Enhancing labour productivity by improving nutrition in Kenya: micro-econometric estimates for dynamic CGE model calibration

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1. Introduction

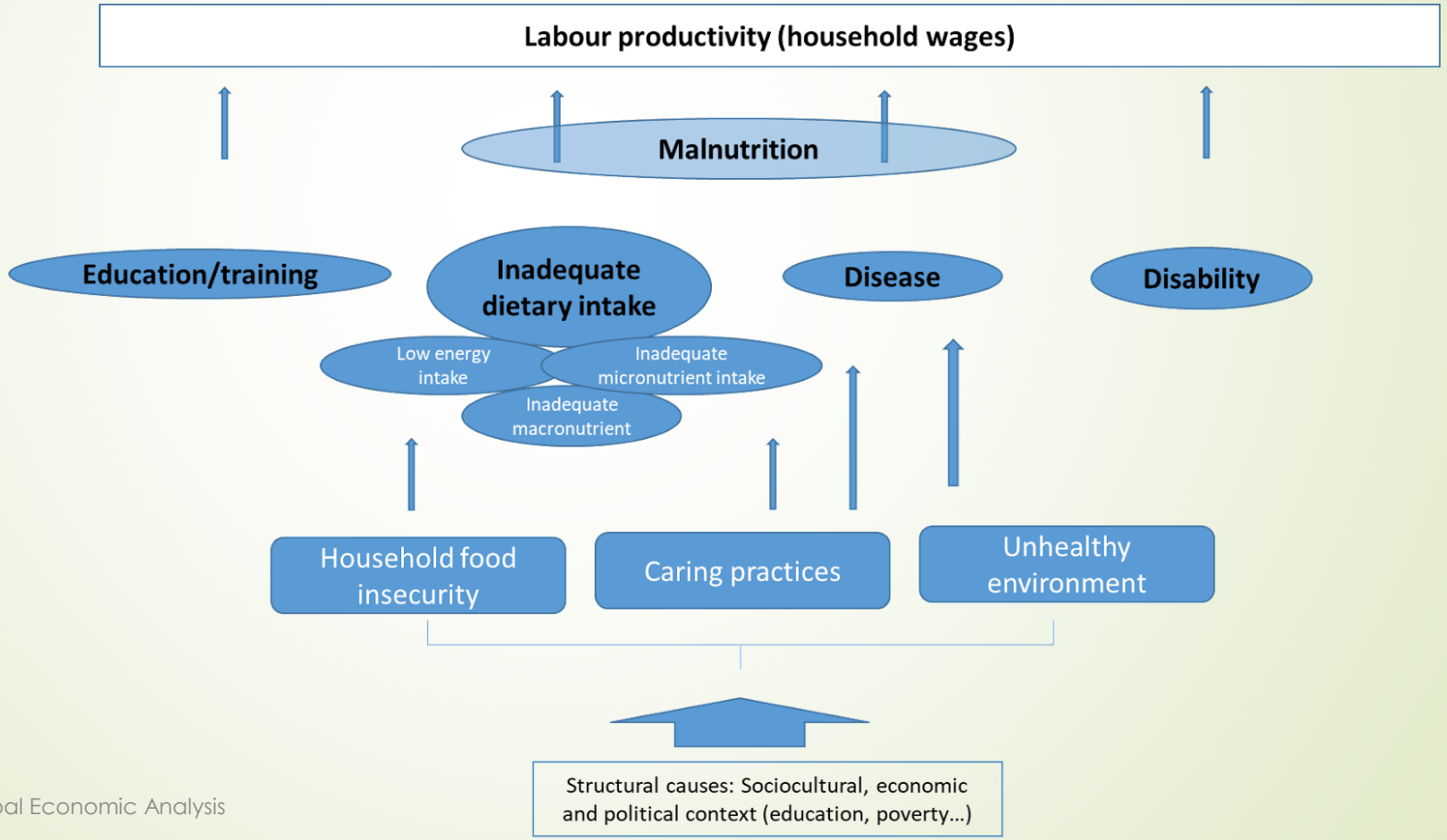
- Kenya is particularly concerned about the achievement of the Sustainable Development Goal #2 (SDG #2: zero hunger), and its associated consequences for society.
- Malnutrition in all its forms (stunting, wasting, micronutrient deficiencies and/or overweight/obesity) can compromise human development and economic growth through different pathways.
- Thus, it is possible to identify at least two pathways through which improving FS&N could enhance labour productivity. Improving the dietary nutrients intake (calories, macro and micronutrients) could allow for better (i) learning capacity and (ii) the reinforcement of health conditions.
- Aim: provide econometric estimates about the linkages between FS&N indicators (i.e., food consumption and nutritional status of households' members) and labour productivity (L-productivity). These estimates are insights for dynamic pathways in a CGE framework.

2. Theoretical framework

- Motivated by the goal to relate SGS #2 and SDG #8, Raji (2020) econometrically estimates the long run causality between nutrition and education, health and economic growth in the case of Nigeria. It finds a unidirectional causality that runs from nutrition intake to education.
- The implication of these results is that the nutrition status of the workers has significant impact on the economic growth in the long run.
- Moreover, this long run results fit also for nutrition in children. Hoddinott et al. (2008) find that improving nutrition in early childhood in Guatemala led to substantial increases in wage rates for adults.
- Many papers suggest a positive link between calories and micronutrients intake and L-productivity at a particular sector level (Strauss, 1986; Tiwasing et al., 2019).

3. Methodology and application to Kenya

Scheme 1. Nutrition impact pathway for Labour productivity



3. Methodology and application to Kenya

- *3.1. Variables and covariates.*

OUTPUT VARIABLE: the household monthly income exclusively from the labour wage (proxy of labour productivity).

EXPLICATIVE VARIABLES: the household food insecurity experience scale, and a battery of new indicators based on micronutrients intake, education and health status.

TWO DATASETS:

- (i) the 2015/2016 Kenya Integrated Household Budgetary Survey
- (ii) the 2018 Kenya Food Composition Tables (FCT KEN2018).

3. Methodology and application to Kenya

- *3.2. Analysis*

Non-parametric regressions between the nutrients variables across percentiles of per capita expenditure (in log) and across percentiles of calories consumed per day per AME at the household level (DEC).

Parametric regression: $lnWame = \alpha + \beta_{1,n} Nut_n + \beta_2 FIES + \beta_{3,e} Educ_e + \beta_4 DnD + \mu$

lnWame natural logarithm of monthly wages computed per adult male equivalent (AME) at the household level; the *n* nutrients (*Nut*) are Calcium, Heme Iron, Zinc, Vitamin C, Vitamin B2 and Vitamin A daily consumed per AME; *Educ* following *e* levels: university, secondary school complete and primary school complete; *DnD* refers to the number of active households' members that presents a chronic disease or a disability

4. Data and results

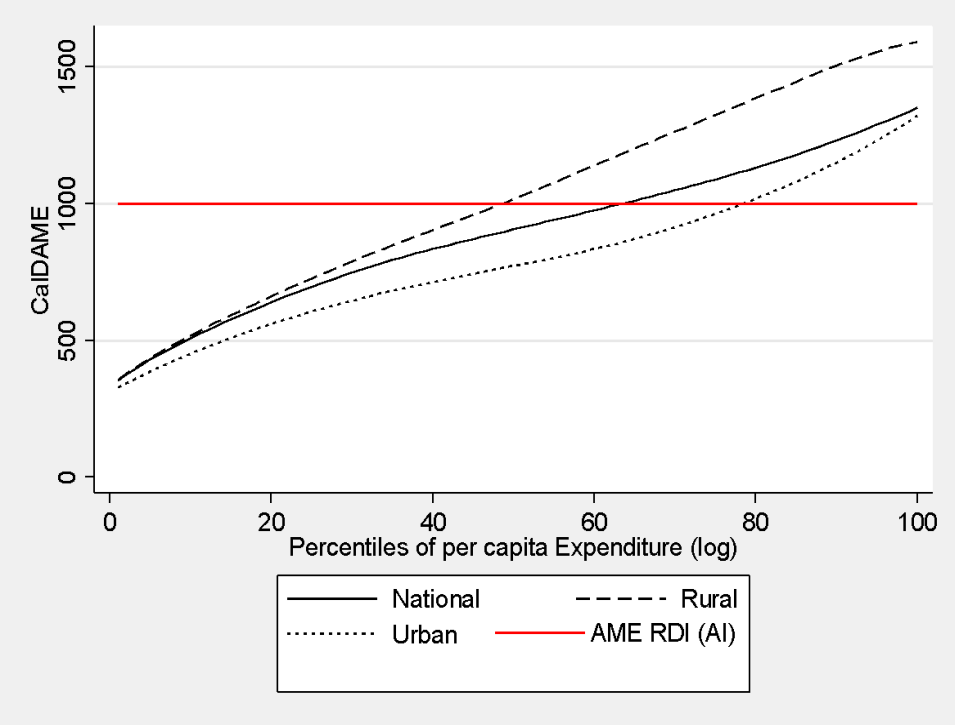
Table 1: Summary of descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Labour Productivity					
ln WageAME	16,346	10.33699	1.302104	3.772261	15.78959
Micronutrients					
Calcium (mg/day/AME)	16,346	827.845	570.7055	0	5849.908
Heme Iron (mg/day/AME)	16,346	1.931763	2.280014	0	28.72333
Zinc (mg/day/AME)	16,346	17.25478	16.44215	0	275.2943
Folate (mg/day/AME)	16,346	950.5068	672.5974	0	7606.352
Vitamin C (mg/day/AME)	16,346	130.8478	126.5033	0	1691.946
Vitamin B2 (mg/day/AME)	16,346	1.780715	1.397158	0	30.04409
Vitamin A (mg/day/AME)	16,346	568.7834	956.0026	0	27055.91
Vitamin B12 (mcg/day/AME)	16,346	4.719269	7.511784	0	119.0382
Food Insecurity					
FIES	16,346	3.96519	3.165905	0	8
Education					
University (ratio)	15,891	0.4554287	0.4040319	0	1
Secondary (ratio)	15,891	0.0124931	0.0869789	0	1
Primary (ratio)	15,891	0.396437	0.4058608	0	1
Health					
DcronD	16,346	2.100147	1.418944	0	14

4. Data and results

- **Non-parametric results**

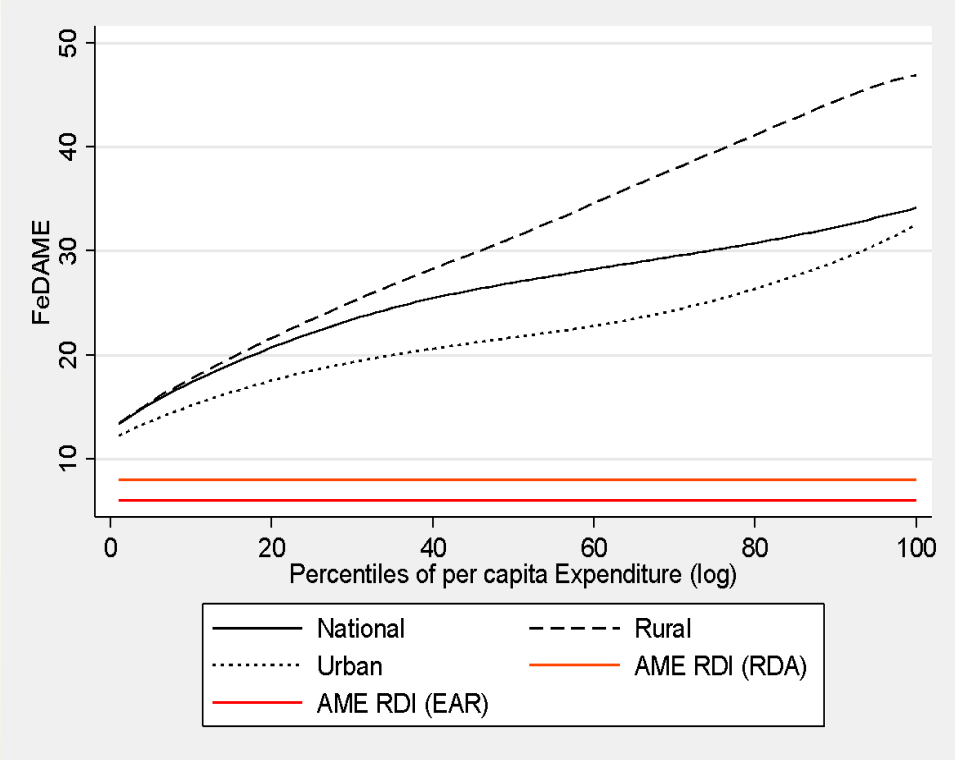
Figure 1: Calcium intake per AME across percentiles of per capita expenditure at the HH level



4. Data and results

- **Non-parametric results**

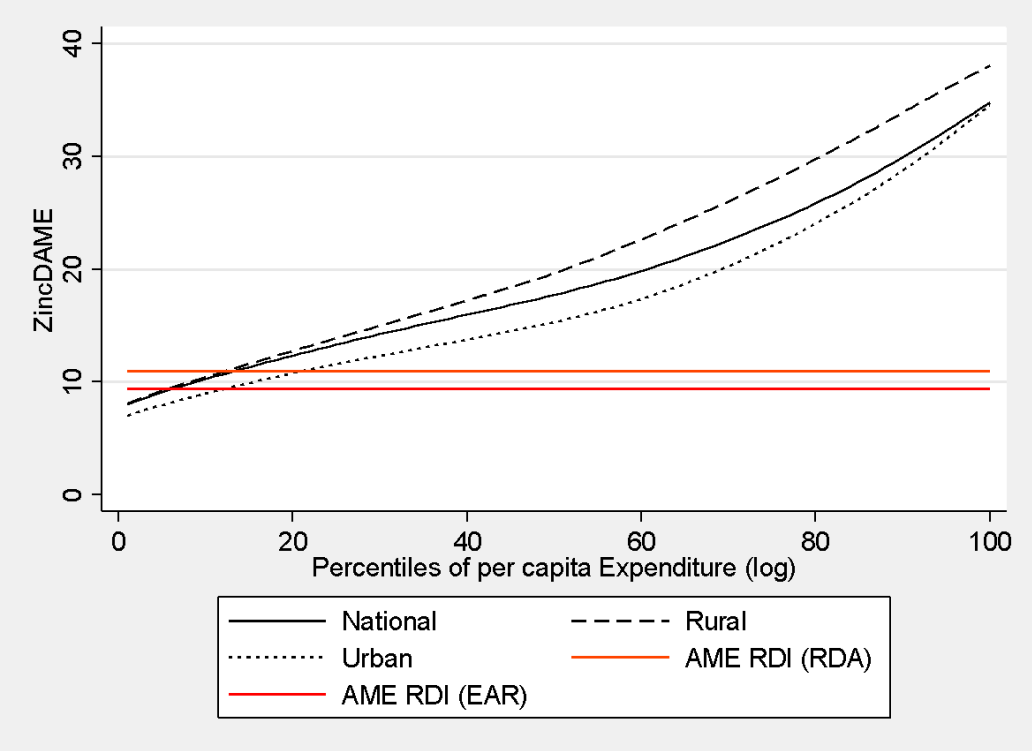
Figure 2: Iron (total) intake per AME across percentiles of per capita expenditure at the HH level



4. Data and results

- **Non-parametric results**

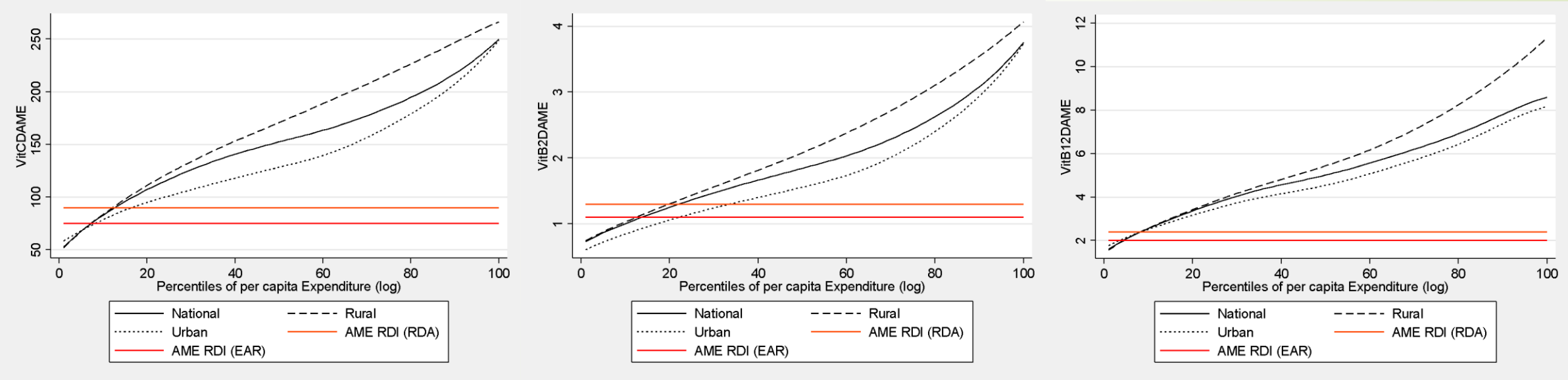
Figure 3: Zinc intake per AME across percentiles of per capita expenditure at the HH level



4. Data and results

- **Non-parametric results**

Figure 4: Water-soluble vitamins (C, B2, B12) intake per AME across percentiles of per capita expenditure at the HH level



Vitamin C

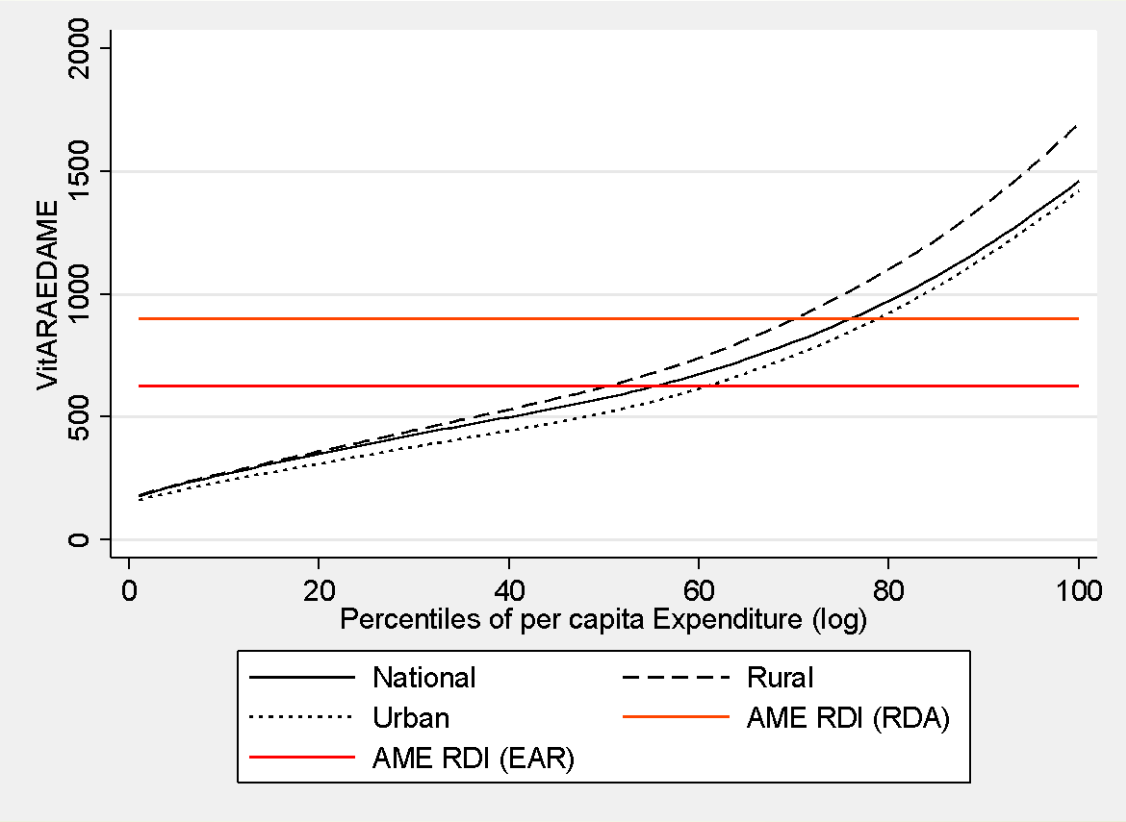
(b) Vitamin B2

(c) Vitamin B12

4. Data and results

- **Non-parametric results**

Figure 5: Lipid-soluble vitamins (A) intake per AME across percentiles of per capita expenditure at the HH level



4.Data and results

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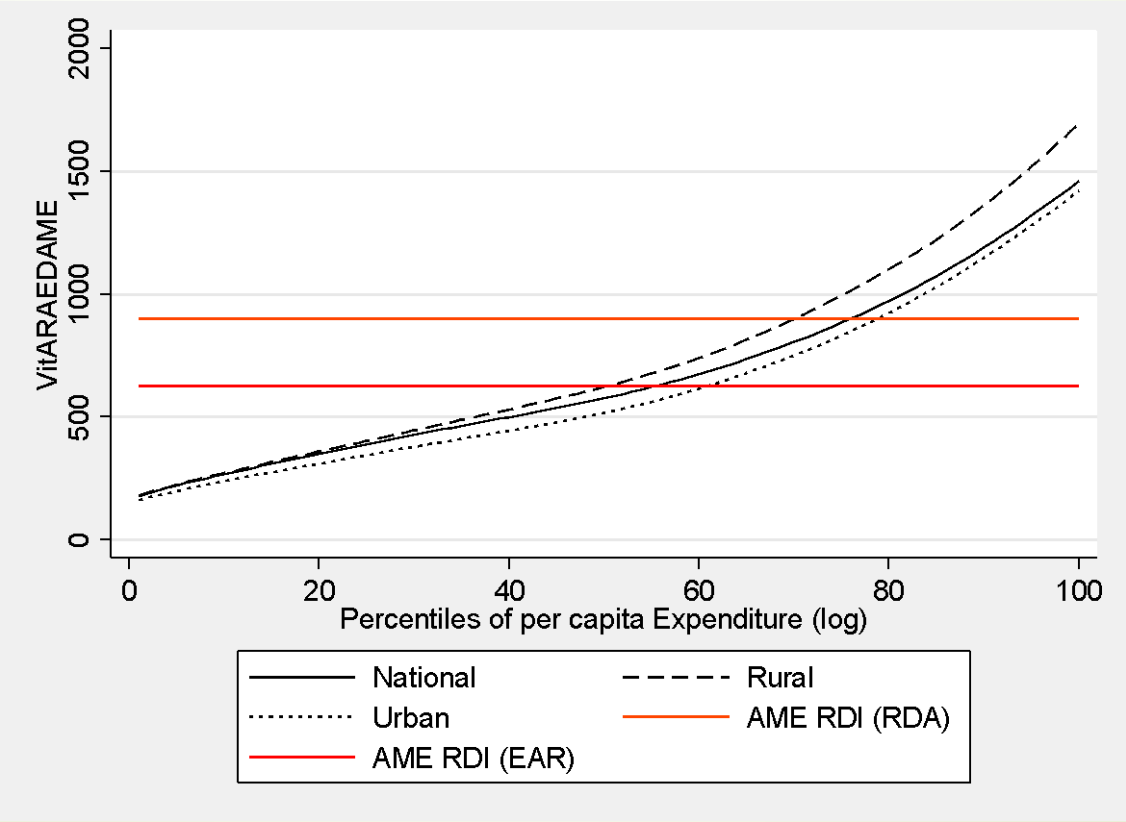
Figure 5: Lipid-soluble vitamins (A) intake per AME across percentiles of per capita expenditure at the HH level



4.Data and results

- **Parametric estimates**

Table 2: Estimates of regression

VARIABLES	Labour Productivity (lnWame)
Micronutrients	
Calcium (mg/day/AME)	0.000101***
	(-0.0000385)
Heme Iron (mg/day/AME)	0.113***
	-6.81E-03
Zinc (mg/day/AME)	0.00409***
	(-0.000714)
Folate (mg/day/AME)	-4.11e-05**
	(-0.0000196)
Vitamin C (mg/day/AME)	-0.000891***
	(-0.000132)
Vitamin B2 (mg/day/AME)	0.0635***
	(-0.0113)
Vitamin A (mg/day/AME)	7.63e-05***
	(-0.0000177)
Vitamin B12 (mcg/day/AME)	-0.0241***
	(-0.00263)
Food Insecurity	
FIES	-0.00207
	(-0.00304)

5. Discussion and Conclusions

- All micronutrients included in the wage-nutrient equation have a positive impact on labour productivity even when adjusted by the daily caloric intake.
- Intake of diets rich in micronutrients is more important than the consumption of diets higher in caloric intake but poor in micronutrients.
- Importance of a diverse diet.
- Improving diets could develop synergies to achieve SDG 2 of “no hunger” and SGD 8 of decent work and growth, being labour productivity one of the key growth drivers.