EXAMINING HOUSEHOLD DEPRIVATION AND THE INTERGENERATIONAL CORRELATION OF EDUCATION: INSIGHTS FROM DEVELOPING COUNTRIES

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ABSTRACT

In the context of deprivation in developing nations, we look into the relationship between parents' education and kids' schooling. The objective is to add to the body of knowledge regarding the critical elements influencing the transfer of education across generations. Child mortality, school attendance, cooking fuel, sanitation, drinking water, power, housing, and assets are all included in the deprivation index that is created. According to our research, there is a substantial link between intergenerational educational connection and deprivation. Compared to men, this bond is a little stronger for the women.

Key words: Family deprivation Developing nations Level of education attained Correlation between education throughout generations

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I. INTRODUCTION

Education is a means to exit from poverty, while poverty is often a huge barrier to enroll in education (Engle & Black, 2008). In developing countries, there is persistent inequality in education and consequently, in the intergenerational transmission of education (Mahler, Lakner, Van Der Weide, & Narayan, 2018; World Bank, 2018). The causes and consequences of the intergenerational correlation of education is one of the most debated topics in economics (Dennison & Swisher., 2018; Neidhofer, Serrano, &Gasparini, 2018). The majority of the early school leavers and out-of-school children come from poor households (UNESCO, 2019). The fact that many of the individuals with low attainment in education come from households with parents with low educational attainment like themselves – the intergenerational transmission of education – has been well documented (Azomahou&Yitbarek, 2016).

This has allowed researchers to address important issues in the relative and absolute intergenerational correlation of education and intergenerational mobility of education such as the relationship with infrastructure, income, occupation, educational development and industrialization (Aydemir&Yazici, 2019; Emran, Ferreira, Jiang, & Sun, 2019; Momo, Rud, Cabus, De Witte, & Groot, 2019; Qi & Wu, 2019; Van Doorn, Pop, &Wolbers, 2011). Studies have investigated the association between economic development factors, institutional characteristics and home environment on the one hand and the degree of intergenerational persistence of educational attainment on the other hand. In developing countries however, school dropout is closely associated with the poor and with children from households with low educated parents. It is not clear, however, what determines the non-financial gaps that occur early in the lives between children from advantaged families (high parental education) and disadvantaged families (low parental education). That is, household inequalities that represent inherited limited opportunities from parents and the lack of basic necessities for a comfortable standard of living for the children.

For instance, given the importance of the home environment in determining the outcomes in children, Aydemir and Yazici (2019) suggested some home environment factors that may contribute to high correlations across generations with regards to educational outcomes. They thus investigated the importance of four home-based deprivations or home environment variables on the intergenerational mobility of education in Turkey. These home variables include the presence of an encyclopedia, musical instrument, the number of siblings, and the ability to watch movies or go to theatres while growing up. Encyclopedia, musical instrument, and the ability to watch cultural events significantly interacted with parent's education to vary the educational attainment of children.

However, this relationship between household environment and the intergenerational correlation of education has not been identified in the literature for developing countries yet. This emphasizes the need to broaden our knowledge on the relevant household characteristics that are associated with the intergenerational correlation of education through their relationship with one's life trajectory (Alkire, 2008; Biggeri, Libanora, Mariani, &Menchini, 2006; Mohaqeqi Kamal, GhaedaminiHarouni, Basakha, &MakkiAlamdari, 2019). In this paper, we are thus interested in how household environment is associated with the intergenerational correlation of education in developing countries, thus extending the investigation of Aydemir and Yazici (2019) to developing countries. Given that this study takes a developing country perspective, the household factors used here are factors that reflect conditions in that region.

We rely on internationally comparable indicators such as those of the global Multidimensional Poverty Index (MPI). They include the most recent internationally comparable deprivation factors of acute poverty of households (Global Multidimensional Poverty Index, 2018). These originated from the explanations of individuals considered poor, with regard to their living conditions or what their daily lives look like. These indicators are taken because they represent the views of the poor with regards to their well-being, priorities and problems (Biggeri et al., 2006). They are the deprivations mentioned in their day-to-day lives. This means that we look at basic utilities that are relevant, and sometimes lacking, for individuals in developing countries. This can provide important information for policy action regarding the intergenerational correlation of education.

This paper thus contributes to the existing knowledge by investigating the interaction between deprivation and the intergenerational correlation of education. We therefore answer the following research question: Does household deprivation or the home environment contribute to the intergenerational correlation of education? Our main hypothesis is that the intergenerational correlation of education significantly increases with household deprivation. We do not identify a causal relationship between deprivation and intergenerational correlation of education, we rather look at the interaction between parent's education and deprivation in explaining educational attainment variation of children. This is because our estimations do not include all potential independent variables that affect educational attainment (Holmlund, Lindahl, & Plug, 2011). Besides omitted variable bias, it is not feasible to methodologically correct for endogeneity bias due to the difficulty in satisfying the exclusion restrictions required for valid instruments. Section 2 of this study reviews the internationally comparable approaches applied to define the quality of living of individuals thereby determining their deprivation status. Section 3 describes the data. Section 4 describes the analytical method to examine the association between educational attainment and deprivation. Section 5 presents the results of the analysis, and Section 6 discusses the results and concludes.

II. CONCEPTUALISATION OF DEPRIVATION

The most frequently used internationally comparable indicators of deprivation in the developing regions are the Bristol, and the Alkire and Foster approaches of poverty measurement (Pinilla-Roncancio& Silva, 2018). For the Bristol approach, Gordon, Nandy, Pantazis, Townsend, and Pemberton (2003) puts forward a conceptual foundation providing an explanation of the measurement of child poverty and its dimensions. It is aimed at highlighting the extent and severity of child poverty in developing countries. It puts

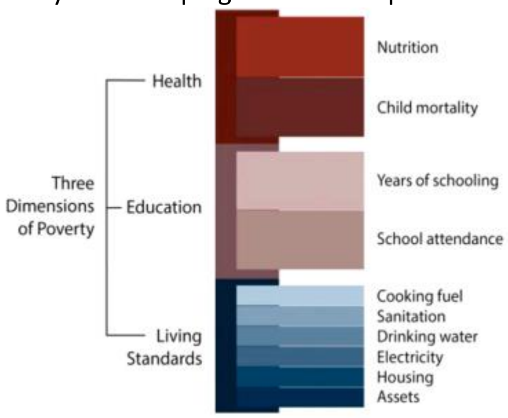

Fig. 1. Composition of the MPI – dimensions and indicators

forward internationally agreed standards and conventions of threshold measures of severe deprivation of basic human needs. In other words, Gordon et al. conceptualised deprivation as a continuum ranging from no deprivation, through mild deprivation, moderate deprivation, and severe deprivation to extreme deprivation. The basic human needs used to analyze the severity level of deprivation of a child include food, drinking water, sanitation, health, shelter, education, information, and services (Gordon et al., 2003). The operationalisation of these measures lies in the deviation of height and weight for age, access to sufficient drinking water, access to toilet facilities, access to medical care, overcrowding of dwelling, learning adequacy, access to communication services, and access to health and education facilities

Alkire and Foster look at deprivations experienced by poor people, derived from the lack they regularly describe when explaining their disadvantages (Alkire et al., 2015). The family of measures developed by Alkire and Foster was used to construct the global MPI in 2010 (Pinilla-Roncancio& Silva, 2018), which was revised in 2018 and 2019 (Global Multidimensional Poverty Index, 2019). The United Nations Development Programme and the Oxford Poverty and Human Development Initiative jointly developed the global MPI. They used health, education, and living standards to measure child poverty across countries. Within these dimensions, they developed ten indicators including nutrition, child mortality, years of schooling, school attendance, cooking fuel, sanitation, drinking water, electricity, housing and assets. They used household-level microeconomic data to identify the numerous deprivations at the individual and household levels. Alkire and Foster's division of the categories into the various indicators and the operationalisation of deprivation are shown in Fig. 1 and Table 1 below respectively:

III. DATA

The data used in this paper to operationalise household deprivation are the Demographic and Health Surveys (DHS). These are nationally representative household survey data available for many developing countries. Information on the household was reported through face-to-face interviews of eligible respondents of the households. This study uses DHS data for twenty-seven developing countries with surveys that were conducted between 2012 and 2018, the survey years vary between countries. The surveys cover a broad range of household, individual and residential characteristics such as education, family dynamics, health, housing, amenities, cities, and regions. The individuals for whom we analyze educational attainment are those aged 20 to 30 and are children of the head of the household. This truncation was in order to include information for those who have relatively recently finished formal education at the time of the survey which enables us to capture mostly the current situations of the households.

As ascertained by Hertz et al. (2008), we assume that the bias that may arise because of the age truncation is small. There could be downward bias from the lower limit for excluding individuals still to complete final education and those who take longer to finish, or an upward mean level bias and downward coefficient bias from the upper limit possibly, because longevity may be correlated with education. The education of the highest educated parent is taken to represent the variable ‘parent’s education’. Therefore, households included are households with individuals aged 20–30 (who are considered as the children in the analysis), and for who we have information on their parent(s). This is regardless of whether there are other children in the household or not. So, some households may have more children while some may not. The data include 27 countries with sample sizes ranging from 1305 (for Zimbabwe) to 10,763

Table 1 Operationalisation of deprivation

Indicators	Households considered deprived
Nutrition	Households have malnourished individual if they: -Have adults 20 to 70 years whose Body Mass Index (BMI) is below 18.5 m/kg2. -Have 5 to 20 years individuals whose age-specific BMI cutoff is below minus two standard deviations. -Have children under 5 years whose z-score of either height-for-age (stunting) or weight-for-age (underweight) is below minus two standard deviations from the median of the World Health organisation 2006 reference population.
Child mortality	Any child has died in the family in the five-year period preceding the survey.
Years of schooling	No household member aged ten years or older has completed six years of schooling.
School attendance	Any school-aged child is not attending school up to the age at which he/she would complete class 8.
Cooking fuel	The household cooks with dung, wood or charcoal.
Sanitation	The household's sanitation facility is not improved or it is improved but shared with other households. (A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, if they are not shared).
Drinking water	The household does not have access to improved drinking water or safe drinking water is at least a 30-minute walk from home, roundtrip. (A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater).
Electricity	The household has no electricity.
Housing	-Floor is made of mud/clay/earth, sand or dung; -Or if dwelling has no roof or walls; -Or if either the roof or walls are constructed using natural materials such as cane, palm/trunks, sod/mud, dirt, grass/reeds, thatch, bamboo, sticks, or rudimentary materials such as carton, plastic/ polythene sheeting, bamboo with mud/stone with mud, loosely packed stones, uncovered adobe, raw/reused wood, plywood, cardboard, unburnt brick or canvas/tent.
Assets	The household does not own more than one of these assets: radio, television, telephone, computer, animal cart, bicycle, motorbike or refrigerator, and does not own a car or truck.

(for Indonesia). The countries include Bangladesh, Benin, Cameroon, Chad, Dominican Republic, Ethiopia, Ghana, Guinea, Haiti, Indonesia, Kenya, Lesotho, Malawi, Mali, Namibia, Nepal, Nigeria, Pakistan, Peru, Philippines, Rwanda, Senegal, Sierra Leone, Tanzania, Uganda, Zambia, and Zimbabwe. All the households included in the countries are those living in their usual residence, since we expect that where they grew up may be more relevant. Survey weights are used in statistical representations to make the surveys nationally representative.

3.1. Descriptive statistics

In this paper, the Alkire and Foster’s deprivation indicators are utilized. We construct an index by summing these indicators, after first creating dummy variables with them indicating ’1’ for being deprived and ’0’ for being non-deprived. The categorical deprivation index variable is then entered in the analysis. The outcome variable ‘educational attainment’ is represented by the number of years of education completed. In total, eight indicators of the three dimensions of deprivation are used as explanatory variables. This include child mortality, school attendance, cooking fuel, sanitation, drinking water, electricity, housing, and assets. Nutrition and years of schooling were left out due to incomplete data and multicollinearity with parent’s education respectively, leaving eight indicators or dummy variables in total.

For the variable ‘school attendance’, we compute the age of class 8 completion depending on the primary school starting age of the various countries. Primary school starting ages are 6, 7, or 8, for the different countries. This gives different ages of class 8 completion, which are 13, 14, and 15, respectively. Parent’s education is the education of the single parent in a single-parent household or the education of the parent having the highest level of education in households with both parents. In Table 2, we present the descriptive statistics of the dependent and independent variables. The dependent variable is educational attainment. The independent variables are the deprivation indicators (child mortality, school attendance, cooking fuel, sanitation, drinking water, electricity, housing, and assets), age, gender, parent’s education, number of household members, and region of residence (rural or urban). We also present the correlation coefficients between parents’ education and the deprivation index within each country and across countries. Results show that they are not highly correlated. In Appendix A, we present per country sample size, educational attainment, parent's education, and the percentage deprived in each deprivation indicator.

IV. METHODOLOGY

A check for collinearity in the data per country shows that the indicators are not highly correlated with each other, with the highest

Table 2 Descriptive statistics of the individual-level characteristics.

Panel A: Main sample					
	Variable	Mean	Standard deviation	Range	
Children	Educational attainment	9.17	4.53	0–20	
	Age	23.57	3.03	20-30	
	Gender: Female (vs Male)	0.43	0.49	0–1	
	Parent's education	6.12	5.12	0–22	
	Deprivation index	3.32	1.95	0–8	
	Number of household members	6.79	3.49	2-50	
	Rural region of residence(vs Urban)	0.56	0.50	0–1	
Index composition	Child mortality	0.08	0.28	0–1	
	School attendance	0.17	0.38	0–1	
	Cooking fuel	0.69	0.46	0–1	
	Sanitation	0.33	0.47	0–1	
	Drinking water	0.26	0.44	0–1	
	Electricity	0.38	0.49	0–1	
	Housing	0.47	0.50	0.1	
	Assets	0.88	0.33	0–1	
Panel B: Further information on educational attainment					
			Frequency	Percent	
	No certificate	1	19,147	22.11	
	Primary certificate	2	30,177	34.85	
	Secondary certificate	3	37,276	43.04	
Matrix of correlations between parents' education and household deprivation index[a]					
(1) −0.41	(6) −0.50	(11) −0.40	(16) −0.37	(21) −0.38	(26) −0.52
(2) −0.48	(7) −0.50	(12) −0.49	(17) −0.47	(22) −0.38	(27) −0.59
(3) −0.42	(8) −0.39	(13) −0.50	(18) −0.40	(23) −0.42	(28) −0.48
(4) −0.50	(9) −0.45	(14) −0.47	(19) −0.49	(24) −0.43	
(5) −0.33	(10) −0.37	(15) −0.52	(20) −0.51	(25) −0.48	

correlation being lower than 0.7. Country-level check however, show a high correlation of 0.8 between fuel and electricity in Zimbabwe. The pooled regression with the eight indicators is therefore conducted with all the countries, and then, with the removal of Zimbabwe. However, both regression analyses produce similar results. Therefore, we present the pooled data regression with Zimbabwe included. The correlation matrices, for the pooled data and country-wise data, are presented in Appendix B and Appendix C respectively. Educational attainment can be operationalized by different measures, including the highest degree completed and completed years of schooling. One limitation with cross-country data on education is that the distribution of education varies across countries. Also, educational attainment might be biased because individuals might have dropped out of school before they have completed a degree, while in developing countries it is not uncommon that individuals drop out of school in the course of a grade level in primary or secondary education.

A finer measure of educational attainment is therefore that which also captures any additional grade(s) completed after the highest degree attained (Aydemir&Yazici, 2019). Therefore, an individual with additional completed years of schooling after the highest degree attained will differ from an individual who dropped out right after completing his/her highest degree. We therefore use completed years of education because it is a more precise measure to capture this. Given its continuous nature, it allows for an analysis by means of ordinary least squares (OLS) regression, which is what we apply in this paper. We measure the intergenerational correlation of education using the regression coefficient and the standardized coefficient. While the regression coefficient uses the years of schooling in the data, the standardized coefficient uses the standardized years of schooling, for both parents and children. We standardize the years of schooling to obtain a distribution with mean zero and standard deviation of one. This divides the years of schooling variable by its standard deviation, for children and parents respectively. We also look at the heterogeneity by conducting the regressions for females and males separately. The standardized coefficient (a1s) relates to the regression coefficient (a1) by:

$$\mathrm{a}_{1s} = \mathrm{a}_1 \frac{\partial p}{\partial c},$$

representing a standard deviation increase in children's education following a standard deviation increase in parents' education. ∂p and ∂c are the standard deviations of parents' and children's years of schooling, respectively. The baseline analysis involves the intergenerational correlation of education with the pooled data using the following linear equation;

$$\mathrm{E}_{ij} = \mathrm{a}_0 + \mathrm{a}_1(\text{parent's education})_{ij} + \mathrm{g}(\text{control variables})_{ij} + \text{error}_{ij} \qquad (1)$$

where Eij represents educational attainment of individual 'i' of country 'j'.

The control variables in the analysis are the number of household members, age, gender, urban/rural residence, city and year fixed effects for the pooled data. The standard errors are clustered at household level and country level. Household level clustering is used because although the children sample may be representative, with each child treated as a separate observation, the parental sample is

Table 3 OLS regression coefficients of children's education on parents' education (1),

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deprivation index (2), and interaction between deprivation index and parent's education (3).

	Overall (1)	(2)	(3)	Female (1)	(2)	(3)	Male (1)	(2)	(3)
PE	0.356***	0.269***	0.204***	0.365***	0.281***	0.201***	0.349***	0.260***	0.201***
	(0.004)	(0.004)	(0.006)	(0.005)	(0.006)	(0.008)	(0.005)	(0.005)	(0.008)
Index		−0.774***	−0.903***		−0.763***	−0.943***		−0.780***	−0.888***
		(0.012)	(0.016)		(0.018)	(0.024)		(0.016)	(0.021)
Index*PE			0.023***			0.031***			0.021***
			(0.002)			(0.002)			(0.002)
NHH	−0.075***	−0.053***	−0.056***	−0.106***	−0.082***	−0.087***	−0.060***	−0.039***	−0.041***
	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)
Residence (U)									
R	−1.616***	−0.589***	−0.589***	−1.580***	−0.628***	−0.621***	−1.652***	−0.574***	−0.577***
	(0.037)	(0.038)	(0.038)	(0.052)	(0.053)	(0.053)	(0.049)	(0.051)	(0.051)
Gender (M)									
F	0.286***	0.168***	0.166***						
	(0.031)	(0.030)	(0.030)						
City	0.002	0.008***	0.008***	0.002	0.007***	0.007***	0.004	0.010***	0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age	0.037***	0.011**	0.011**	0.013	−0.033***	−0.032**	0.074***	0.045***	0.044***
	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Constant	8.104***	11.208***	11.662***	9.715***	12.538***	13.105***	7.137***	10.344***	10.756***
	(0.144)	(0.147)	(0.151)	(0.207)	(0.209)	(0.212)	(0.193)	(0.197)	(0.202)
R^2	0.387	0.432	0.434	0.440	0.482	0.485	0.349	0.396	0.398
N	86,600	86,600	86,600	36,826	36,826	36,826	49,774	49,774	49,774
YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: PE = Parent's education, NHH = Number of household members, *U* = Urban, *R* = Rural, *M* = Male, *F* = Female, YFE = Year fixed effects, CFE = Country fixed effects, *** $p<0.01$, ** $p<0.05$, standard error in parenthesis.

not representative. This is because parents with more than one child in our data are over-represented. The variable for the standard error clustering is therefore created to have household-country paired values. In the second analysis, we look at the correlation between the deprivation index and educational attainment, thereby adding the deprivation index to Eq. (1), as shown below;

$$E_{ij} = b_0 + b_1(\text{parent's education})_{ij} + b_2(\text{deprivation index})_{ij} + f(\text{control variables})_{ij} + \text{error}_{ij} \quad (2)$$

Thirdly, we include an interaction term between parent's education and the deprivation index, as follows;

$$E_{ij} = c_0 + c_1(\text{parent's education} \times \text{deprivation index})_{ij} + c_2(\text{parent's education})_{ij} + c_3(\text{deprivation index})_{ij} + h(\text{control variables})_{ij} + \text{error}_{ij} \quad (3)$$

Table 3 below presents the results of Eq. (1), (2), and (3), for all individuals, female, and male. Standardized results are presented in the appendix. We however, take a step in confirming the direction of our results by applying an ordered Probit model as well. This estimation groups the individuals into certificate obtained (no certificate, primary certificate, and secondary certificate).

V. RESULT

5.1. Baseline estimates

We present the baseline intergenerational correlation of education for the entire sample without controlling for the deprivation index (1), and with the controls for deprivation index (2). This is to show that the intergenerational correlation after controlling for the deprivation index is lower than the one without the deprivation index control. Fig. 2 below plots this outcome. The analysis on intergenerational correlation of education (1) in Fig. 2 shows that the correlation coefficient between children's and parent's years of education range is 0.36, that is, the increase in years of education following a one year increase in parent's education. This is similar to what was found in a previous study on developing countries (Momo et al., 2019), 0.39, and a bit higher than what Akbulut-Yuksel and Turan (2013) found for Sub-Saharan Africa, 0.20. After controlling for the deprivation index, the intergenerational correlation reduces to 0.27. this implies that when parents' education increase by one years, children's education increase by 0.27 years.

Fig. 3 presents the results after controlling for separate items in the deprivation index. The results show that each coefficient with a measure of deprivation is lower than the baseline estimate (0.356). They range from child mortality (0.354) through water (0.350), fuel (0.338), assets (0.334), school attendance (0.339), sanitation (0.330), electricity (0.327), and housing (0.323).

Fig. 4 summarizes results for men and women. The heterogeneous intergenerational correlation shows the same pattern for both female and male. That is, the baseline estimates without deprivation index are higher than the estimates with controls for the deprivation index. However, the male estimates are lower than those for females. They are 0.35 (compared to 0.36 for females) in the uncontrolled baseline estimate and 0.26 (compared to 0.28 for females) in the deprivation-controlled estimate. Table 3 below presents the OLS regression results of Eqs. (1), (2), and (3) for the pooled data, and by gender. The standardized results are presented in Appendix D.

Appendix D reports the standardized correlation coefficients between parents' and children's years of schooling. The standardized coefficient without controlling for deprivation is 0.40 and the coefficient with controls for deprivation is 0.30. Thus a one standard deviation increase in parent's education leads to a 0.40 standard deviation increase in children's education. This deviation in

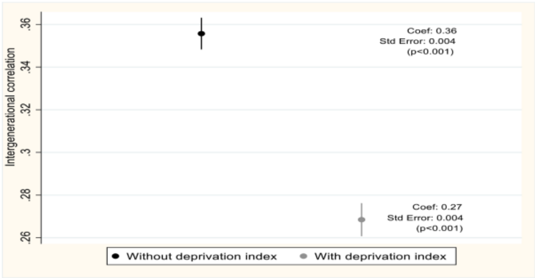

Fig. 2. OLS intergenerational correlation coefficients with confidence intervals for the baseline equation without deprivation index (1), and with deprivation index (2)

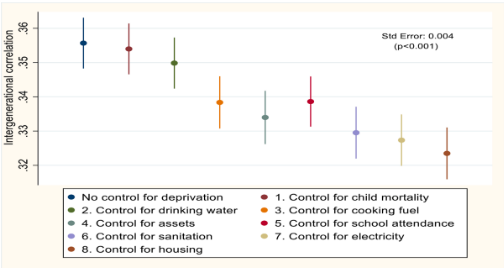

Fig. 3. OLS intergenerational correlation coefficients with confidence intervals for the baseline Eq. (1), and estimated coefficients with one single measure each, of household deprivation.

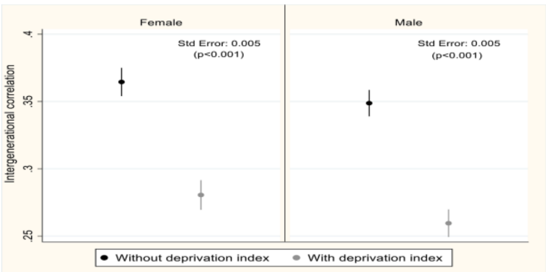

Fig. 4. OLS intergenerational correlation coefficients with confidence intervals for the baseline equation without deprivation index (1), and with deprivation index (2), by gender.

children's education reduces to 0.30 with the inclusion of the deprivation index. These standardized values show a strong association of parent's education with educational attainment. The coefficient of (2) on Table 3 on the correlation between the deprivation index and educational attainment reveals that deprivation seems to weaken educational attainment. This relationship is statistically significant, with 0.77 years decrease in educational attainment following an additional deprivation in the household. This decrease in years of educational attainment after controlling for deprivation is slightly higher for men (− 0.78) than for women (− 0.76). In terms of intergenerational persistence by gender, the standardized coefficients without and with controlling for deprivation indicates that for both women (0.41 and 0.31) and men (0.39 and 0.29) there is a strong and similar association between parent's education and educational attainment.

Our coefficient of interest, the interaction term in the third row of the results of (3) on Table 3, indicates the relationship of home environments with the intergenerational transmission of education. The interaction terms of parent's education and the deprivation index on the overall, the female and the male outcomes show a significantly positive correlation coefficient. This indicates a stronger relationship between parents' years of schooling and children's years of schooling when the number of deprivations are higher, or, the educational attainment of children who grew up in more deprived households depend more on the parents' education. Overall, a one year increase in parent's education leads to an additional 0.02 years increase in children's education for one unit increase in the deprivation index. This relationship is a little bit stronger for women (0.03) as compared to men (0.02). The outcome on the interaction term confirms our main hypothesis that the intergenerational correlation of education significantly increases with household.

5.2. Robustness analysis

We provide further support for the correlation between intergenerational transmission of education and deprivation in this section. The method we apply here is the ordered Probit analysis where educational attainment is the certificate obtained. Y* is the latent variable that indexes the certificate obtained, with a vector of parameters Xij, and an error term;

$$Y* = \beta X_{ij} + e_{ij}$$

The latent variable is displayed in ordered categories coded 1,2,3, and the following respective responses;

$$\begin{aligned} Y* &= 1 \text{ if } Y* \leq \alpha_1 \\ Y* &= 2 \text{ if } \alpha_1 < Y* \leq \alpha_2 \\ Y* &= 3 \text{ if } \alpha_2 < Y* \leq \alpha_3 \end{aligned}$$

These are three categories of the dependent variable; no certificate (1), primary certificate

(2), and secondary certificate (3). The variables of the parameters in Xij are the ones defined in the OLS equations above. For interpretation purposes, we present the marginal effect of the explanatory variables parent education and deprivation index from the baseline without deprivation control and the baseline with deprivation control. The result of this analysis is reported in Appendix E. Based on the Probit model, parent's education significantly correlates with obtaining a certificate in the model without the deprivation index. The positive sign of the coefficient (0.11) indicates that obtaining a certificate increases with parent's education. In the model, the marginal effects show that a one year increase in parent's education correlates significantly and makes it 3% (−0.023) less likely to have no certificate, 0.7% (−0.006) less likely to have primary certificate, and 3% (0.029) more likely to have a secondary certificate.

When the deprivation index is included in the analysis, the coefficient of the correlation of parent's education is reduced to 0.08. This coefficient is however, still statistically significant. The marginal effects of parent's education reduce slightly to − 0.017, − 0.005, and 0.022, respectively. The deprivation index also correlates significantly with certificate in the model. Its negative coefficient (− 0.233) implies that obtaining a certificate reduces with a unit increase in deprivation. The marginal effects of the deprivation index show that a one unit increase in deprivation is significantly associated and makes it 5% (0.048) more likely to have no certificate, 1% (0.013) more likely to have primary certificate, and 6% (− 0.062) less likely to have secondary certificate. In general, parent's education mostly correlates with no certificate and secondary certificate in both equations, as their marginal effects are of a similar higher magnitude. This might be an explanation of the fact that school dropout is prevalent among the poor, who are also mostly children from households with parents with a low educational attainment. Overall, this result is consistent with the finding of the OLS estimates that deprivation reduces the magnitude of the correlation between parent's educational attainment and that of the children.

Given the complexity of the DHS survey design, we account for stratification and clustering by incorporating information about the primary sampling unit, sampling weight, and stratification through the 'svyset' command in Stata (Takramah&Aheto, 2021). Re-running the analysis with the 'svy' syntax does not alter the results. Appendix F presents the results of Table 3 accounting for survey design characteristics.

VI. DISCUSSION AND CONCLUSION

In this paper, we set out to establish the contribution of deprivation measured by characteristics of the home environment to the intergenerational correlation of education. Evidence on the contribution of home environment is scarce in developing countries. We combine different deprivations in a developing country setting, representing the home environment in a multidimensional manner. Deprivation was analyzed as an index from the combination of dummy variables of deprivation indicators in a pooled data of 27 countries. The analyses were based on interactions with parent's education in an intergenerational transmission of education regression to assess the contribution of deprivation index.

First, there is generally a strong relationship between being deprived and the intergenerational correlation of education. This relationship represents an additional 0.02 years increase in children's education following a 1 year change in parent's education for a one unit increase in the deprivation index. So, deprivation strengthens the intergenerational transmission of education and reduces social mobility. This finding is in line with that of Aydemir and Yazici (2019) who find that educational attainment of children in a favourable home environment or higher level of home resources depend less on the educational attainment of their parents. However, their finding holds true for women (0.05 and 0.09 in relation with father's years of schooling and mother's years of schooling, respectively) but is insignificant for men.

Deprivation in school attendance is found in households where there is a school-aged child of up to the age of class 8 completion that is not attending school. Children may not attend school as their parents because of less priority attributed to school and limited school facilities, transmitted from generation to generation. The majority of children not attending school are found in Africa, a good amount of these live in Nigeria (Odeyemi, Olufunlayo, Ogunnowo, &Onajole , 2016). For this country, there are many other reasons for staying out of school besides income, in societies of consistent educational underachievement. Parents as well as children are eager to do business, while there is limited support to encourage learning and career prospects (Okwaraji, Obiechina, Onyebueke, Udegbunam, &Nnadum, 2018). Other major hindrances include distance to school, with lack of infrastructures for transport; and cultural practices of parents who do not believe in the importance of formal education and prefer keeping children at home or send them to religious schools and early marriage (Bello &Hakimi, 2017).

Given that the influence of parent's education on children's education also extends to material provisions (cooking fuel, sanitation, drinking water, electricity, housing and assets), inequalities from intergenerational correlation of education may arise from social isolation and the living circumstances that shaped the behavior of parents. As explained in (d'Addio, 2007), this affects childhood care from parents and the educational prospects of the children. He emphasizes on the importance of services that help shape children's upbringing. In other words, parents from poor families may become affected in their behaviors, aspirations, standards and values, that develop in them a culture of poverty. This culture affects the later outcomes of children

One possible measure through which deprivation correlates with the intergenerational transmission of education is the genetic endowments that affect both children's ability to attain higher education and parent's ability to acquire basic home resources. Parents with lower ability accumulate less resources and have children who are unable to obtain more schooling (Huang, 2013). Another mechanism that could give rise to the significantly positive association between educational persistence and deprivation might be that in households with more home and time-consuming duties, educational aspirations may be low, and parental opinions and decisions regarding children's education may be shaped negatively.

The findings in this paper are in accordance with the literature on the importance of looking to the actual home environment or deprivations of households in the intergenerational transmission of education of students from poor families. While these findings cannot establish causal relationships, they provide useful hints about the underlying causal mechanisms that lead to the association between poverty and the intergenerational correlation of education. In the context of the developing countries, these findings establish that the intergenerational correlation of education differs by the deprivation status of households. These include having school-aged children that are not attending school; cooking fuel of dung, wood or charcoal; unimproved or shared sanitation facilities; unsafe or shared drinking water; no electricity; unimproved housing; and absence of assets. The deprivations thus suggest that although both financial and non-financial availability are likely to be important in the intergenerational transmission of education, the latter is likely to facilitate the task of ensuring that young people have equal opportunities to succeed.

In our view, these findings are useful for policy focus. School-aged children's school enrolment, as well as the household living standard indicators play an important role in achieving early and sustained development required for higher educational attainment. Deprivation hampers social mobility. Where a culture of poverty - a consequence of parents from poor or uninspired family background – has shaped parental values and aspirations,

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income provision such as one dollar a day may not impact on educational attainment. Policies that might contribute to improving intergenerational mobility of education could include the modification of parental values through the creation of incentives and basic services for a convenient living condition. This would also help to reduce any predominance of informal and household-based social and economic activities that negatively affect school attendance and retention. Policy should also focus on improving college retention and completion by preparing students earlier in their academic career for the desire and demands of higher level of schooling.

A few limitations in these analyses should be noted. First, although the data are nationally representative, we have slightly modified the actual sample sizes by some eliminations due to requirements and truncation. This is a limitation which may affect predictive power to a representative population. Second, there may be other characteristics that influence the relationship between parent's education and children's education, thereby influencing the magnitude of the correlation coefficients of the intergenerational correlation of education. Third, our data is cross-sectional, not longitudinal. Therefore, we do not control for possible change in deprivation status of the household while the individual was growing up. Future research therefore on causality with control for possible changes in deprivation status in this area would help in providing more insight into the moderating effect of household deprivation in the study of intergenerational correlation of education.

Appendix A. Country-level descriptive statistics of deprivation variables

Country(survey year)	Sample size	Educational attainment		Parent's education		Percentage deprived in each indicator							
		Min	Max	Min	Max	Child mortality	School attendance	Cooking fuel	Sanitation	Drinking water	Electricity	Housing	Assets
Bangladesh(2014)	3492	0	18	0	18	9.8	6.6	84.7	24.8	2.0	31.2	63.9	98.9
Benin(2017/2018)	2394	0	17	0	17	9.1	33.8	95.9	67.4	31.1	61.4	48.9	92.6
Cameroon(2018/2019)	2585	0	17	0	17	9.3	12.5	83.0	36.6	20.6	33.7	46.5	89.7
Chad(2014/2015)	2191	0	18	0	20	18.5	45.1	94.6	77.4	36.5	83.9	89.8	92.5
Dominican Republic (2013)	1796	0	20	0	22	45.2	1.4	10.6	5.1	1.9	1.7	8.7	81.2
Ethiopia(2016)	2951	0	18	0	22	6.5	19.9	86.7	70.6	26.2	59.0	85.4	97.5
Ghana(2014)	1518	0	18	0	20	8.0	16.5	85.1	34.3	26.2	28.7	32.5	86.1
Guinea(2018)	1621	0	19	0	19	7.5	34.2	97.1	37.8	15.7	43.9	33.6	85.8
Haiti(2016/2017)	3643	0	16	0	16	5.5	5.2	97.6	50.0	28.5	67.3	45.9	96.0
Indonesia(2017)	10,763	0	18	0	18	4.2	2.6	31.1	22.2	36.3	2.3	9.9	79.0
Kenya(2014)	5197	0	20	0	19	6.4	5.7	96.3	55.9	37.5	79.7	98.4	93.8
Lesotho(2014)	1356	0	18	0	18	6.0	4.0	68.4	27.4	14.6	70.5	39.9	88.5
Malawi(2015/2016)	3122	0	17	0	20	10.5	4.7	97.9	13.2	11.6	79.7	62.2	9.37
Mali(2018)	1497	0	17	0	17	10.4	42.3	97.9	36.6	20.2	39.9	63.9	78.0
Namibia(2013)	1457	0	16	0	20	12.3	5.5	64.6	55.3	15.4	53.1	47.9	73.5
Nepal(2016)	2016	0	11	0	11	3.8	2.2	70.5	10.6	4.3	6.7	66.2	93.0
Nigeria(2018)	6344	0	20	0	20	13.1	18.9	90.3	42.6	30.4	39.6	36.8	83.3
Pakistan(2017/2018)	5775	0	16	0	16	9.0	17.6	48.2	11.9	10.3	5.0	50.9	81.5
Peru(2012)	4963	0	17	0	17	4.0	78.2	28.6	24.5	5.8	7.1	48.6	84.9
Philippines(2017)	6372	0	19	0	19	2.0	3.1	58.9	8.8	5.3	5.2	31.2	86.6
Rwanda(2014/2015)	2513	0	18	0	20	8.8	8.6	99.6	28.7	27.2	78	80.8	98.8
Senegal(2017)	3125	0	20	0	21	7.5	38.1	79.8	30.8	21.4	38	40.6	94.3
Sierra Leone(2013)	2463	0	19	0	19	15.0	23.1	99.9	42.6	34.3	81.3	53.8	96.9
Tanzania(2015/2016)	2149	0	17	0	21	8.5	23.5	99.5	60.4	29.2	74.3	58.7	92.6
Uganda(2016)	2380	0	20	0	21	10.0	13.2	99.3	65.5	19.4	74.4	70.3	94.3
Zambia(2018/2019)	2643	0	18	0	22	7.3	16.1	91.9	42.1	26.2	61.8	50.3	88.9
Zimbabwe(2015)	1305	0	19	0	21	3.2	4.8	62.3	27.9	16.0	57.7	30.8	78.5

Appendix B. Matrix of correlations (pooled sample)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.054	0.054	0.054						
(3) Cooking fuel	0.041	0.041	0.041	0.041					
(4) Sanitation	0.059	0.059	0.059	0.059	0.059				
(5) Drinking water	0.025	0.025	0.025	0.025	0.025	0.025			
(6) Electricity	0.069	0.069	0.069	0.069	0.069	0.069	0.069		
(7) Housing	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	
(8) Assets	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031

Appendix C. Matrix of correlations per country

Bangladesh	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.037	0.100	1.000						
(3) Cooking fuel	0.068	0.233	0.013	1.000					
(4) Sanitation	0.045	0.214	0.075	0.187	1.000				
(5) Drinking water	−0.012	0.028	0.013	0.054	0.120	1.000			
(6) Electricity	0.071	0.224	0.114	0.284	0.280	0.156	1.000		
(7) Housing	0.105	0.339	0.045	0.509	0.321	0.084	0.394	1.000	
(8) Assets	−0.020	0.085	0.006	0.046	0.036	0.015	0.048	0.045	1.000

Benin	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.078	0.223	1.000						
(3) Cooking fuel	0.044	0.301	0.073	1.000					
(4) Sanitation	0.087	0.327	0.252	0.249	1.000				

Benin	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(5) Drinking water	0.026	0.094	0.205	0.085	0.230	1.000			
(6) Electricity	0.099	0.312	0.233	0.240	0.462	0.162	1.000		
(7) Housing	0.097	0.261	0.207	0.161	0.406	0.116	0.452	1.000	
(8) Assets	0.062	0.241	0.067	0.318	0.270	0.100	0.277	0.190	1.000

Cameroon	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.073	0.073	0.073						
(3) Cooking fuel	0.078	0.078	0.078	0.078					
(4) Sanitation	0.100	0.100	0.100	0.100	0.100				
(5) Drinking water	0.084	0.084	0.084	0.084	0.084	0.084			
(6) Electricity	0.125	0.125	0.125	0.125	0.125	0.125	0.125		
(7) Housing	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	
(8) Assets	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025

Chad	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.020	0.264	1.000						
(3) Cooking fuel	0.062	0.221	0.155	1.000					
(4) Sanitation	0.038	0.274	0.227	0.320	1.000				
(5) Drinking water	0.009	0.103	0.065	0.172	0.294	1.000			
(6) Electricity	0.090	0.221	0.189	0.408	0.482	0.233	1.000		
(7) Housing	0.033	0.254	0.151	0.360	0.455	0.187	0.464	1.000	
(8) Assets	0.015	0.152	0.118	0.332	0.327	0.104	0.381	0.345	1.000

Dominican Republic	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	−0.012	0.080	1.000						
(3) Cooking fuel	0.015	0.248	0.067	1.000					
(4) Sanitation	0.035	0.080	0.038	0.185	1.000				
(5) Drinking water	−0.019	0.072	−0.017	0.138	0.061	1.000			
(6) Electricity	0.009	0.037	−0.016	0.149	0.067	0.264	1.000		
(7) Housing	0.032	0.143	−0.003	0.240	0.153	0.087	0.080	1.000	
(8) Assets	0.022	0.191	−0.004	0.142	0.079	0.046	0.064	0.109	1.000

Ethiopia	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.069	0.153	1.000						
(3) Cooking fuel	0.067	0.384	0.130	1.000					
(4) Sanitation	0.070	0.341	0.165	0.427	1.000				
(5) Drinking water	0.082	0.216	0.181	0.229	0.307	1.000			
(6) Electricity	0.088	0.413	0.237	0.462	0.606	0.413	1.000		
(7) Housing	0.046	0.293	0.100	0.341	0.528	0.224	0.470	1.000	
(8) Assets	0.025	0.186	0.043	0.209	0.198	0.096	0.172	0.251	1.000

Ghana	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.077	0.090	1.000						
(3) Cooking fuel	0.062	0.315	−0.033	1.000					
(4) Sanitation	0.031	0.362	0.033	0.271	1.000				
(5) Drinking water	−0.055	−0.118	0.022	−0.181	−0.137	1.000			
(6) Electricity	0.053	0.349	0.051	0.253	0.384	−0.027	1.000		
(7) Housing	0.090	0.339	0.017	0.266	0.361	−0.061	0.471	1.000	
(8) Assets	−0.014	0.191	−0.103	0.329	0.190	−0.060	0.226	0.173	1.000

Guinea	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.124	0.154	1.000						
(3) Cooking fuel	0.035	0.065	0.055	1.000					
(4) Sanitation	0.087	0.221	0.184	0.081	1.000				
(5) Drinking water	0.044	0.166	0.131	0.075	0.317	1.000			
(6) Electricity	0.101	0.260	0.202	0.153	0.465	0.290	1.000		
(7) Housing	0.109	0.225	0.227	0.115	0.440	0.245	0.502	1.000	
(8) Assets	0.062	0.265	0.085	0.119	0.222	0.142	0.310	0.241	

(continued on next page)

Guinea	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
									1.000

Haiti	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.041	0.106	1.000						
(3) Cooking fuel	0.014	0.159	0.037	1.000					
(4) Sanitation	0.055	0.248	0.124	0.139	1.000				
(5) Drinking water	0.048	0.193	0.138	0.079	0.330	1.000			
(6) Electricity	0.004	0.292	0.083	0.207	0.403	0.371	1.000		
(7) Housing	0.032	0.283	0.127	0.120	0.413	0.339	0.412	1.000	
(8) Assets	−0.013	0.208	0.010	0.224	0.159	0.119	0.211	0.151	1.000

Indonesia	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.033	0.041	1.000						
(3) Cooking fuel	0.070	0.169	0.062	1.000					
(4) Sanitation	0.059	0.153	0.067	0.221	1.000				
(5) Drinking water	0.000	0.012	0.017	−0.063	0.051	1.000			
(6) Electricity	0.024	0.100	0.052	0.183	0.146	0.029	1.000		
(7) Housing	0.033	0.108	0.052	0.200	0.159	0.005	0.179	1.000	
(8) Assets	0.056	0.169	0.042	0.239	0.170	−0.013	0.076	0.136	1.000

Kenya	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.031	0.234	1.000						
(3) Cooking fuel	0.022	0.137	0.044	1.000					
(4) Sanitation	0.029	0.154	0.092	0.188	1.000				
(5) Drinking water	0.025	0.135	0.071	0.145	0.197	1.000			
(6) Electricity	0.061	0.137	0.016	0.366	0.349	0.285	1.000		
(7) Housing	0.009	0.046	0.019	0.280	0.145	0.094	0.222	1.000	
(8) Assets	0.008	0.124	0.021	0.314	0.199	0.151	0.330	0.213	1.000

Lesotho	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	−0.035	0.125	1.000						
(3) Cooking fuel	0.058	0.221	0.098	1.000					
(4) Sanitation	−0.015	0.260	0.163	0.350	1.000				
(5) Drinking water	0.019	0.151	0.129	0.214	0.271	1.000			
(6) Electricity	0.033	0.265	0.090	0.537	0.299	0.226	1.000		
(7) Housing	−0.034	0.272	0.142	0.457	0.486	0.213	0.352	1.000	
(8) Assets	0.023	0.196	0.073	0.262	0.164	0.064	0.223	0.228	1.000

Malawi	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.032	0.118	1.000						
(3) Cooking fuel	0.043	0.121	0.033	1.000					
(4) Sanitation	0.002	0.155	0.024	0.038	1.000				
(5) Drinking water	0.033	0.123	0.056	0.053	0.072	1.000			
(6) Electricity	0.071	0.298	0.090	0.291	0.150	0.170	1.000		
(7) Housing	0.071	0.336	0.109	0.184	0.154	0.183	0.562	1.000	
(8) Assets	0.042	0.165	0.052	0.373	0.078	0.086	0.375	0.250	1.000

Mali	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.146	0.222	1.000						
(3) Cooking fuel	0.020	−0.031	0.033	1.000					
(4) Sanitation	0.104	0.289	0.248	0.045	1.000				
(5) Drinking water	0.145	0.205	0.200	0.051	0.309	1.000			
(6) Electricity	0.124	0.339	0.265	0.083	0.487	0.324	1.000		
(7) Housing	0.120	0.405	0.309	0.004	0.474	0.337	0.500	1.000	
(8) Assets	0.060	0.239	0.015	0.066	0.217	0.147	0.266	0.278	1.000

Namibia	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Namibia	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.021	0.133	1.000						
(3) Cooking fuel	0.028	0.430	0.146	1.000					
(4) Sanitation	0.026	0.396	0.124	0.667	1.000				
(5) Drinking water	−0.031	0.156	−0.018	0.303	0.314	1.000			
(6) Electricity	0.004	0.334	0.092	0.684	0.636	0.335	1.000		
(7) Housing	0.014	0.311	0.104	0.566	0.574	0.326	0.551	1.000	
(8) Assets	0.016	0.228	0.068	0.281	0.342	0.182	0.277	0.363	1.000

Nepal	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.075	0.053	1.000						
(3) Cooking fuel	0.061	0.271	0.054	1.000					
(4) Sanitation	0.058	0.056	0.101	0.173	1.000				
(5) Drinking water	−0.004	0.061	−0.032	0.120	0.023	1.000			
(6) Electricity	0.050	0.134	0.054	0.169	0.076	0.071	1.000		
(7) Housing	0.049	0.311	0.058	0.552	0.170	0.104	0.183	1.000	
(8) Assets	0.014	0.181	0.028	0.211	0.075	0.048	0.073	0.228	1.000

Nigeria	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.195	0.270	1.000						
(3) Cooking fuel	0.107	0.204	0.140	1.000					
(4) Sanitation	0.095	0.239	0.144	0.240	1.000				
(5) Drinking water	0.035	0.105	0.155	0.029	0.216	1.000			
(6) Electricity	0.092	0.241	0.233	0.233	0.445	0.279	1.000		
(7) Housing	0.166	0.319	0.316	0.227	0.346	0.216	0.435	1.000	
(8) Assets	0.059	0.203	0.065	0.228	0.194	0.087	0.237	0.233	1.000

Pakistan	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.045	0.211	1.000						
(3) Cooking fuel	0.035	0.315	0.206	1.000					
(4) Sanitation	0.068	0.195	0.220	0.264	1.000				
(5) Drinking water	−0.003	0.014	0.045	0.109	0.111	1.000			
(6) Electricity	−0.019	0.145	0.182	0.217	0.336	0.129	1.000		
(7) Housing	0.058	0.178	0.189	0.361	0.266	0.063	0.199	1.000	
(8) Assets	0.069	0.208	0.031	0.151	0.130	0.035	0.083	0.028	1.000

Peru	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.040	−0.090	1.000						
(3) Cooking fuel	0.085	0.434	−0.041	1.000					
(4) Sanitation	0.087	0.354	−0.024	0.524	1.000				
(5) Drinking water	0.047	0.126	−0.030	0.181	0.289	1.000			
(6) Electricity	0.056	0.244	−0.025	0.381	0.367	0.214	1.000		
(7) Housing	0.072	0.356	−0.014	0.537	0.469	0.179	0.262	1.000	
(8) Assets	0.025	0.154	0.001	0.156	0.159	0.068	0.090	0.166	1.000

Philippines	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.013	0.101	1.000						
(3) Cooking fuel	0.053	0.243	0.087	1.000					
(4) Sanitation	0.026	0.288	0.128	0.212	1.000				
(5) Drinking water	0.025	0.196	0.059	0.161	0.245	1.000			
(6) Electricity	0.051	0.218	0.053	0.165	0.239	0.212	1.000		
(7) Housing	0.039	0.195	0.048	0.370	0.190	0.102	0.247	1.000	
(8) Assets	0.015	0.130	0.038	0.309	0.108	0.077	0.088	0.212	1.000

Rwanda	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.071	0.048	1.000						
(3) Cooking fuel	0.019	0.082	−0.003	1.000					
(4) Sanitation	0.047	0.105	0.018	0.040	1.000				
(5) Drinking water	0.014	0.083	0.022	0.039	0.100	1.000			
(6) Electricity	0.019	0.258	0.061	0.119	0.190	0.191	1.000		
(7) Housing	0.054	0.262	0.038	0.130	0.201	0.152	0.578	1.000	
(8) Assets	0.020	0.122	0.009	0.337	0.071	0.068	0.202	0.220	1.000

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Senegal	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.096	0.244	1.000						
(3) Cooking fuel	0.077	0.287	0.237	1.000					
(4) Sanitation	0.102	0.216	0.216	0.301	1.000				
(5) Drinking water	0.055	0.104	0.046	0.237	0.242	1.000			
(6) Electricity	0.094	0.262	0.215	0.349	0.512	0.315	1.000		
(7) Housing	0.098	0.159	0.161	0.305	0.446	0.290	0.489	1.000	
(8) Assets	0.012	0.057	−0.030	−0.027	0.061	0.023	0.143	0.064	1.000

Sierra Leone	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.059	0.161	1.000						
(3) Cooking fuel	0.015	0.054	0.019	1.000					
(4) Sanitation	0.078	0.258	0.131	0.030	1.000				
(5) Drinking water	0.049	0.267	0.194	0.025	0.357	1.000			
(6) Electricity	0.108	0.322	0.137	0.073	0.316	0.316	1.000		
(7) Housing	0.083	0.323	0.143	0.038	0.374	0.422	0.402	1.000	
(8) Assets	0.023	0.189	0.087	0.061	0.131	0.130	0.321	0.175	1.000

Tanzania	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.051	0.151	1.000						
(3) Cooking fuel	−0.053	0.050	0.038	1.000					
(4) Sanitation	0.070	0.239	0.253	0.056	1.000				
(5) Drinking water	0.094	0.083	0.253	0.014	0.407	1.000			
(6) Electricity	0.088	0.231	0.213	0.116	0.572	0.317	1.000		
(7) Housing	0.080	0.269	0.228	0.054	0.602	0.323	0.585	1.000	
(8) Assets	0.042	0.134	0.115	0.007	0.291	0.135	0.399	0.301	1.000

Uganda	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.019	0.147	1.000						
(3) Cooking fuel	0.012	0.069	0.033	1.000					
(4) Sanitation	0.024	0.235	0.068	0.117	1.000				
(5) Drinking water	0.003	0.123	0.007	0.042	0.125	1.000			
(6) Electricity	0.048	0.237	0.080	0.144	0.417	0.022	1.000		
(7) Housing	0.045	0.285	0.130	0.131	0.480	0.132	0.502	1.000	
(8) Assets	−0.014	0.165	0.042	0.173	0.294	0.084	0.312	0.304	1.000

Zambia	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.066	0.185	1.000						
(3) Cooking fuel	0.066	0.191	0.119	1.000					
(4) Sanitation	0.085	0.195	0.147	0.331	1.000				
(5) Drinking water	0.118	0.135	0.151	0.228	0.341	1.000			
(6) Electricity	0.108	0.280	0.194	0.521	0.511	0.356	1.000		
(7) Housing	0.126	0.283	0.192	0.366	0.509	0.365	0.656	1.000	
(8) Assets	0.034	0.165	0.083	0.393	0.242	0.164	0.341	0.321	1.000

Zimbabwe	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Child mortality	1.000								
(2) School attendance	0.000	0.102	1.000						
(3) Cooking fuel	0.052	0.363	0.144	1.000					
(4) Sanitation	0.022	0.329	0.118	0.445	1.000				
(5) Drinking water	0.051	0.187	0.079	0.314	0.292	1.000			
(6) Electricity	0.051	0.360	0.147	0.841	0.484	0.327	1.000		
(7) Housing	0.029	0.324	0.124	0.492	0.540	0.311	0.531	1.000	
(8) Assets	0.042	0.245	0.082	0.472	0.271	0.182	0.463	0.292	1.000

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