12-1-2016

Economic Growth And Child Undernutrition

Stephen A. O'Connell
Swarthmore College, soconne1@swarthmore.edu

C. Smith

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Sebastian Vollmer and colleagues (April, 2014)[1] conclude that "the contribution of economic growth to the reduction in early childhood undernutrition in developing countries is very small, if it exists at all". Progress will therefore require a shift from "the so-called trickle-down approach of a growth-mediated strategy" to "direct investments in health and nutrition".[1]

Using the same Demographic and Health Survey data as Vollmer and colleagues,[1] we found that the association between economic growth and childhood undernutrition was strong and significant. We traced the findings of Vollmer and colleagues to specific shortcomings in their empirical approach—using a measure of real gross domestic product (GDP) that distorts country-level growth rates, overlooking the influence of a few highly unusual observations, and placing too much emphasis on short intra-survey intervals—and to limitations in their underlying thought experiment. Our interpretation of the evidence is that an effective attack on childhood malnutrition must be two-pronged, combining direct health interventions with vigorous efforts to advance economic growth.

To establish these points, we worked directly with the survey-level aggregates, leaving aside important questions of within-country heterogeneity. This approach is appropriate because although the study by Vollmer and colleagues employs more than half a million child-level observations, the dataset contains only 121 pieces of information on real GDP per capita—each observation being assigned the national real GDP per capita for the relevant country and survey year. A mishandling of the survey-level relationship between real GDP per capita and undernutrition cannot be rescued through appeals to the ecological fallacy.

Columns 1–3 of the table reproduce the "very small to null" results of Vollmer and colleagues using an unbalanced panel of the 121 survey-level observations reported in their data appendix. Each column in the table shows the coefficient on the log of real GDP per capita in a bivariate logistic regression estimated by ordinary least squares. All regressions contain a full set of 36 country dummy variables and $T-1=21$ year dummy variables. As in the study by Vollmer and colleagues, the inclusion of country dummies removes country-level means from all variables.

Whether these initial point estimates are indeed very small depends in part on the thought experiment. The table provides a simple metric: the reduction in undernutrition that would be predicted on the basis of these coefficients, if a country that started with a prevalence rate of 50% were to grow by 2·74% per year between 2015 and 2030. A growth rate of 2·74% is not far from the sample mean, but would be enough to increase real GDP per capita by half over the course of the 2030 Agenda for Sustainable

See Online for appendix

	Data from Vollmer and colleagues[1]			Addressing measurement error in real GDP per capita			Removing extremely influential observations		
	Stunting	Wasting	Underweight	Stunting	Wasting	Underweight	Stunting	Wasting	Underweight
$\ln \gamma_{it}$ (PWT8·0)	–0·203	–0·222	–0·148	..	..	..	..	..	..
t-statistic	–1·611	–1·002	–0·851	..	..	..	..	..	..
p value	0·116	0·323	0·401	..	..	..	..	..	..
$\ln y_{it}$ (National Accounts)	..	..	..	–0·424*	–0·023	–0·221	–0·643†	–0·730*	–0·683†
t-statistic	..	..	..	–1·833	–0·060	–0·585	–2·792	–1·827	–2·795
p value	..	..	..	0·075	0·952	0·562	0·008	0·076	0·008
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p value, F(21,35) for time effects	<0·0001	0·013	<0·0001	0·050	0·003	<0·0001	0·0001	<0·0001	<0·0001
N	121	121	121	121	121	121	119	118	117
R^2	0·940	0·918	0·968	0·942	0·917	0·968	0·947	0·929	0·976
Adjusted R^2	0·885	0·845	0·938	0·889	0·842	0·938	0·897	0·862	0·954
Predicted cumulative reduction in undernutrition to 2030 (in percent of population under 3 years old)§									
2·74% annualised growth rate of y_{it} to 2030	2·06	2·25	1·50	4·29	0·23	2·24	6·48	7·35	6·88
5·00% annualised growth rate of y_{it} to 2030	3·71	4·05	2·71	7·70	0·42	4·03	11·55	13·05	12·24

A strong association between child undernutrition and income emerges after correcting for measurement error and unusual observations. For more information on the calculations and a list of observations excluded from the final three columns, please see the appendix. The dependent variable is the log of the odds ratio for the survey-level prevalence of undernutrition, and y_{it} denotes real GDP per capita in country *i* and year *t*. t-statistics are below coefficients, and significance levels are below those. Standard errors are clustered at the country level. Symbols (*,†) indicate significance at the 10% and 1% levels, respectively. See the appendix for an explanation of the prevalence rate calculations. Annualised growth at 2·74% or 5% would increase cumulative GDP per capita by 50% and 108%, respectively, between 2015 and 2030. See table A2 (appendix p 4) for a list of observations excluded in the final three columns. Note that the final underweight regression has only 116 effective observations, because the Armenia dummy variable absorbs the 2005 observation (the only one left for Armenia) once the 2000 and 2010 observations have been omitted. §Assuming an initial prevalence rate of 50%. GDP=gross domestic product. PWT=Penn World Tables.

Table: **Bivariate logistic regressions for child undernutrition**

Development—a far cry from the 5% thought experiment emphasised by Vollmer and colleagues. Columns 1–3 make it clear that sustained growth has meaningful traction, even when using the results of Vollmer and colleagues. That traction is nonetheless modest at best, and of course we cannot reject that it is zero.

The remaining columns implement two key modifications. Columns 4–6 replace the Penn World Tables (PWT) 8·0 data with real GDP per capita in constant local currency. The PWT data are designed to facilitate cross-country comparisons of living standards. But such comparisons are not relevant in these regressions because country means have been eliminated from the datea via the country dummies. What does matter is getting the growth rates right between surveys, and from this perspective, the PWT 8·0 data are inappropriate. A key innovation of version 8—the chain-linking of successive benchmark years—invalidates the use of these data in studies of economic growth.[2] Quick inspection indeed yields outlandish annual growth rates between survey years, including rates of 18 and 30 percent per annum for Nigeria. The PWT intra-survey growth rates can be loosely interpreted as unbiased estimates of the national growth rates, but with very large measurement errors (appendix p 2). The coefficients on real GDP are therefore biased towards zero. Consistent with this interpretation, two of the three coefficients are much larger when we use the correct variable, and the stunting coefficient is now statistically significant. These effects are even more dramatic when time effects are omitted (appendix p 3).

Columns 7–9 retain the appropriate GDP data but exclude extremely influential observations. This exercise could well have left the results unchanged or pushed them further towards zero. What it conveys instead is that a few unusual observations play a key part in pushing the results of Vollmer and colleagues towards zero. All three coefficients are now large and statistically significant. For the stunting and underweight variables, the point estimates (in columns 1 and 3, respectively) do not even lie within the new 90% confidence intervals ([–1·021, –0·264] for stunting, column 7; [–1·085, –0·281] for underweight, column 9). The resulting association between growth and changes in childhood nutrition is too strong to be dismissed. Sustained growth at 5% could reduce the prevalence of undernutrition by more than 10% of all children under the age of 3 years. Figure A2 (appendix p 4) illustrates this exercise, which we conduct in the “within” space of the data so that the influence calculation focuses on the coefficient on real GDP per capita. Again, coefficients are generally even larger when time effects are omitted.

In a companion piece,[3] we show that coefficients also rise substantially when we focus on the longest intra-sample periods in each country. This is consistent with the greater influence of measurement error on short-period growth rates and the importance of sustained growth in changing economic behaviour. We also argue that the inclusion of time effects is a judgment call. Fixed effects are known to bias estimated coefficients towards zero in the presence of measurement error by reducing the signal-to-noise ratio in the data.[4] Figure A3 (appendix p 6) shows the compression of sample information when time effects are included. With so few surveys per year, there is substantial additional danger that the time effects are overfitting the data rather than successfully identifying and neutralising the influence of country-invariant factors. At the very least, we believe that studies with small and unbalanced panels at their core should report results both with and without time effects.

Direct interventions are surely crucial for improving childhood undernutrition.[5] But by dismissing growth—and even in placing growth and direct interventions into opposition—the study by Vollmer and colleagues has its results and its recommendations badly wrong.

We declare no competing interests. The views expressed here are solely those of the authors and do not represent official positions of the United States Government or the United States Agency for International Development.

*Stephen A O’Connell, Caroline Smith
soconne1@swarthmore.edu

Swarthmore College, Swarthmore, PA 19081, USA (SAO’C); Economic Policy Office, Bureau of Economic Growth, Education and Environment, United States Agency for International Development, Washington, DC, USA (CS)

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2 Feenstra RC, Inklaar R, Timmer M. PWT 8·0–a user’s guide. University of California, Davis and University of Groningen, 2015. https://www.rug.nl/research/ggdc/data/pwt/v80/pwt_80_user_guide.pdf (accessed Oct 28, 2016).

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4 Griliches Z, Hausman JA. Errors in variables in panel data. *J Econom* 1986; **31:** 93–118.

5 United States Agency for International Development (USAID). Multi-sectoral nutrition strategy, 2014–2025. USAID, 2014. https://www.usaid.gov/sites/default/files/documents/1867/USAID_Nutrition_Strategy_5-09_508.pdf (accessed Oct 19, 2016).