 [24.45 - 54.86]	30.11
Employment in agriculture (in % of total employment)	57.26 [49.81 - 64.70]	82.1
Life expectancy at birth, total (in years)	54.45 [52.19 - 56.72]	49.13
Population, total	41200000 [1746791 - 80600000]	33800000
Population ages 0-14 (% of total)	42.75 [41.42 - 44.09]	44.48
School net enrolment primary (in %)	64.40 [58.50 - 70.30]	53.43
Primary completion rate (in % of relevant age group)	51.14 [43.38 - 58.91]	54.79
Pupil-teacher ratio in primary schools	41.86 [38.23 - 45.49]	41.35

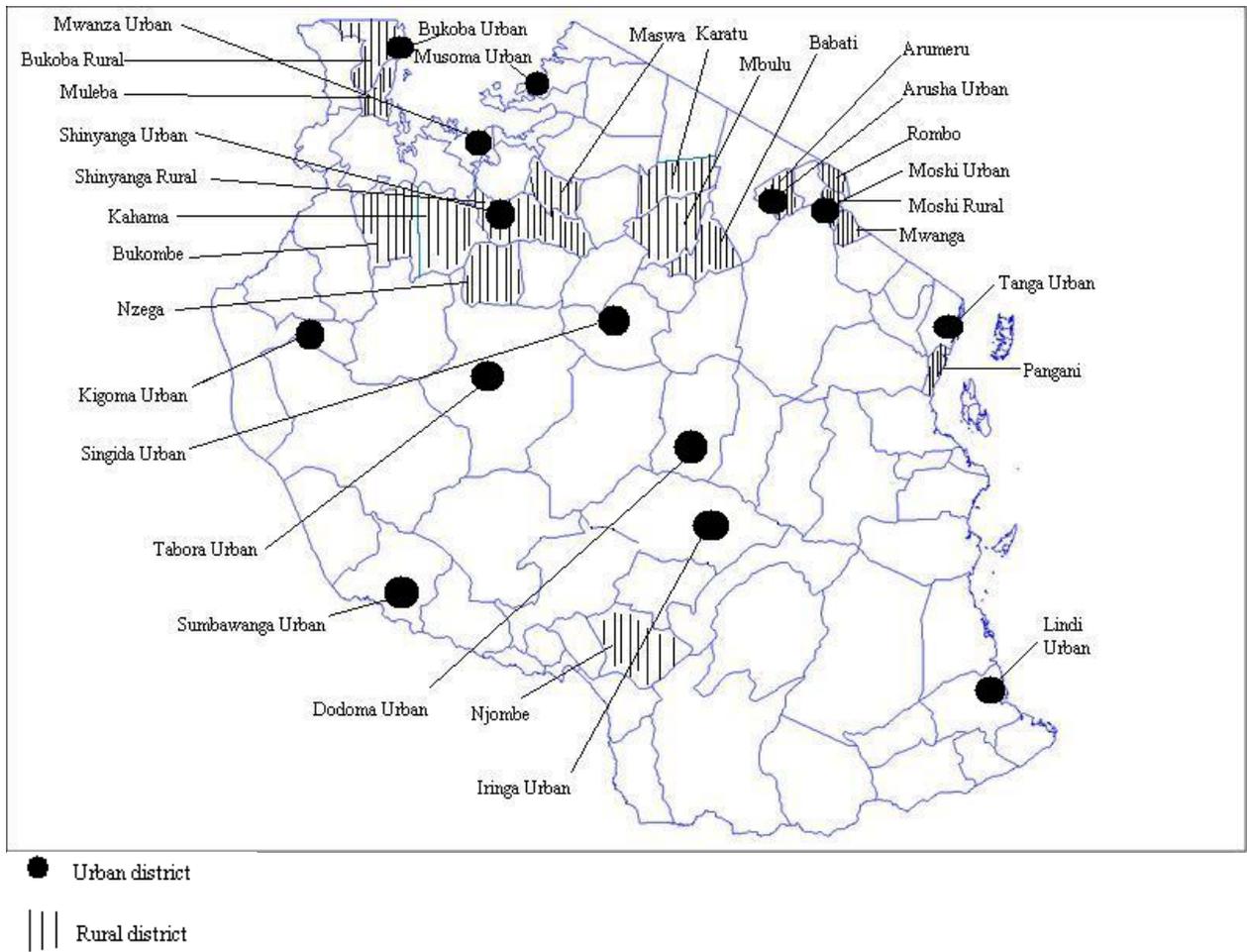
Note: Values denote the mean estimates and 95% confidence intervals are reported in parentheses.

Source: World Bank, 2008; for all countries in the classification "low-income" (N=52), for the year 2000 (missing values are approximated by values for proximate years)

## Appendix 2: List of regions, districts and wards of school mapping dataset

Region	District	Number of wards
Arusha	Arumeru	37
	Arusha Urban	15
	Babati	21
	Karatu	13
	Mbulu	16
Dodoma	Dodoma Urban	15
Iringa	Iringa Urban	13
	Njombe	27
Kagera	Bukoba Rural	41
	Bukoba Urban	14
	Muleba	31
Kigoma	Kigoma Urban	11
Kilimanjaro	Moshi Rural	31
	Moshi Urban	15
	Mwanga	16
	Rombo	20
Lindi	Lindi Urban	9
Mara	Musoma Urban	13
Mwanza	Mwanza Urban	20
Rukwa	Sumbawanga Urban	13
Shinyanga	Bukombe	14
	Kahama	34
	Maswa	18
	Shinyanga Urban	13
	Shinyanga Rural	36
Singida	Singida Urban	13
Tabora	Nzega	37
	Tabora Urban	21
Tanga	Pangani	13
	Tanga Urban	22

### Appendix 3: Location of school mapping districts



#### Appendix 4: Variables and descriptive statistics

Variable	Definition and source	Mean	Standard deviation	Min	Max
<b>enrolment</b>	Std. I - VII net enrolment rate in percent	68.33	14.71	24	98
<b>exampassrate</b>	Percentage of candidates that successfully passed the primary school leaving exam (PSLE) <sup>11</sup>	20.19	17.01	0	77
<b>family-school relation</b>	Percentage of villages in a ward where the community tries to improve the relation between school and the community	73.98	23.86	0	100
<b>monitoring</b>	Percentage of villages in a ward where school attendance is monitored by the community	52.84	29.89	0	100
<b>school-lunch</b>	Percentage of villages in a ward where the community provides school lunch	39.70	33.91	0	100
<b>parents' education</b>	Percent of literate adult population (14 years +)	79.18	15.66	24	100
<b>parents' income</b>	Percentage of houses in the ward that are equipped with electricity	16.34	21.38	0	100
<b>ethnic diversity</b>	Probability that two randomly drawn individuals in the same district are members of different ethnic groups (100 denotes a probability of 1) <sup>15</sup> <i>Source:</i> United Republic of Tanzania, 1971 <i>Level:</i> district	56.40	25.54	9.83	91.87
<b>parents' spending</b>	Logarithm of school income per pupil generated through the collection of school fees, in 100 TShs	9.29 <sup>a)</sup>	21.68 <sup>a)</sup>	0 <sup>a)</sup>	489.97 <sup>a)</sup>
<b>state spending<sub>t-1</sub></b>	Logarithm of the sum of recurrent and construction (e.g. construction and maintenance of primary schools and classrooms, and construction of teacher houses) spending for the financial year 1 <sup>st</sup> July 1998 until 30 <sup>th</sup> June 1999 per pupil in the district, in 100 Tshs, deflated (2000) <i>Source:</i> United Republic of Tanzania, 1998A and 1998B. <i>Level:</i> district	235.36 <sup>a)</sup>	70.06 <sup>a)</sup>	105.73 <sup>a)</sup>	426.37 <sup>a)</sup>
<b>teachers</b>	Percentage of teachers that hold a diploma plus teachers that have a Grade A qualification <sup>16</sup>	52.12	13.45	0	88
<b>books</b>	Amount of textbooks (mathematics, Kiswahili, English, science, skills studies, and social studies), in 100 books	25.61	15.73	1.04	102.66
<b>children</b>	Age 7 - 13 population of the ward, per 100 people	18.35	11.88	0.86	129.65
<b>distance</b>	Percentage of students that need between 0 – 30 minutes to reach the school	62.78	20.53	0	100
<b>villages</b>	Total number of villages per ward	6.60	5.77	1	50
<b>schools</b>	Number of primary schools per ward	4.50	2.56	1	19
<b>private-schools</b>	Percentage of private schools in the ward	6.21	15.34	0	77.77

Notes: If not state otherwise the source of the data is MoEC/JICA (2002A) and on ward level.

a) The descriptive statistics are reported for non-logarithmized variables.

## Appendix 5: Correlation matrix

	family-school relation	monitoring	school-lunch	parents' education	income	ethnic diversity	parents' spending	state spending <sub>t-1</sub>	teachers	books	children	distance	schools	villages	private schools
family-school relation	1.00														
monitoring	0.18	1.00													
school-lunch	-0.21	-0.30	1.00												
parents' education	0.04	0.10	0.14	1.00											
income	-0.11	0.05	0.13	0.50	1.00										
ethnic diversity	-0.18	-0.10	0.13	0.04	0.39	1.00									
parents' spending	0.09	0.06	0.06	0.07	-0.001	-0.0656	1.00								
state spending <sub>t-1</sub>	-0.08	-0.003	0.12	0.41	0.35	0.20	0.01	1.00							
teachers	0.02	0.03	-0.01	0.35	0.35	0.14	0.07	0.10	1.00						
books	0.13	0.05	0.16	0.17	-0.03	-0.26	0.14	-0.19	0.001	1.00					
children	0.07	0.06	-0.03	-0.03	-0.15	-0.10	0.06	-0.42	-0.02	0.61	1.00				
distance	0.03	0.04	0.04	0.27	0.23	0.10	-0.05	0.21	0.15	0.02	-0.04	1.00			
schools	0.10	0.04	-0.002	-0.15	-0.38	-0.35	0.09	-0.41	-0.15	0.68	0.64	-0.12	1.00		
villages	-0.08	0.06	-0.18	0.11	0.17	0.27	-0.07	-0.02	0.27	0.07	0.30	0.16	-0.006	1.00	
private schools	0.001	-0.05	0.13	0.09	0.23	0.11	0.08	-0.06	0.13	0.07	0.05	-0.05	-0.06	0.05	1.00

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