Born into adjustment: child health, parental education, and the International Monetary Fund

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Parental education is located at the center of global efforts to improve child health. In a developing-country context, the International Monetary Fund (IMF) plays a crucial role in determining how governments allocate scarce resources to education and public health interventions. Under reforms mandated by IMF structural adjustment programs, it may become harder for parents to reap the benefits of their education due to wage contraction, welfare retrenchment and generalized social insecurity. This study assesses how the protective effect of education changes under IMF programs, and thus how parents' ability to guard their children's health is affected by structural adjustment. We combine cross-sectional stratified data (countries=67; children=1,941,734) from the Demographic Health Surveys and the Multiple Indicator Cluster Surveys. The sample represents approximately 2.8 billion (about 50%) of the world's population in year 2000. Based on multilevel models, our findings reveal that programs reduce the protective effect of parental education on child health, especially in rural areas. For instance, in the absence of IMF programs, living in an household with educated parents reduces the odds of child malnourishment by 38% (OR=0.62; 95% CI: 0.66 to 0.58); in the presence of programs, this drops to 21% (OR=0.79; 95% CI: 0.86 to 0.74). In other words, the presence of IMF conditionality decreases the protective effect of parents' education on child malnourishment by no less than 17%. We observe similar adverse effects in sanitation, shelter, and health care access (including immunization); but a beneficial effect in countering water deprivation.

International Monetary Fund | Education | Child health | Development

Introduction

Parental education is a key determinant of child health. Across developing countries, children born to mothers with no education are three times more likely to die at a young age than those born to mothers with secondary education (1). At the same time, the allocation of scarce resources to essential social and public health institutions in low- and middle-income countries frequently unfolds under the policy parameters set by powerful international financial institutions (2), like the International Monetary Fund (IMF).

The IMF monitors the global economy and provides support to governments in economic turmoil, notably via its lending programs. In exchange for low-cost financing, governments must agree to implement a set of reforms, known as *conditionalities*. The IMF relies on conditionalities to foster macroeconomic stability through "correct[ing] maladjustments in [government] balance of payments without resorting to measures destructive of national or international prosperity" (3).

The success of IMF's programs and the degree of collateral damage they produce for public health is an ongoing controversy (2, 4–6). Already in the 1980s, the years of recession and omnipresent IMF programs especially in African and Latin America, the United Nations Children's Fund (UNICEF) cautioned against endangering vulnerable households and child health (7). Following the recent global recession, further UNICEF reports revealed that policy-makers remained focused on short-term economic considerations, while rolling back critical education and health interventions (8). The IMF responded to such critiques by emphasizing its commitment to strengthening public health. Its Poverty Reduction Strategy (9) has—purportedly—been tailored to the needs of low-income countries (10). Yet, although past research has studied the impact of IMF programs on child health (11–13), no study—to our knowledge—have conducted a systematic global analysis using micro-data.

This study assesses the connections between IMF programs and parents' ability to protect their children's health. Educational attainment is a reliable indicator of parents' earning and socio-economic class (14), and thus, households' ability to withstand economic change (15–18). As a tool to promote development, governments provide free or low-cost education. Parents benefit as their human capital increases, giving them more capabilities to nurture their children. Conditional cash transfer programs keep children in schools and away from child labor, which increase their cognitive capacities and improve their health (19). However, access to and the value of education can be affected by economic reform policies (20, 21). In the pursuit of macroeconomic stability, IMF programs include austerity measures that are associated with significant rollbacks of these social policies (22). For instance, governments are forced to spend less on teachers and contracting teachers' wages. Tuition costs are passed on to the households, reducing parents' access to quality education. Their human capital decreases, their employability, and earnings (7), ultimately affecting the health of their children. Consequently, we hypothesize a link between such IMF-mandated austerity measures and the protective effect of parental education on child health.

Data and Methods

Data

Significance

his study adds to the state of the art by analyzing the impact of International Monetary Fund (IMF) programs on children's health, mediated by their parents' education. It is the first to combine macro and micro-data to address this issue systematically across five dimensions of child health: water, malnutrition, shelter, sanitation, and health care access. The sample represents about 2.8 billion (about 50%) of the world's population in year 2000. Using multi-level models, we find that although IMF programs do not correlate directly with child health indicators, they reduce the protective effect of parental education on child health, especially in rural areas, and have a mixed impact across the five dimensions of urban child health.

Reserved for Publication Footnotes

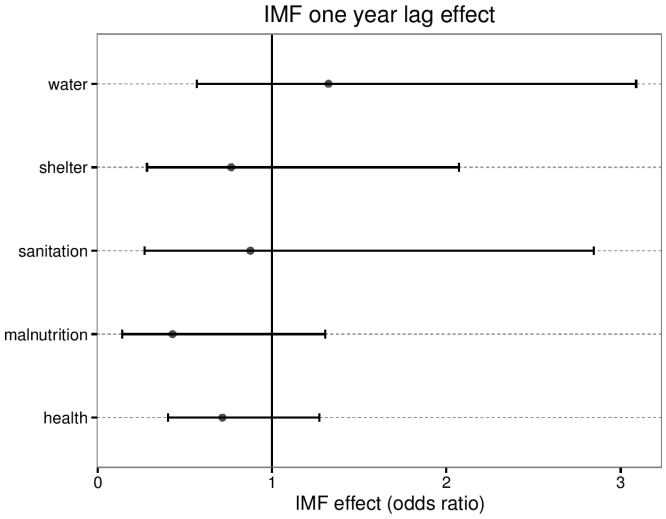

Fig. 1. World Map of severe child health deprivation. Data sample and average severe child health deprivation (in %). Authors' calculations based on the micro data. White colour indicating excluded country.

This study combines country, household, and child-level data, Table S1 reports sources. The micro-data comes from the Demographic and Health Survey (DHS) and UNICEF's Multiple Indicator Cluster Survey (MICS). Building on a two-stage cluster sampling procedure, the aim of these nationally representative surveys is to measure living conditions (23). In the first stage, the DHS and MICS statisticians construct a sampling frame defining the stratification of the population by key demographics, using the latest census. This frame numbers country regions into primary sampling units (clusters), which are then further sampled with a probability proportional to their population size. In the second stage, all households are listed in each cluster, of which about 20 to 30 are randomly selected for an on-location face-to-face interview. The sample sizes normally vary between 4,000 to 30,000 households depending on population size, with a typical response rate exceeding 90% (24). With these standardized procedures, DHS and MICS surveys enable global analyses.

Our pooled sample represents about 2.8 billion (approximately 50%) of the world's population by year 2000. Figure 1 captures this sample's geographical distribution of child health deprivation. Our dataset includes 67 low and middle-income countries sampled once, with different timing, determined by the DHS and MICS. The surveys were conducted around the year 2000 with a range of about ± 5 years, just before the substantial global efforts put in place by various agencies to immunize children: notably, before the Millennium Development Goals was taking effect and just before the Bill and Melinda Gates Foundation became involved. Table S2 outlines sample years and sizes.

We measure child health across five dimensions: children's access to non-hazardous sanitation, improved water sources, and vital health care (including immunization), safe housing, and if they are sufficiently nourished. We derive these definitions from Gordon *et al.*'s (25) pioneering study of child poverty in the developing world. Table 1 outlines how these five dimensions are operationalized. A core strength of these measures is that they indicate actual access to resources, instead of consumption opportunities as is done in monetary approaches. The term *deprivation* is understood as a latent continuum that ranges from no to mild, moderate, severe and extreme deprivation (26). Severe and extreme deprivations describe circumstances that exert highly deleterious effects on children's health, eventually resulting in mortality (25). Table 1 outlies these five thresholds; when a child's health circumstances reaches over these cut-points, then that child is deprived in that dimension (covering both extreme and severe), with a resulting dichotomous outcome variable.

[Figure 1 about here], [Table 1 about here]

We use the head of household's educational attainment from the DHS and MICS as a measure of parental education. The head is the person leading the household's family affairs, and is commonly the oldest man (27). We focus on the head of household's rather than the mother's education, as the head, with his or her elevated status in the family, is likely to affect both the child's and mother's behavior (28). Educational attainment, regardless of whether it is the head's or the mother's, correlates highly with poverty; less educated respondents consistently have lower socioeconomic status than their educated counterparts. We include a household geographical indicator to capture urban versus rural disparities. Our design controls for the number of adults and children living in the household; the more adults dwelling in the households, the more likely children are properly cared for (29). The analysis also controls for the age and gender of the child. Table S3 shows the frequency of children by their age, head's educational attainment, and household location.

Finally, we draw on country-level data. The presence or absence of IMF programs in a particular country and year is measured as a dummy variable (30). This measure indicates that the government and the IMF have agreed to implement a program to adjust the fiscal imbalances in the target country, in exchange for a loan (2). The starting year defines when the program was approved, if the agreement was signed in the first half of the year; otherwise, the starting period is the following year. These programs are tailored to each country, but will contain on average 40 conditions of which about 15 tend to be structural (31). Structural adjustment is the most intrusive types of condition, often reducing social spending considerably, containing privatization or liquidations of state-owned enterprises in various public sectors (5): energy, agriculture, water and sewage systems, healthcare, and education. Other types of conditions include tax increases and trade liberalization. With the use of a dummy variable, we assume that programs have similar effects on child health. Even though an imperfect indicator, this approach follows conventions in the field (2, 32), including work by the IMF itself (30). Unraveling the heterogeneous effect of conditionalities is an important future research task.

The analysis also included additional country-level variables, defined in Table S1, that could confound the effect on child health; Table S4 shows descriptive statistics while Table S5 outlies correlations.

Statistical methods

The analysis has two core equations. First, we estimate a Heckman selection model to predict a country's likelihood to participate in an IMF program, as program participation is not random. Poorer countries, being more vulnerable to economic turmoil, are more likely to solicit IMF support (2). Relying on a version of the specification used by the IMF's Independent Evaluation Office (33), we use: IMF program participation in the previous year, GDP growth, democracy, current account balance, GDP per capita, the total number of countries on IMF programmes, and UN voting affinity with G7 countries. The latter two variables fulfil the exclusion restriction: a variable that is significant in explaining the country's participation decision in an IMF program, but is not correlated with the dependent variable of the outcome equation. After estimation, we calculate the inverse Mills ratio to be included in the outcome equation to control for the unobserved factors, potentially affecting selection into programs (34). A complete outline of the motivation behind the Heckman model is given in *SI Text*.

Second, we estimate the IMF effect on child health with multi-level equations to account for the hierarchical nature of our data (35): children are nested in households, households in

Table 1. Individual level indicator – dependent variables – five dimensions of overall child health

Child Deprivation	Cases	Proportion deprived
Water: Children who only have access to surface water (e.g., rivers) for drinking or who lived in households where the nearest source of water was more than 15 minutes away. Children < 18 years old.	1,941,734	0.24
Malnutrition: Children whose heights and weights for their age were more than -3 standard deviations below the median of the international reference, that is, severe anthropometric failure. Children < 5 years old.	815,264	0.07
Shelter: Children in dwellings with more than five people per room and/or with no flooring material. Children < 18 years old.	1,926,435	0.51
Sanitation: Children who had no access to a toilet of any kind in the vicinity of their dwelling, that is, no private or communal toilets or latrines. Children < 18 years old.	1,940,599	0.28
Health (immunization &health-access): Children who has not been immunized against diseases or young children who had a recent illness involving diarrhea and had not received any medical advice or treatment. [polio, measles, DPT (against diphtheria, pertussis, and tetanus), tuberculosis (Bacillus Calmette-Guérin) recommended by the WHO]. Children < 5 years old	944,895	0.13

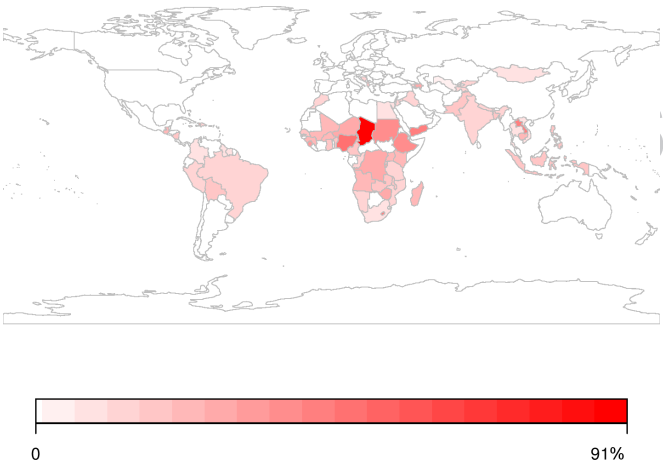

Fig. 2. Marginal effect of IMF program on five dimensions of child health. Above odds ratio 1 the effect is adverse; below 1 the effect is beneficial (the lower odds ratio, the less likely the child is deprived). The models cannot detect any significant effect. Error bars are 95% CIs.

neighborhoods, neighborhoods in broader geographical regions, and lastly, all these levels are nested in countries. Because of some sparse observations within households and by neighbourhood, the estimation does not converge when we include these levels. We settled on a parsimonious two-level model: children nested in countries. This model is likely to give some upward biased standard errors for the household variables, but does not otherwise affect the estimates.

$$Logit(ChildHealth^a_{d,ikt}) = \beta_{0k} + \beta_1 IMF^b_{k,t-1} + \beta_2 Education^a_{k,t} + \beta_3 IMF^b_{k,t-1} \cdot Education^a_{k,t} + \beta_4 InvMill^b_{k,t-1} + \boldsymbol{\beta_5 X^a_{i,k,t}} + \boldsymbol{\beta_6 X^b_{k,t-2}}$$

$$\beta_{0k} = \beta_0 + \mu_k$$

$$\text{where } \mu_k \sim N(0, \sigma^2),$$
$$\text{child deprivation } d \in (water, food, shelter, sanitation, health)$$

Our base model is a random intercept logit model with child i nested in country k. The random term u_k captures each country's deviation from the conditional mean (the intercept); it is assumed to be normally distributed with variance σ^2. The outcome variable $ChildHealth^1_{ik}$ measures whether a child is severely health deprived or not, in five dimensions (the index d). The key explanatory variable $IMF^2_{k,t-1}$, indicates whether an IMF agreement was in place in the preceding year. $InvMill^2_{k,t-1}$ controls for selection bias, as described above: a positive effect implies that unobserved factors, which make IMF program participation more likely, increase the probability of severe deprivation. A number of country controls $X^2_{k,t-2}$ as well as household and child controls are included $X^1_{k,t}$: log GDP per capita, received foreign aid, health spending, civil war, population dependency ratio (share of the population aged under 15 and over 65), democracy, year of interview. All country level covariates are lagged two years. The superscript indicates the level of analysis (a designates the child level, and b the country level).

Time is present in two ways in our research design: first, in terms of the sampling date of when the DHS and MICS surveyed children's living conditions (which varies between countries); and second, as lags of the country-level covariates (as described above, we use an identical lag structure across countries). Each child (and country) is only sampled once, thus rendering the design of our study cross-sectional. IMF programs' effect on children will likely take some time to materialize and to fade out; using the presence of a program in the previous year has been proposed as an appropriate way of capturing this lagged impact (12, 13). We lag the pre-treatment conditions by two years and thus avoid post-treatment controls, which will give us the total treatment effect (36). In short, limited data availability imposed by sampling dates restricts our analysis to a cross-sectional design, and country lags, facilitated by available observations of covariates, are central to our methodological approach.

Although our design does not use quasi-experimental design methods, such as difference-in-differences which would require pre- and post-program measurements of child health, it nevertheless captures differences in child health by parental educational attainment between countries under treatment and countries serving as controls. We do this by including a set of interaction terms to our base model to capture these moderation effects (37). We stratify the analysis further by evaluating this effect by household location, as the literature has found large heterogeneity when looking at disparities between urban and rural households in low- and middle-income countries (29).

The lack of pre- and post-treatment measurement of child health implies that we cannot study shifts in deprivation prevalence and trajectories of child health as a function of IMF programs. Ideally, a panel study of children followed over time, before and after the presence of an IMF program, and in countries with and without a program, would enable a full-fledged causal analysis. While we do not claim causality, our approach nonetheless sheds important light on the complex associations between IMF programs, parental education, and child health.

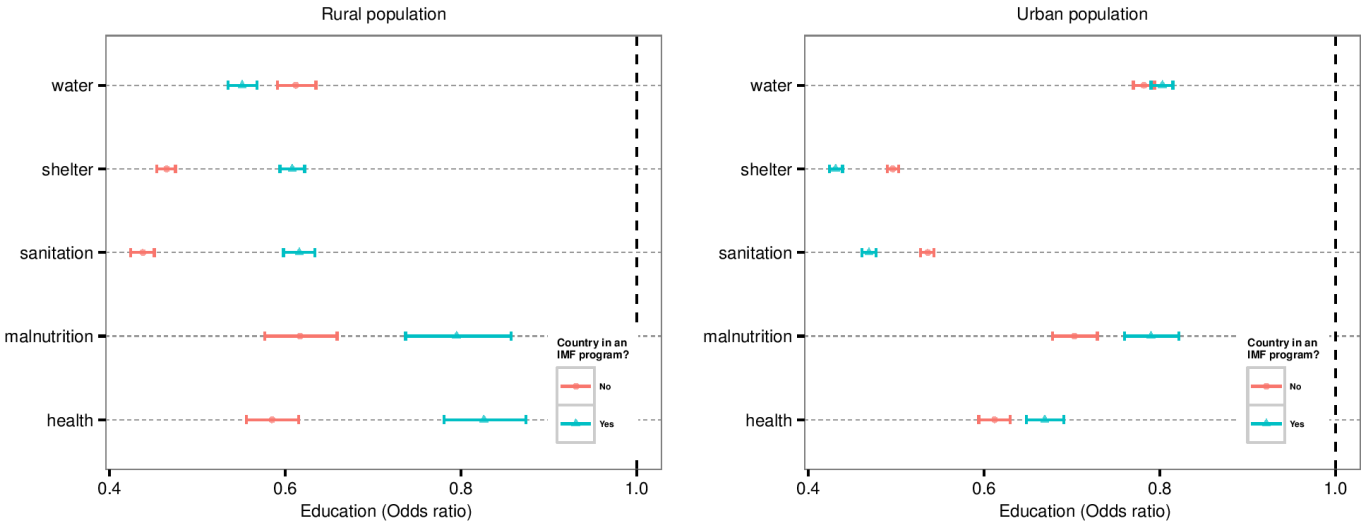

Fig. 3. The protective effect of education in the urban versus rural population. The panel shows the effect of the head of household's education on their children's health outcomes (educated versus non-educated), moderated by country participation in IMF programs. The figure captures the partial marginal effect on the odds ratio scale with 95% CIs. Above odds ratio 1 the effect is adverse; below 1 the effect is beneficial. When a country participates in a program, the beneficial effect of parental education against malnutrition and health deprivation tends to weaken in both the urban and rural population; the beneficial effect of parental education increases in shelter and sanitation deprivations in urban population.

Results

[Figure 2 about here]

Figure 2 visualizes the estimated impact of IMF programs on the five dimensions of child health—the complete regressions results are presented in Table S6. Although most coefficients indicate an adverse effect, they are not statistically significant. The confidence intervals are large, as this is a country-level measure with weaker statistical power compared to the child-level measures. As expected, as the head of household's level of education increases, the odds of severe child health deprivation decrease. For instance, living in a household where at least one of the parents has primary education corresponds to a 16% drop in the odds of severe malnourishment compared to one with no parental education; the difference is even starker, at 42%, for parents with secondary education. This beneficial effect of parental education is consistent and significant across all five child health dimensions.

Our models reveal a highly-pronounced gap between rural and urban populations: a shift from urban to rural areas increases the odds of water and sanitation deprivation prevalence by a factor of five. For malnourishment and health deprivation, the same shift is associated with a 50% increase. While these disparities are well-known in the development literature (29, 38), less is known about how they change in the presence of IMF programs.

In the next step, we estimate the moderation effect of IMF programs on education and household location. Figure 3 visualizes how the marginal effects of education change according to the presence or absence of programs, stratified by rural versus urban context; Table S8 shows these exact interactive effects. Table S7 reports the full estimated model, which include a three-way interaction between programs, head of household's education, and household's location (urban vs. rural). We reduced the three education categories (no education, primary, and secondary+) to two (no education versus education), facilitating interpretation. We report the unreduced models in Table S15. Except for location interacted with education for health deprivation, all interaction terms are statistically significant.

[Figure 3 about here]

For rural populations, the protective effect of parental education decreases significantly when countries participate in IMF programs. Children face higher odds of suffering from deprivation in four out of the five dimensions. In the absence of a program, children living in an educated household have a reduced odds of being malnourished by 38% (OR= 0.62; 95%-CI: 0.66 to 0.58), compared to children of uneducated households; under adjustment, this beneficial effect drops to 21% (OR= 0.79; 95%-CI: 0.86 to 0.74). In other words, the presence of IMF conditionality erodes the protective effect of education against child malnourishment by no less than 17% in rural contexts. This effect is comparable across the other deprivations. In shelter deprivation, the presence of IMF yields an erosion of 15%; in sanitation, the decrease is 18%; and in health (healthcare including immunization) the loss is 24%. Water deprivation is an exception: living in an educated household improves children's odds of avoiding water deprivation by 39% (OR = 0.61; 95%-CI: 0.63 to 0.59) to 45% (OR= 0.55; 95%-CI: 0.57 to 0.53).

In contrast, children in urban areas see no change in the odds of water deprivation, but they experience a beneficial change in the odds of being shelter and sanitation deprived. The shift from no to some parental education corresponds to a change from a 50% (OR = 0.5; 95%-CI: 0.50 to 0.49) to 57% (OR = 0.43; 95% CI: 0.44 to 0.42) decrease in the odds of suffering from shelter deprivation; an improvement of 7%. In sanitation deprivation, the improvement is also 7%. Conversely, urban children experience a deterioration in the odds of being malnourished and health deprived (healthcare including immunization): 9% and 6%, respectively.

SI Text discusses and Table S10 to Table S14 presents our tests of the robustness of the selection equation, with alternative specifications; Figure S1 and Figure S2 show how these specification affect the outcome model. Overall, these tests show that the results produced in the outcome stage, hold even with a less robust selection equation (less predictive probit model). *SI Text* presents further sensitivity analysis, focusing on the specification of the multilevel models (outcome stage)—keeping the selection equation constant. First, in the interaction analysis above, we reduced the education three-level categories to a binary one (educated vs. non-educated) for clarity of presentation purposes. We present the result for the three-level interaction in Table S15, Figure S3 and Figure S4. Although there are some nuances in the moderation effect, the inference we draw are consistent. Second, instead of one year lagged effect, we estimated the main effect of IMF programs using three versions of historical burden:

sum of programs (Table S16 and Figure S5), count of structural conditions (Table S17 and Figure S6), count of quantitative conditions (Table S18 and Figure S7). The results confirm the absence of significant direct relationships with all five dimensions of child health. *SI Text* also outlines checks of key multilevel model assumptions, normality of residuals (Figure S8 to Figure S12) and homoscedasticity (Figure S13 to Figure S17). These test show a fair conformity to these assumptions. The inferences drawn from this study hold even by controlling for potential outliers (e.g. Sudan and Malawi). Fourthly, sample (DHS and MICS) weighted estimations are presented in Table S9, showing high consistency with the unweighted estimations used in the main results. Lastly, we face no serious multicollinearity between our key country variables, as shown by the correlation matrix in Table S5.

Discussion

This study has shown that IMF programs erode the protective effect of parental education on child health, especially in rural areas. We also find some mixed results in urban areas. Children of educated parents still have better health than their peers with uneducated parents. However, this gap shrinks under programs. We offer some potential explanations of these observations by highlighting the broader relationship between IMF programs and the societal effects of austerity (5, 7, 13, 32, 38–40). Our study raises four main questions.

First, and most importantly, why does the protective effect of parental education erode under IMF programs? Our results indicate that austerity undermines the benefits and value of educational capital. We propose a series of interlinked ways in which this can happen. A first (direct) mechanism involves the impacts of reduced fiscal space under austerity, which undermines a government's capacity to provide tuition-free or low-cost quality education. On the one hand, fewer parents will gain access to education. On the other, even those who may get an education, will be affected by IMF-mandated government wage bill ceilings, which can limit the numbers of teachers in public schools, leading to staff shortages, reduced teaching quality, and further devaluation of education (21, 41). This depreciation of educational resources is then likely to reduce the beneficial effect of parental education on child health, weakening the capabilities of households and communities (20).

Another (indirect) mechanism is closely intertwined with the first: under austerity, governments spend less not only on education but also on the protection of labour. Reductions in public spending on social policies, mandated by the IMF, can yield social insecurity and wage repression, resulting in a downward mobility for the middle classes. In the context of rapidly changing socioeconomic environments during periods of structural adjustment programs, degrading employment prospects wrought by economic deregulation curb the otherwise important marginal utility of basic educational resources in the making of parents' ability to protect their children (4, 13, 42). As a result, the gap between parents who have an education and those who lack gets reduced.

Over and above these mechanism, parents lacking an education in the first place—who tend also to be the poorest segment of the population—are already economically excluded from the labour market, and therefore, these changes seems to effect them less.

Second, why is the protective effect of education weaker in rural compared to urban areas, under IMF programs? It is plausible that under economic turmoil, governments will channel scarce resources towards cities rather than villages, as these are major sites for corporate profit, and thus, can generate further tax revenue (4). This, in turn, implies that educated rural families have a harder time mobilizing resources for the benefits of their children.

Third, why do the benefits of education increase in rural areas in relation to water deprivation? Among its manifold privatization conditionalities, water privatization has been imposed by the IMF in developing countries (43). Against the backdrop of previous research, our findings suggest that the more educated—who tend to also have higher socio-economic status—stand out as the principal beneficiaries of this measure. As people will have to pay the full cost for water access, the poor will tend to choose less costly, albeit less safe, water sources (4). The availability of water is more widespread in the urban areas, which can explain why no significant change is observed in our models.

Fourth, why do the benefits of education decrease in relation to malnutrition and health care access, not only in rural but also in urban areas? A potential mechanism lies in the IMF's Poverty Reduction Strategy, which might be equalizing the risk exposure across different educational, socioeconomic and spatial landscapes (44). However, the Poverty Reduction Strategy commenced post-1999, meaning only some of the surveys in our sample would pick up this potential effect. Another possible explanation pertains to the seeming inefficiency of health systems, as evidenced by the insignificant effect of health spending in our models. The absence of any effect is consistent across different measures for health spending; of eight different it is only significant in one case (see Table S19 and Table S20). Realistically, increased health spending should have some beneficial effect on children's health. However, under IMF programs, government subsidies for immunization, healthcare, and food are often the first to be dismantled (13, 45). This may indicate that health-related resources are inefficiently allocated by governments implementing adjustment programs. Further research can probe the concrete mechanisms through which conditionalities affect health system efficiency.

Before evaluating the policy relevance of this study, it is important to note its main limitations. First, this study focuses on program participation as an aggregate package of conditions. Disentangling the effect of the various types of conditions on child health is an important task for future research (31). Second, the research design permits mainly a discussion of correlation but not causation. For lack of a proper time-dimension for the outcome variable, our study cannot establish the nature and direction of causality. Although we used a lagged treatment variable for IMF programs and the country level covariates, we cannot control for endogenous child health trends (initial values before program implementation). Third, we used Gordon *et al.* and UNICEF's definitions (thresholds) for severe child health deprivations (25). Evaluating how the results change across different thresholds is an important task for future studies. Fourth, we focused on the head of household's educational attainment, who tends to be the husband or the oldest male of the family (27). While this is an encompassing proxy of the household's socioeconomic status (28), there might be further differential effects in relation to the gender of the child and paternal structures. Our results show, for example, that, except for access to health services including vaccination where we find no significant difference between boys and girls, for the other outcomes boys tend to have higher odds of being deprived. The difference is small for water, shelter and sanitation (1% higher odds), and larger in nutritional deprivation (6%). This differential might be explicated by further disentangling family gender compositions.

Although we used data sampled over a decade ago, there are substantive reasons to believe that the effects of IMF programs are still comparable today. Even though the IMF has sought to change its public image and purports to have transformed its lending practices (9), its programs still aim towards the same goals: to balance government spending via steep reductions in social spending, privatization of public services, and declines in the provision of public goods as educational resources (8, 31).

In sum, our study suggests that IMF programs are working at cross-purposes vis-à-vis child health. IMF interventions seek to foster economic stability, which yields beneficial effects for the population. However, at the same time, these IMF-mandated adjustment measures diminish the protective effect of parental education on child health. Government officials need to ensure that policy recommendations or demands made by the IMF do not entail inadvertent deleterious effects, whether directly or via erosion of parental resources. One way of achieving this is to expand the recently launched co-cooperation between the IMF, the World Bank and UNICEF (46, 47), geared towards closer monitoring of the socio-spatially multidirectional impacts of adjustment on children. This effort would give policy-makers the opportunity to identify both beneficial and adverse effects over time, and thus to orient adjustment policies towards fostering economic stability without endangering population health.

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