



Agriculture-nutrition linkages in Tajikistan: Delving deeper into the nexus

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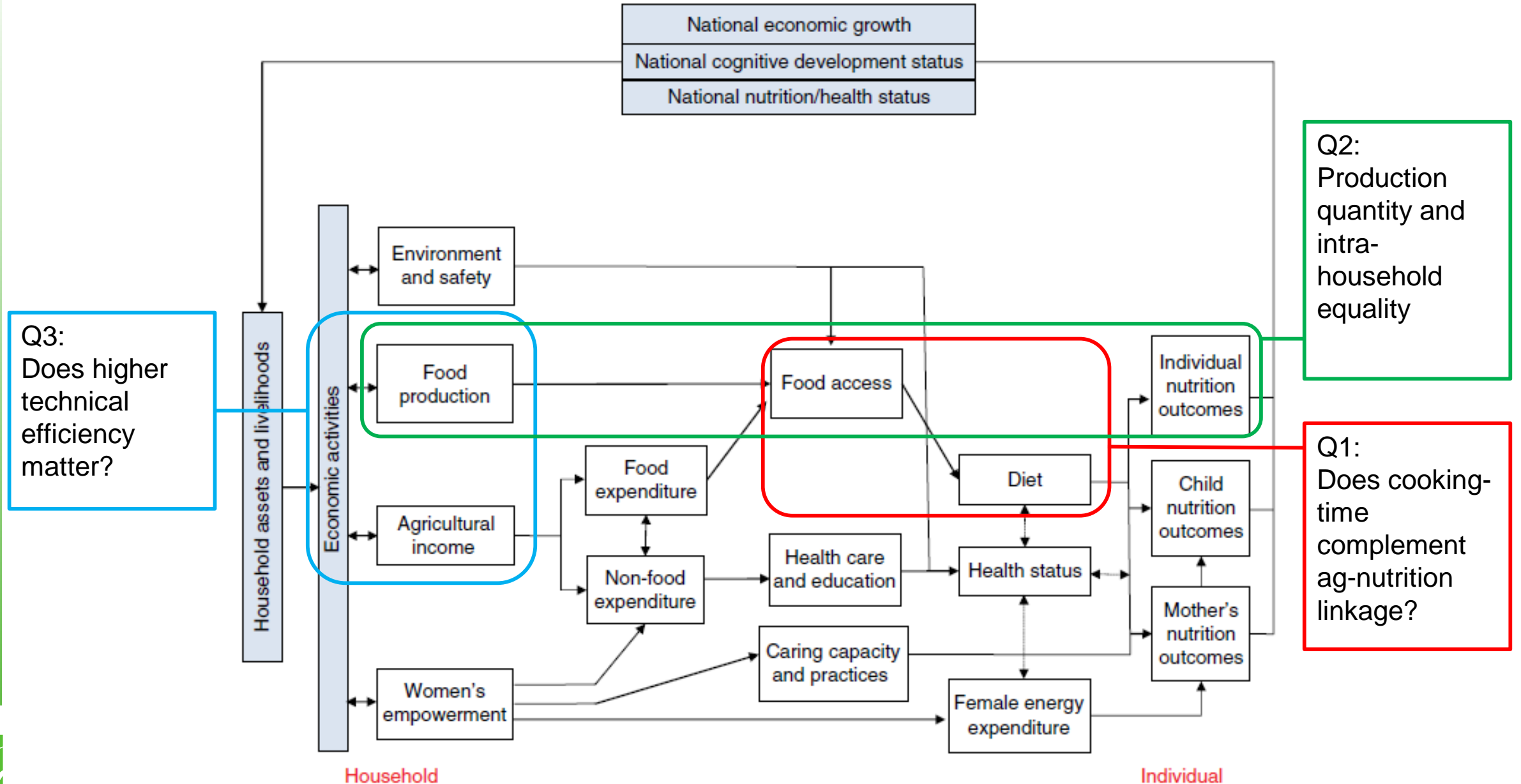
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Background

- **Malnutrition** in low-income countries including Tajikistan
- **Food-based approach** to complement medical approach
- **Nutrition-sensitive approach** to complement nutrition-specific approach
- **Agriculture-nutrition linkage**
 - Recognized as important (World Bank 2007; FAO 2015; Ruel et al. 2018; Fan et al. 2019)
 - However, knowledge gap still large, including Tajikistan (Takeshima et al. 2019)
- **Richer sets of evidence needed for various aspects of agriculture-nutrition linkage**

Analytical framework and empirical questions



Source: Modified from Fan et al. (2019).

Literature

Agriculture-nutrition linkage in Tajikistan

- **Strong linkage at household-level, especially in more subsistence regions** (Takeshima et al. 2019)
 - Dietary diversity (household, children, women), stunting

Intra-household variations (among women)

- **Variation in dietary requirements** – pregnancy, lactation, economic activities, etc. (Pitt et al. 1990; Harris-Fry et al. 2017)
- **Age** (Oddo et al. 2012; Lhotska et al. 2015; Hasan et al. 2017; Beal et al. 2017; Kerr 2017; Nguyen et al. 2018; Khanam et al. 2018; Dillon et al. 2018)
- **Marriage status** (Keding et al. 2011)
- **Household wealth / income, household size** (Haddad et al. 1997)
- **Household-level food availability** (Harris-Fry et al. 2017)
- **Does aggregate quantity matter for intra-household allocations of nutrition? – little evidence**

Time allocations for cooking / child care

- **Importance of time allocations for cooking / child care** (Komatsu et al. 2018; Johnston et al. 2019)
 - E.g., bioavailability of nutrients in cooked food
- **Household food production and time allocations for cooking / child care – are they complementary? – little evidence**

Productivity, technical efficiency

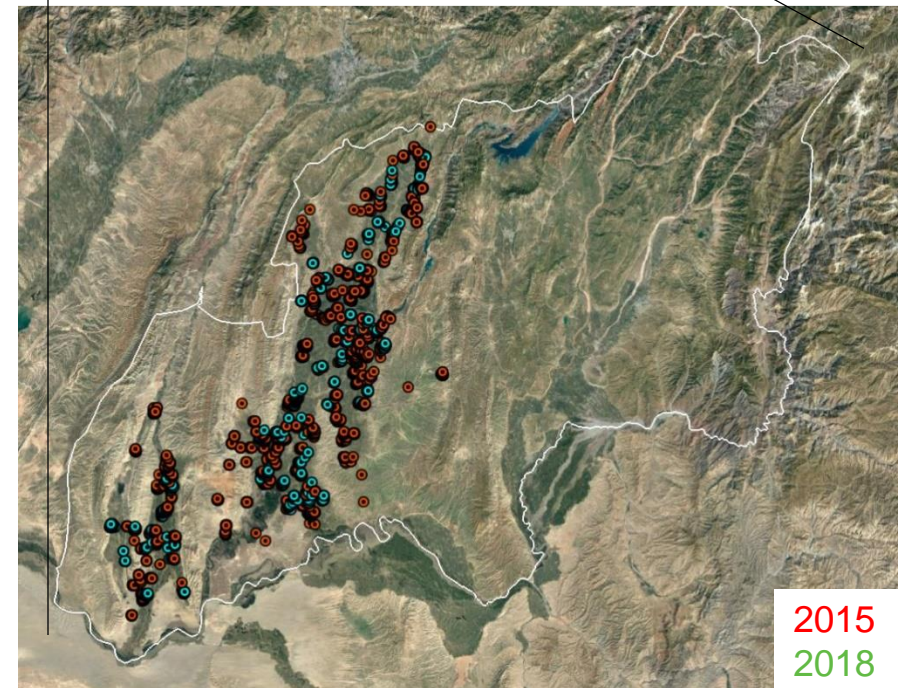
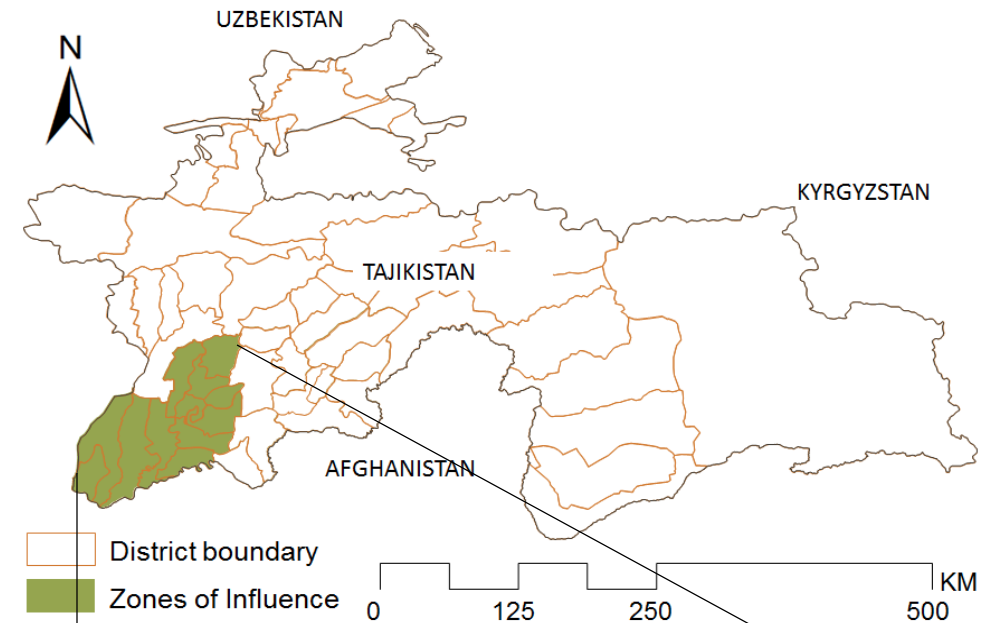
- **Efficiency of nutrition-sensitive agriculture (NSA)**
 - Cost of NSA – **little evidence** (Ruel et al. 2018)
- **High resource-requirements of many NSA interventions**
 - Labor - increased burden on female members (Johnston et al. 2019)
- **Does raising ag productivity / efficiency improve nutrition? - little evidence**

=> Need more evidence for these aspects within the agriculture-nutrition linkage

Data

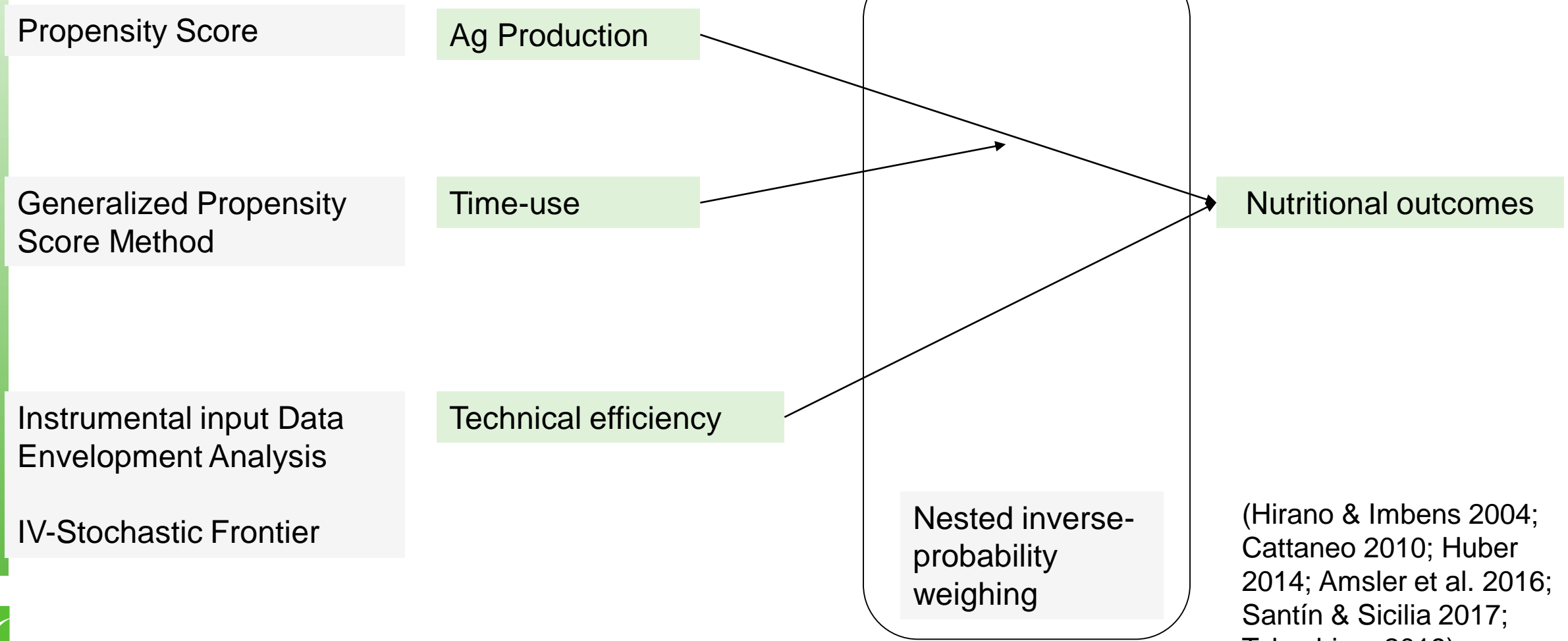
Tajikistan's Khatlon province

- 2015 February – March
 - 2000 households
 - About 3500 women of RPA
 - Representative within Zones-of-Influence (USAID Feed-the-Future)
- 2018 August
 - 1200 households
 - About 2000 women of RPA
 - Purposively selected (growing targeted crops)
 - More commercial



Source: Google Earth; IFPRI Surveys 2015/2018

Empirical methods: Multi-level propensity-score based estimations, Data Envelopment Analysis

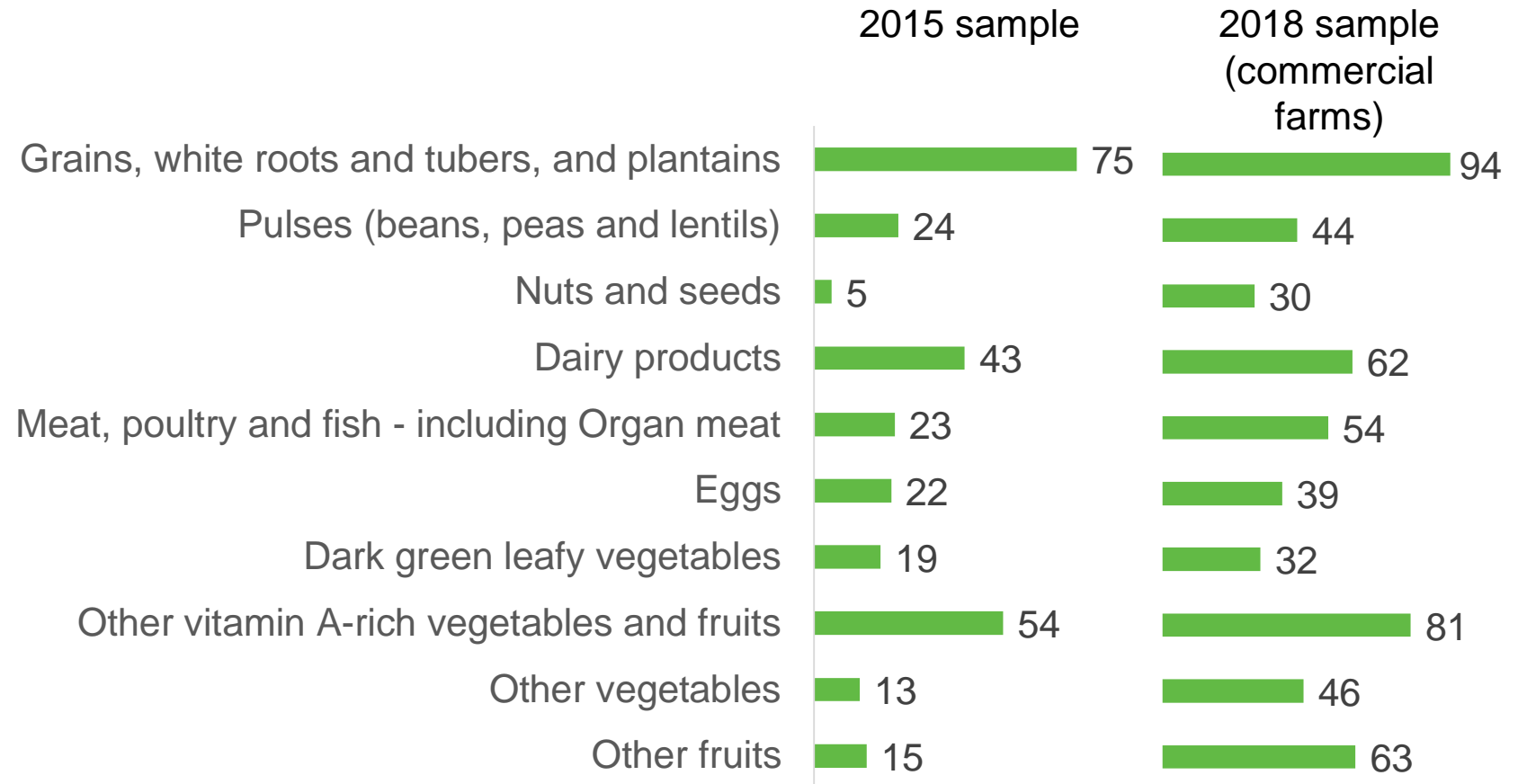


(Hirano & Imbens 2004; Cattaneo 2010; Huber 2014; Amsler et al. 2016; Santín & Sicilia 2017; Takeshima 2019)

Nutritional outcome indicators: Dietary diversity of women

- Women of reproductive age (15-49) – 24 hour recall
- 10 food groups
- In hhds with multiple respondents,
 - WDDS differ among women in **45%** of hhds
 - intra-household variations = **20-30%** of all variations

% of women consuming each food group



Women Dietary Diversity Score	2015 sample	2018 sample
Mean	2.96	5.43
Std.dev	2.39	2.40

Source: IFPRI Surveys 2015/2018

Data: Time-use

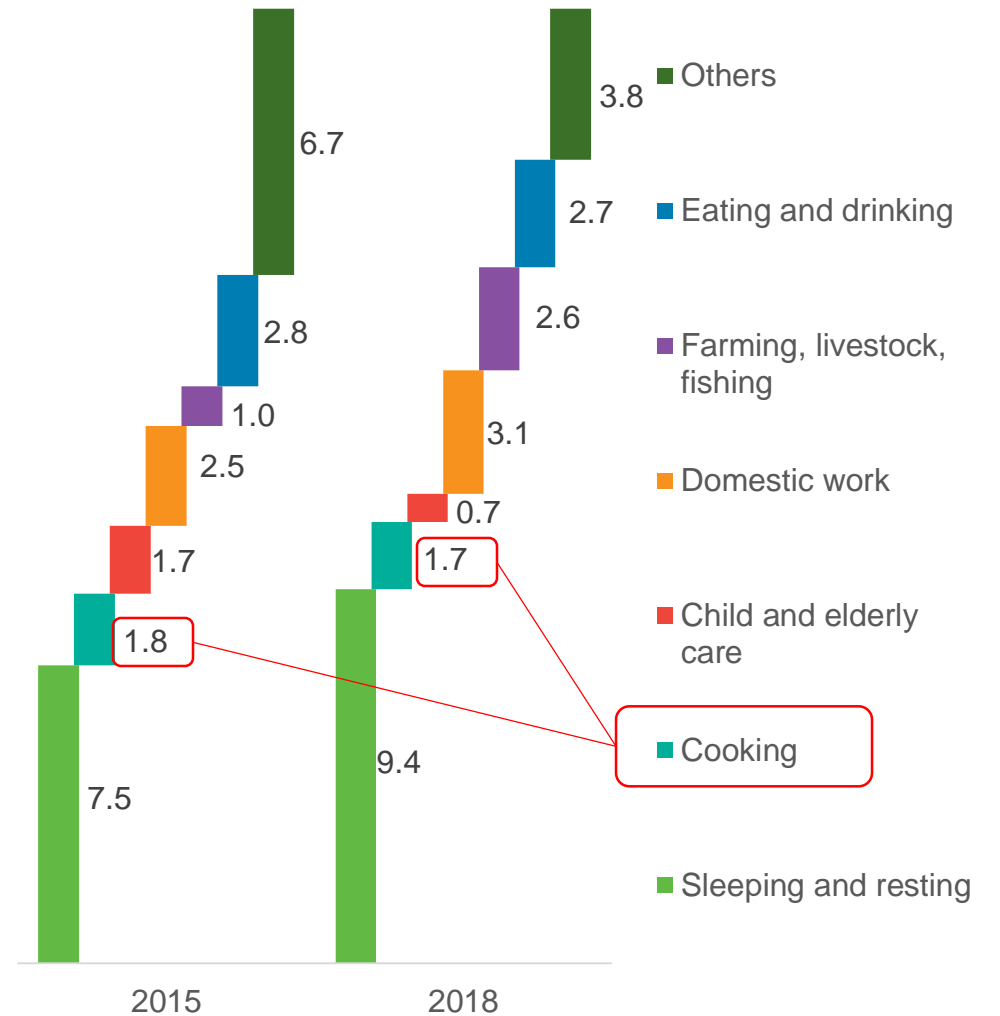
24-hour recall, primary respondent of the household

Activity	Night		Morning		Day																		
	4	5	6	7	8	9	10	11	12	13	14	15											
A Sleeping and resting																							
B Eating and drinking																							
C Personal care																							
D School (also homework)																							
E Work as employed																							
F Own business work																							
G Farming/livestock/fishing																							
J Shopping/getting service (incl health services)																							
K Weaving, sewing, textile care																							
L Cooking																							
M Domestic work (incl fetching wood and water)																							
N Care for children/adults/elderly																							
P Travelling and communing																							
Q Watching TV/listening to radio/reading																							
T Exercising																							
U Social activities and hobbies																							
W Religious activities																							
X Other, specify...																							

Primary respondent:

- One per household
- Mostly female of reproductive age (15-49 yrs old)

Average time-use (hours)



Source: IFPRI Surveys 2015/2018

Agricultural production descriptive statistics

Characteristics	2015 data		2018 data	
	mean	median	mean	median
Farm size – total (ha)	0.82	0.14	0.80	0.20
household plot	0.12		0.15	
presidential plot	0.04		0.04	
individual dehkan	0.66		0.39	
collective dehkan	0.00		0.22	
Agricultural capital				
Own tractors (%)	4		2	
Number of different types of agricultural machines	0.57		0.31	
Crop DDS	2.49		2.95	
Production value of 10 food group (Somoni)	4,446	1,533	7,149	3,051
Production value of 10 food group (PPP USD)	2,214	754	3,345	1,427

Source: IFPRI Surveys 2015/2018

Average age of working-age members
Share of female among working-age members (%)
Household size (male, female) (0-5, 6-15, 15-60, 61-)
Average years of formal education of working-age members (years)
Durable assets (2007 somoni)
Own cow (yes = 1)
Durable assets – improved cookstove (value)
Own refrigerator, freezer (yes = 1)
Improved sanitation ^a (yes = 1)
Finished floor ^a (yes = 1)
Finished wall ^a (yes = 1)
Improved water source ^a (yes = 1)
In community with centralized garbage collection (yes = 1)
In community with centralized sewage system (yes = 1)
Whether the community had received inoculation campaigns (yes = 1)
Distance to nearest food market—average of all types of markets (minutes)
Distance to road/ Distance to railroad
Distance to the nearest state daycare (ln_dmn_inst_15)
Night-time light
Altitude (meter)
Rainfall – historical average (annual, millimeters)
Rainfall – survey year (annual, millimeters)
Euclidean distance to the river (geographical minutes)
Groundwater depth (meters)
Terrain ruggedness index
Obtained credit (yes = 1)
Share of perennial crop area
Remittances received in a year (2007 somoni)
Owned farm area (hectares)
Extension – whether the communities receive government extension visit (yes = 1)
Extension – whether receiving extension advice (yes = 1)
Agricultural capital – owning tractors
Agricultural capital – number of other types of assets owned
Food price (average per kilogram of all 12 groups, 2007 somoni)
Other intra-household factors
Household food security / scarcity related indicators (household level)
Relations with primary respondents (Direct / indirect relatives, in-laws)
Presence of second helpers (who can help serving food to others)
Whether having care-taking children or not (<= 5)
Whether having care-taking boy or not (<= 5)
Age order within the household (by gender)
Variables affecting the time-use and self-selection of primary respondents
Age – primary respondent
Education – primary respondent
Age – all eligible household members (female, 15 -49)
Education – all eligible household members (female, 15 -49)
Other male members older than primary respondent
Other female members older than primary respondent
Other male members younger than primary respondent
Other female members younger than primary respondent
Number of caretaking children – primary respondent
Number of caretaking children – all eligible members (female, 15 -49)
Pregnancy (yes = 1) – primary respondent
Number of pregnant women in the hhd – all eligible members (female, 15 -49)
Expenses on domestic services (paid staff in private service such as child care, babysitting, cooks, cleaners, drivers, gardeners, etc.)
Individual level
Age of the child (days)
Gender of the child (female = 1)
Prebirth rainfall in 12 months before birth (mm)
Age of caregivers (year)
Education of caregivers (year)
Born in January–March (yes = 1)
Born in April–June (yes = 1)
Born in July–September (yes = 1)
Born in October–December (yes = 1)
Age (year)
Education (years completed)
Pregnant (yes = 1)
Lactating status

Household demographics

Household assets including cooking assets

Health / sanitation

Access to market

Agroclimatic factors

Access to capital (credit, remittances)

Farm and agricultural market characteristics

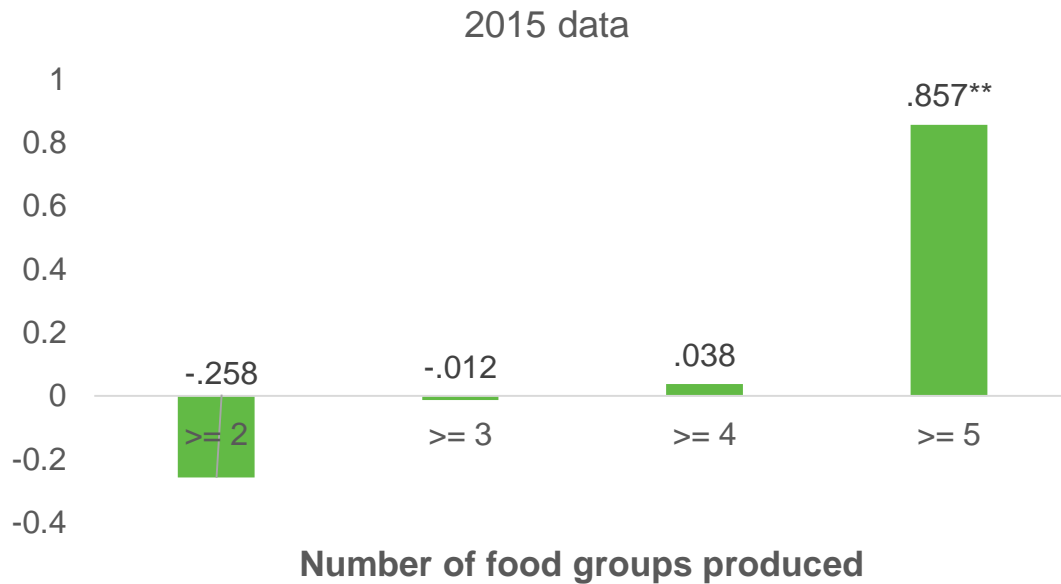
Other intrahousehold factors

Characteristics of primary respondent and relation to other hhd members

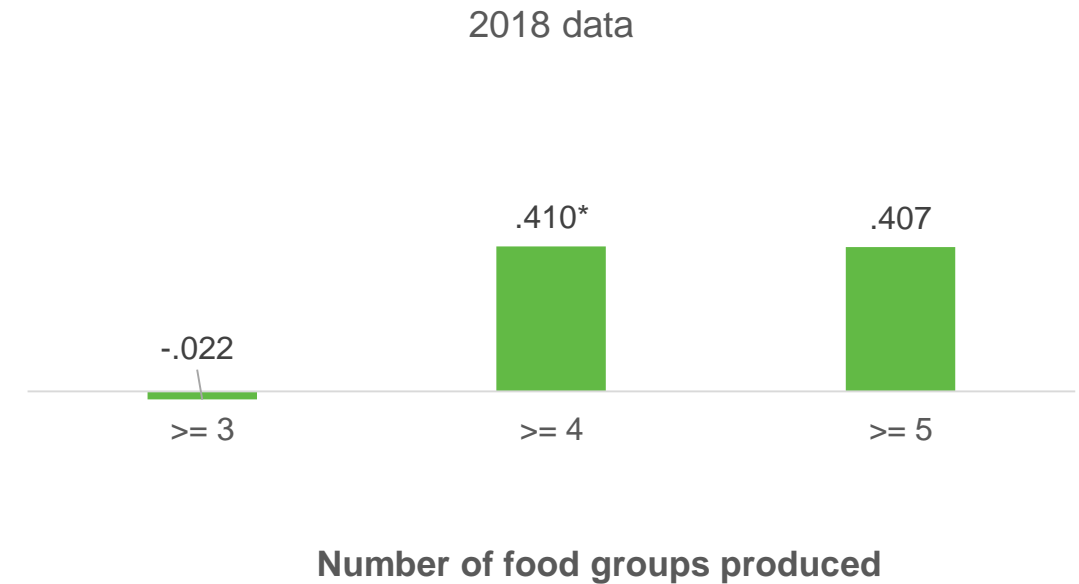
Characteristics of individual women and children

Results 1: Household food production and time-use complementarity

Effects of cooking-time on Women DDS



Source: IFPRI Surveys 2015/2018



Source: IFPRI Surveys 2015/2018

Change in DDS of all women due to 10 % longer cooking time

=> Increase by 0.09 if household produce 5 or more food groups

=> Increase by 0.04 if household produce 4 or more food groups

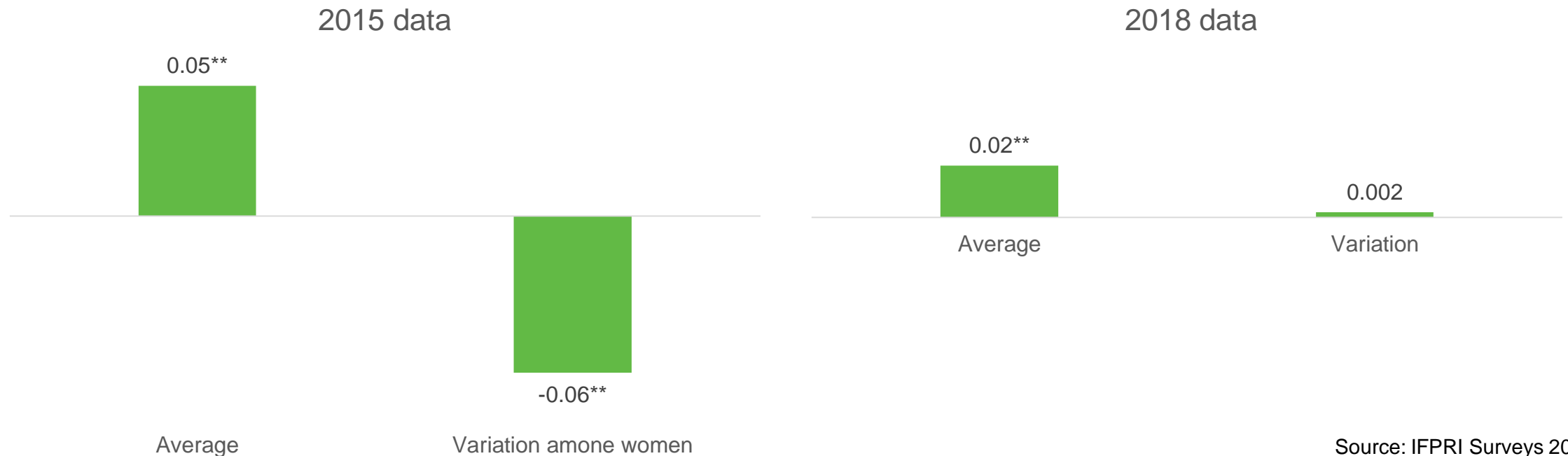
Given the prevailing environment of the sample:

- investing more time in cooking enhances dietary diversity of females
- this effect is stronger if the household grows more diverse groups of crops

=> household food production and time-investment in cooking is complementary to each other

Results 2: Household agricultural production quantity and intra-household nutritional improvement

Household ag production quantity and women DDS (average / variance among females in the hhd)



Source: IFPRI Surveys 2015/2018

Doubling production of 10 food-groups

- Raises WDDS by 4 %
- Reduces intra-household variation by 6 %

Doubling production of 10 food-groups

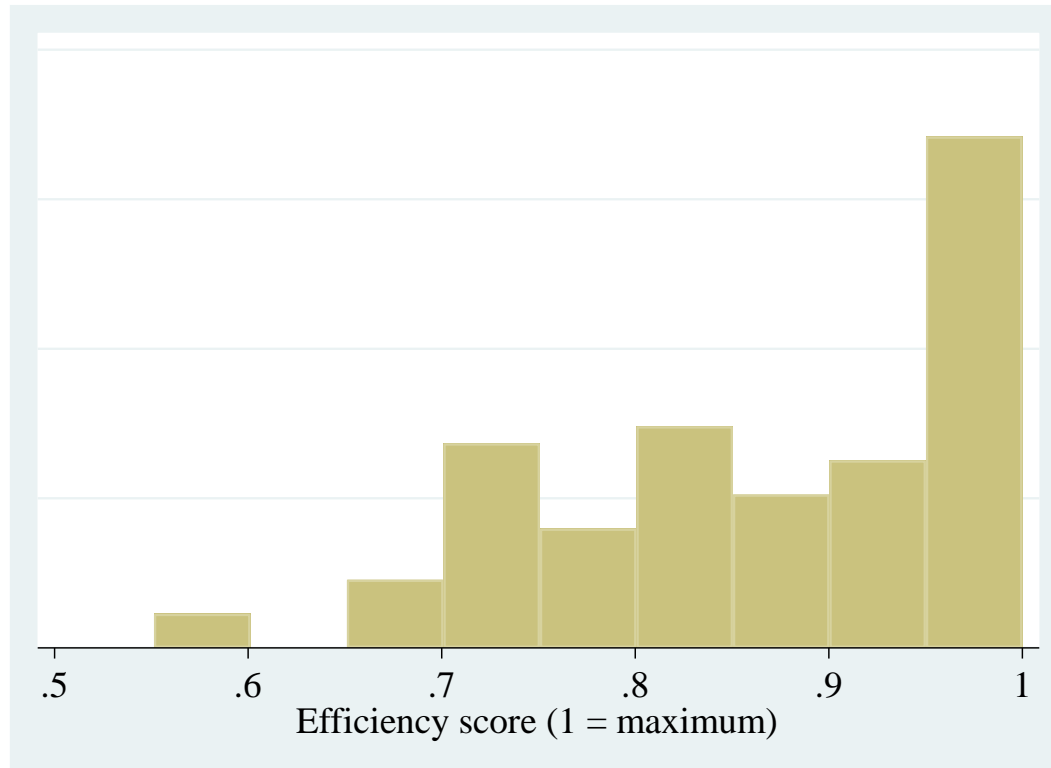
- Raises WDDS by 2 %

Given the prevailing environment of the sample:

- Increasing household-level production at *intensive margins* is important in not only raising average, but also reducing intra-household inequality in dietary diversity among women

Results 3: Agricultural productivity / technical efficiency – on-farm diversification linkages

Distribution of technical efficiency



Source: Data Envelopment Analysis.

The effects of technical efficiency on WDDS

1.097**
(.542)

10% increase in Technical Efficiency
=> raises DDS of all women by 3%

Complementarity between technical efficiency and cooking time

.074*
(.042)

10% increase in Technical Efficiency
=> Increase DDS of all women by 0.01 per 1 hour of cooking

Raising the *technical efficiency* in smallholder ag production

- facilitates nutrition-sensitive on-farm diversification, enhances women's DDS
- raises returns-to investment in cooking-time

Implications (among the studied sample in Tajikistan)

- Household's own production remains important because
 - Cash incomes are insufficient
 - Food market is inaccessible and risky (which poor households cannot bear)
 - Scale economies have not yet emerged and smallholder production system is still more efficient
- Diversity and quantity of food produced – both important
 - Diversity – raise overall dietary diversity
 - Quantity – reduce intra-household inequality in dietary diversity
- Nutrition-sensitive time-allocation - more effective when raw food items are diverse and abundant
- Raising technical efficiency of farm production further strengthens these linkages

=> Our study provides direct evidence for these hypotheses

In the short- to- medium terms,

- Promotion of nutrition-sensitive time-allocations should combine improved household food production
- Crop diversification (home garden etc.) should also achieve certain scale (quantity of each food group)
- Public investments for technical efficiency improvements
 - Agricultural R&D and extension for diverse commodities (vegetables / fruits, livestock, not only grains)
 - Location-specific agricultural R&D;
 - Farm management skills transfer across generation
- However, results
 - hold only among samples in Tajikistan's Khatlon region; **not** to be generalized to the rest of Eurasia

Conclusions

- **Food-based approach** is equally important for nutrition as medical approach, especially where infrastructure for supervision of supplementation and fortification is limited (Howson et al. 1998; Allen & Gillespie, 2001)
- **Nutrition-sensitive approach** equally important as **nutrition-specific approach**
- **Agricultural production at household level**
=> important **food-based / nutrition-sensitive approach** in itself, and important catalyst for other food-based / nutrition-sensitive approach
- **More evidence continues to be needed** in different settings, and can be attained through the empirical methods used in our study

Key references

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Thank you !

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