HIT AND MISS: Why is the relationship between economic growth & malnutrition so varied?

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Overview

- Increasingly recognized that malnutrition is not only a dimension of poverty, but also a cause
- Yet unlike the case of monetary measures of poverty, there is a perception that economic growth is not very effective in reducing malnutrition
- Despite the importance of the question, there is little cross-country work establishing that, or exploring why the relationship is so varied

Overview

- The goal here is to:

1. Construct a larger, more diverse data set, with a range of anthropometric measures, including for adults (women)
2. Apply more sophisticated models from growth-poverty literature to malnutrition, especially on sectoral sources of growth
3. Test for dietary impacts on malnutrition (one of the key linkages between income & malnutrition)

2. Previous research & theory

- Smith & Haddad (2000) and Haddad et al (2003) derived cross-section growth-malnutrition elasticities of -0.50 from both cross-country data and 10 household surveys, for underweight
- Heltberg (2009) parallels growth-poverty literature by looking at spells (changes) of stunting and growth; he gets a much smaller elasticity of -0.20.
- More informally, we know there have been strong improvements in fast-growing countries (China, Vietnam), but also nutritional laggards: India, Egypt

2. Previous research & theory

- But low growth-malnutrition elasticities are plausible
- Growth and monetary measures of poverty have a definitional relationship (Bourgignon) based on mean income changes and distributional changes, so high elasticities are expected
- In contrast, no definitional relationship for nutrition and growth, and there are many potential "leakages:

  . . . Poor diets, high inequality, low spending on public goods, poor feeding and childcare practices, perhaps related to employment and growth
- For children, health constraints are particularly important

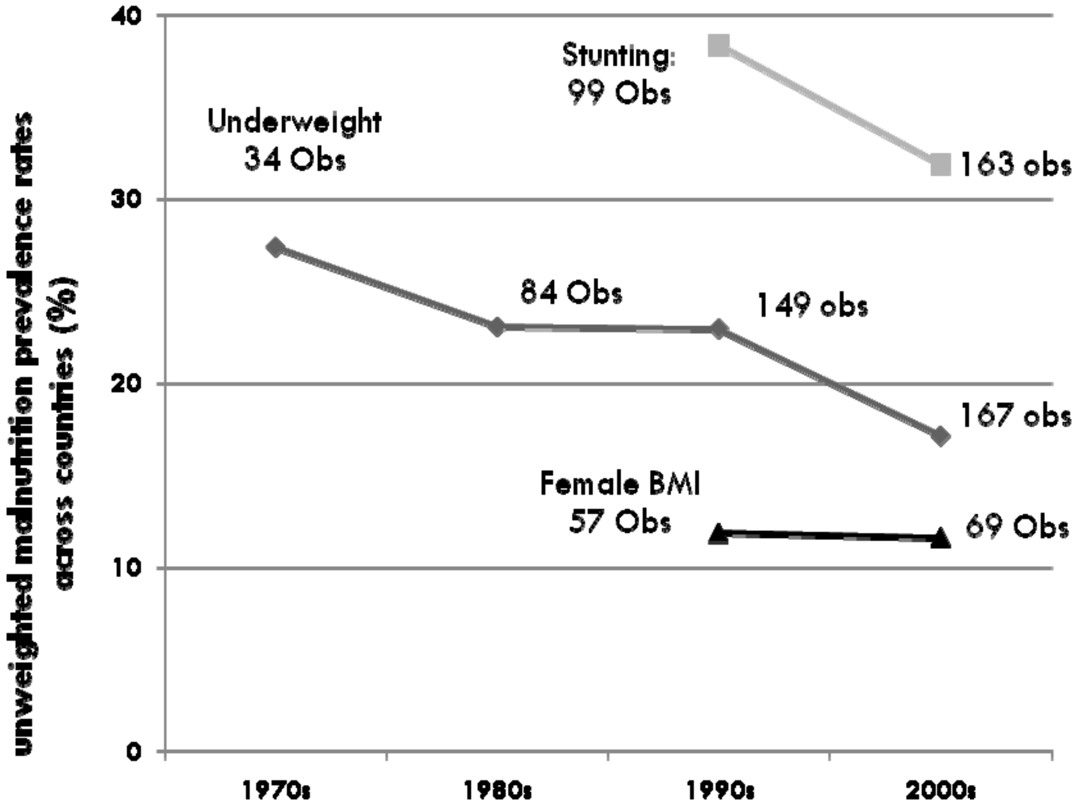
3. Data & methods

- Weight-for-age<2 std (underweight), height-for-age<2 std (stunting), relative to WHO norms; and low BMI women (BMI<18.5)
- We have updated Smith-Haddad dataset on underweight from 174 observations to 474.
- But relatively fewer observations for stunting, and much fewer for female BMI
- Quite comprehensive, but mostly developing countries, yet not much data on China
- Also have rural & urban nutrition data from DHS
- Added growth variables and dietary variables, and other determinants of nutrition

3. Data & methods

- Regressions in levels (“long run”, LR) could be biased by reverse and simultaneous causation
- Also not very interesting to know that nutrition and income converge in the long run: we want improvements in the next few years
- So like poverty-growth literature, we prefer differenced regressions; endogeneity minimized
- Since levels are in logs, and differenced regressions are in percentages, coefficients are elasticities, so we can compare LR to SR

Trends in underweighted averages of the three malnutrition indicators; and correlations between indicators



	Under-weight	Stunted	low BMI
Under-weight	1.00		
Stunted	0.86	1.00	
low BMI	0.86	0.57	1.00

Source: Authors' estimates from various sources. See text for details.

3. Aggregate economic growth and malnutrition outcomes: comparing the long run to the short run

Table 3. Long run (levels) estimates of growth-malnutrition elasticities

Regression No.	1	2	3	4	5
Dep. Variable	Poverty ($1/day)	Poverty ($1/day)	Stunting	Under-weight	Female BMI
No. Observations	452	446	263	333	111
GDP per capita	-1.07***		-0.42***	-0.65***	-0.83***
Average household income		-1.35***			
R-squared	0.42	0.45	0.31	0.32	0.26

Notes: These are Least Absolute Deviation (LAD) regressions designed to minimize the influence of outliers. R-squared is pseudo R-squared only. *, **, *** indicate significant at the 10%, 5% and 1% levels, respectively.

3. Aggregate economic growth and malnutrition outcomes: comparing the long run to the short run

Table 3. Short run (differenced) estimates of growth-malnutrition elasticities

Regression No.	1	2	3	4	5
Dep. Variable	Poverty ($1/day)	Poverty ($1/day)	Stunting	Under-weight	Female BMI
No. Observations	252	254	161	251	57
GDP per capita	-0.31**		-0.12**	-0.19***	-0.05
Average household income		-0.74***			
Initial levels, y	0.14	0.32	0.22	0.82	-1.00

Notes: These are Least Absolute Deviation (LAD) regressions designed to minimize the influence of outliers. R-squared is pseudo R-squared only. *, **, *** indicate significant at the 10%, 5% and 1% levels, respectively.

4. Do sectoral growth effects matter?

- Christiaensen, et al. (2006) test a specific disaggregation of growth in GDP per capita where per capita agric. growth (g_a) and nonagric. (g_n) growth rates are weighted by initial shares of GDP (s):

1. $g_p = e_a.s_a.g_a + e_n.s_n.g_n$

- We can also weight growth in sectoral GDP per sectoral capita by employment shares

Regressions in levels are significant and somewhat larger for agric. growth than non-agric. growth

Table 5. Associations between malnutrition and sectoral GDP per sectoral capita, in levels

Regression No.	1	2	3	4	5	6
Dep. Variable	Underweight	Underweight	Stunting	Stunting	Female BMI	Female BMI
No. Observations	373	325	244	244	62	50
GDP data source	UN	WDI	UN	WDI	UN	WDI
Log, ag. GDP per ag. capita	-0.56***	-0.54***	-0.34***	-0.34***	-0.59***	-0.50***
Log, nonag. GDP per nonag. capita	-0.12*	-0.12*	-0.12***	-0.12***	-0.50***	-0.59***
R-squared	0.31	0.34	0.41	0.41	0.15	0.26

But differenced regressions uncover very few significant results; measurement error?

Table 6. Differenced regressions for malnutrition and sectoral GDP per total capita weighted by sectoral GDP shares

Regression No.	1	2	3	4	5	6
Dep. Variable	Stunting	Stunting	Underweight	Underweight	Female BMI	Female BMI
No. Observations	161	149	257	220	58	52
GDP data source	UN	WDI	UN	WDI	UN	WDI
GDP-weighted ag. growth p.c.	-0.06	0.02	-0.16	-0.56	**-0.95**	**-0.69***
GDP-weighted non-ag. growth p.c.	-0.19**	-0.17	-0.20#	*-0.22*	*0.12*	0.01
Initial malnutrition	0.03	0.01	0.08	0.05	-0.13	-0.02
R-squared	0.03	0.03	0.01	0.03	0.03	0.02

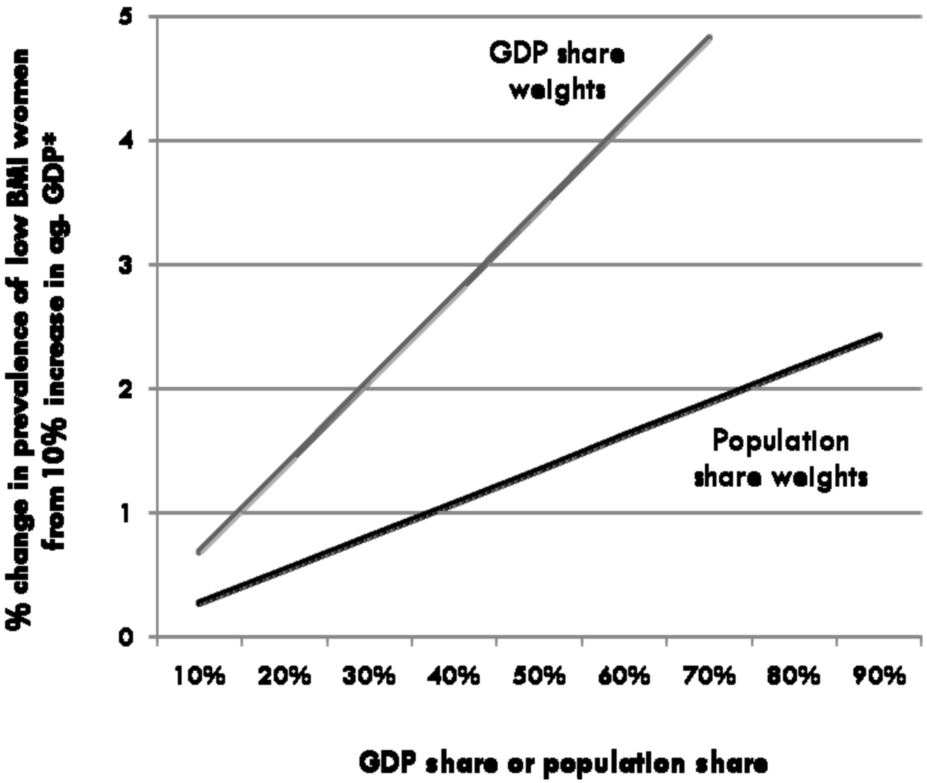
Population-weighted regressions yield a similar pattern

Table 7. Differenced regressions for malnutrition and sectoral GDP per sectoral capita weighted by sectoral population shares

Dep. Variable	Stunting	Stunting	Underweight	Underweight	Female BMI	Female BMI
No. Observations	167	146	259	221	62	51
data source	UN	WDI	UN	WDI	UN	WDI
Agricultural growth	-0.15	-0.13	-0.11	-0.45	**-0.39**	**-0.27****
Nonagric. growth	-0.26	-0.24	-0.33#	-0.49*	-0.52	-0.03
Initial malnutrition	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.02	0.02	0.01	0.04	0.05	0.06

4. Do sectoral growth effects matter?

- So no robust sectoral effects for childhood malnutrition, but agric. growth appears more important for adult (female) malnutrition, with fairly large effects
- Makes sense? Income-food consumption linkage more important for adult malnutrition



Notes: *"ag. GDP" is agricultural GDP relative to the total population in the case of GDP share weighted regressions, and relative to the agricultural population in the population share weighted regressions. Because of this the two simulations conducted in Figure 2 are not strictly comparable.

5. Decomposing nutrition improvements by the rural-urban dichotomy

$$N_t - N_{t-1} = w_r(N_{r,t-1} - N_{r,t-1}) + w_u(N_{u,t} - N_{u,t-1}) + w_s(S_{u,t} - S_{u,t-1}) + error$$

- Where $w_s = N_{r,t-1} - N_{u,t-1}$. Urban undernutrition pervasively lower than rural; but does rural-urban migration lower total undernutrition rates?? (last term)

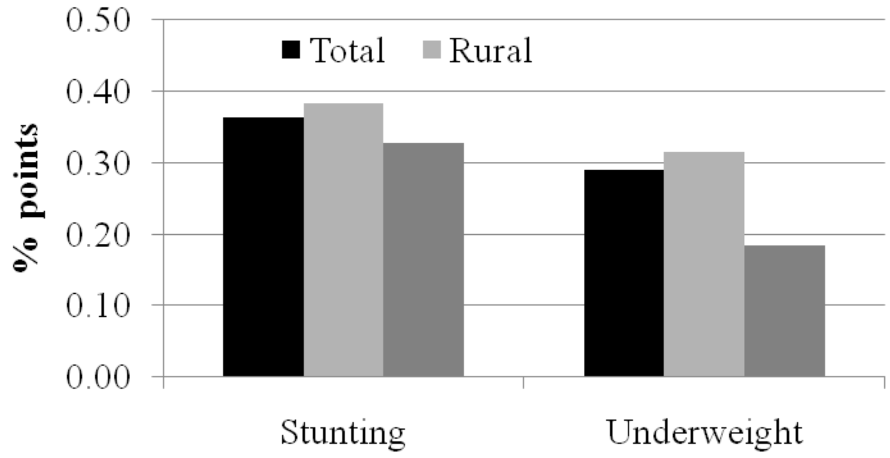
Table 8. The variation in changes in nutrition accounted for by rural and urban changes, and intersectoral shifts

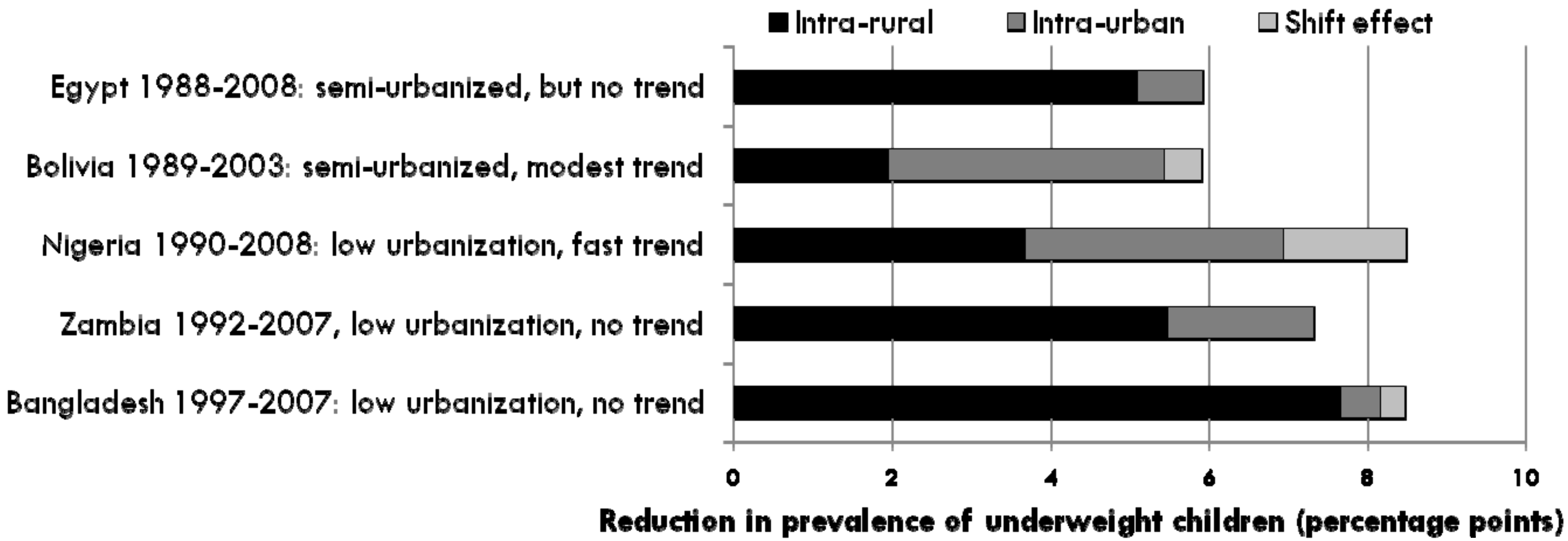
Indicator	Intra-rural	Intra-urban	Shift effects	Sum
Underweight	61.8%	36.5%	4.2%	100%
Stunting	60.0%	37.7%	4.3%	100%
Low BMI	66.6%	34.5%	2.1%	100%

- Over the short run, the answer is “no”; most change is intra-sectoral

□ Moreover, rural nutrition has been improving faster than urban, although much variation across LDCs

Figure 3. Annualized changes in child malnutrition: 1990-2007





5. Incomes, diets & nutrition outcomes

- Calorie consumption & dietary diversity both improve with income, but at a diminishing rate; but what are their respective impacts on nutrition scores?

Figure 5. Daily energy supply and GDP per capita

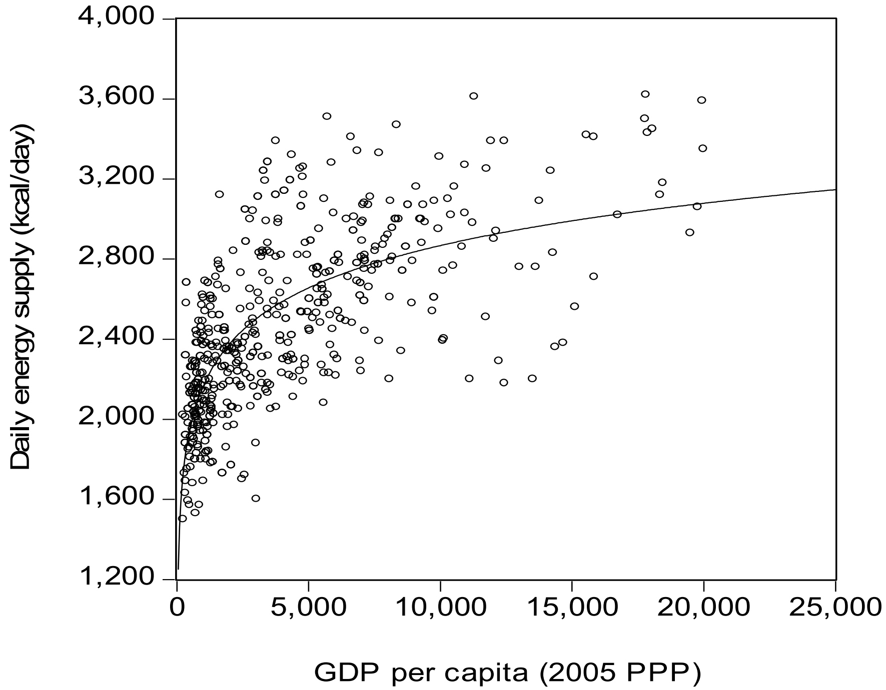
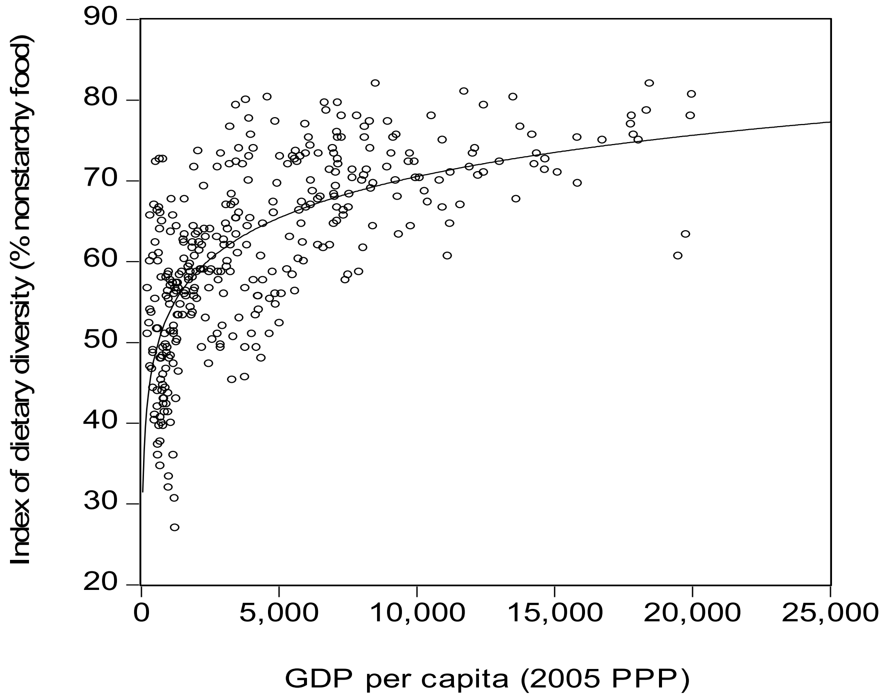


Figure 6. Dietary diversity and GDP per capita



5. Incomes, diets & nutrition outcomes

- We test FAO's "food security" data against nutrition scores, but dataset only big enough to run in levels; we add regional fixed effects in an attempt to minimize endogeneity

Table 11. FAO (2009b) variables capturing food consumption patterns

Measures of macronutrients intake	Measures of dietary diversity
Calorie consumption per person	Contribution of Carbohydrates in total Dietary consumption.
Protein consumption per person	Contribution of Proteins in total Dietary consumption.
Measures of micronutrients intake	% of non-starchy sources of energy supply
The dietary availability of vitamin A	% of non-starchy sources of fat supply
Iron intake from animal sources	% of non-starchy sources of protein supply
Iron intake from vegetable sources	The daily fat consumption per person

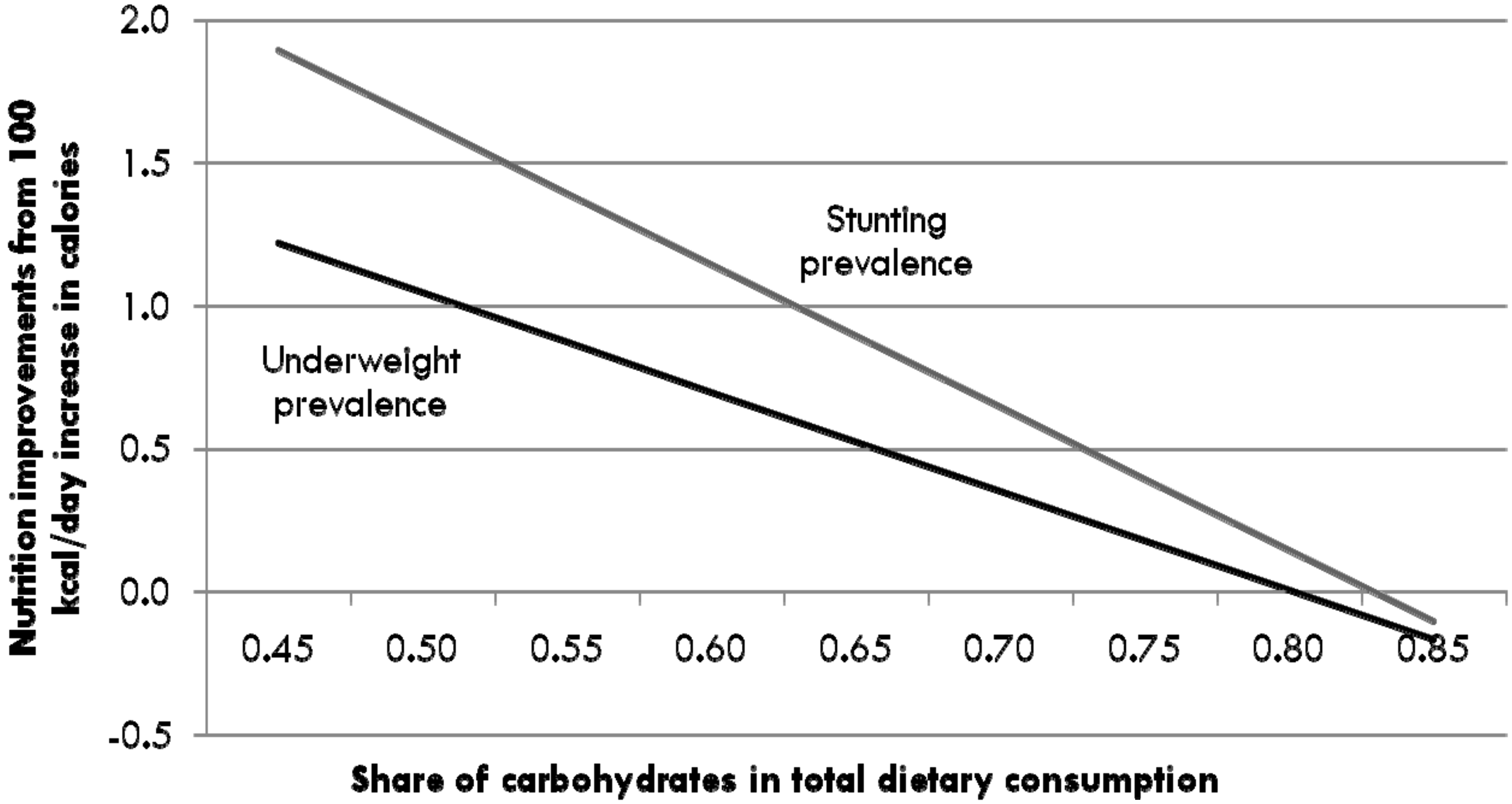
5. Incomes, diets & nutrition outcomes

- Dietary diversity has larger effects than calories alone. Moreover, as expected, there are sharply diminishing returns to calorie consumption when diets are not diverse

Dependent variable	Underweight	Underweight	Underweight
Estimated in . . .	Logs of levels	Logs of levels	Levels
No. of Observations	110	96	96
Calorie supply	-1.92***		-0.03***
Calorie-Protein supply		-0.87**	
Dietary diversity index		-1.86***	
Share of carbohydrates in diet*calorie supply			0.03***
R-squared	0.50	0.75	0.79
Adjusted R-squared	0.48	0.71	0.76

In fact, extra calories estimated to yield no improvements when diets are extremely monotonous

Figure 7. The estimated impact of 100 kcal/day increase in calorie consumption at different levels of dietary diversity



6. Summary of main points

- Cross-country regressions have limitations, but seem to uncover some interesting stylized facts:
- Growth effects on malnutrition much lower than effects on $/day poverty, especially in short run
- No evidence that agricultural growth is beneficial for children's nutrition, but maybe for adult's
- Rural nutrition improved faster than urban, and population shifts not important in the short run
- Diet important, as expected, but dietary diversity seems to matter more, with calorie effects limited by dietary by diversity.

7. In future work

- Part of an IFPRI 2020 study, so final paper will complement regressions with “meta-analysis” of success stories and failures (“outliers”)
- Expand the research question beyond income: what is driving nutrition changes?
- Expand dataset with Indian states, Chinese provinces, and FAO food balance sheets
- Address endogeneity issues, even if only indirectly
- Alternative measures of income: consumption, GDP less mining, DHS wealth index, thresholds?