



WELCOME TO THE TRA 6 LECTURE SERIES INNOVATION PATHWAYS TO SUSTAINABILITY

NUTRITION-SENSITIVE AGRICULTURE: EMPIRICAL EVIDENCE
FROM DEVELOPING COUNTRIES

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Nutrition-sensitive agriculture: Empirical evidence from developing countries

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Nutrition-sensitive agriculture...

...is agriculture that promotes healthy nutrition for all.

- Worldwide, around 700 million people are chronically undernourished
 - >2 billion are micronutrient-deficient
 - >2 billion are overweight or obese
 - Malnutrition and low dietary quality are among the biggest risk factors for poor health and premature death
- ➔ **Agriculture, as currently observed, not sufficiently nutrition-sensitive**



Analysis of agriculture-nutrition links

1. Global perspective

- Historical trends
- Future challenges

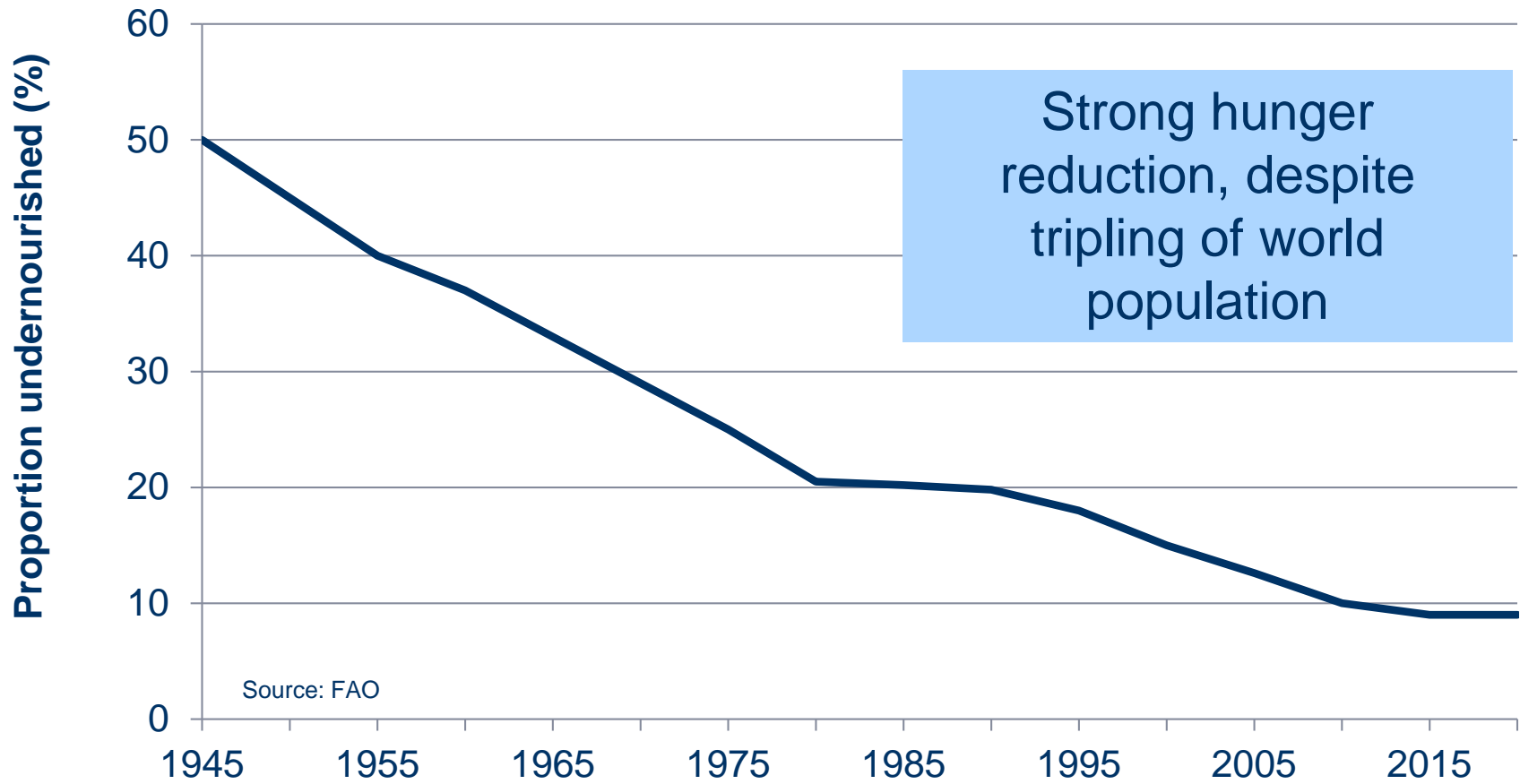
2. Micro-level perspective

- What type of agriculture is useful to improve nutrition in the small farm sector?



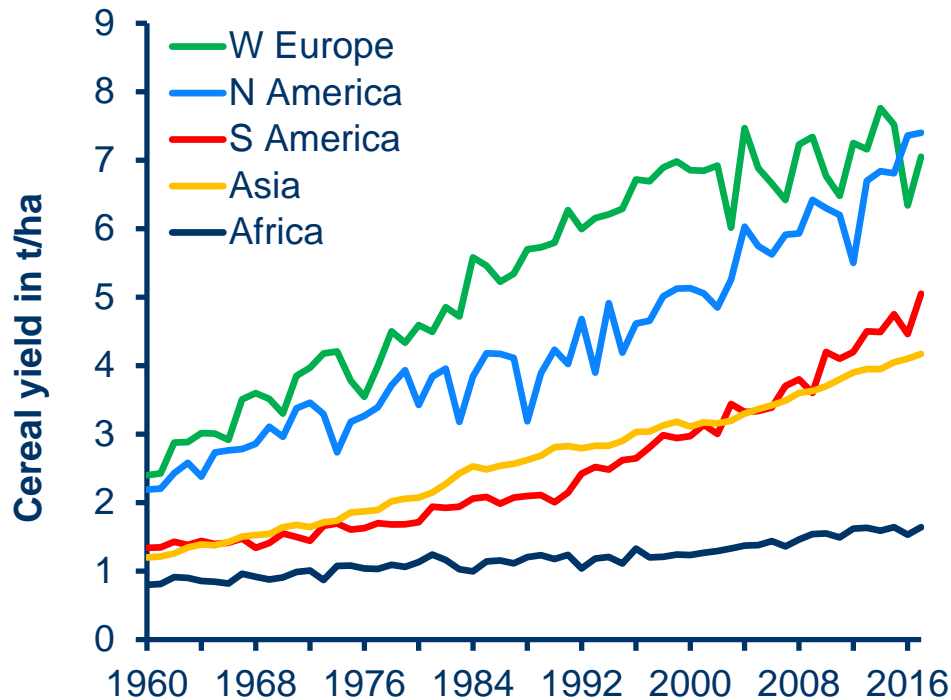
Global hunger: Longer-term trends

700 million (9%) suffer from hunger; progress stagnating, but...



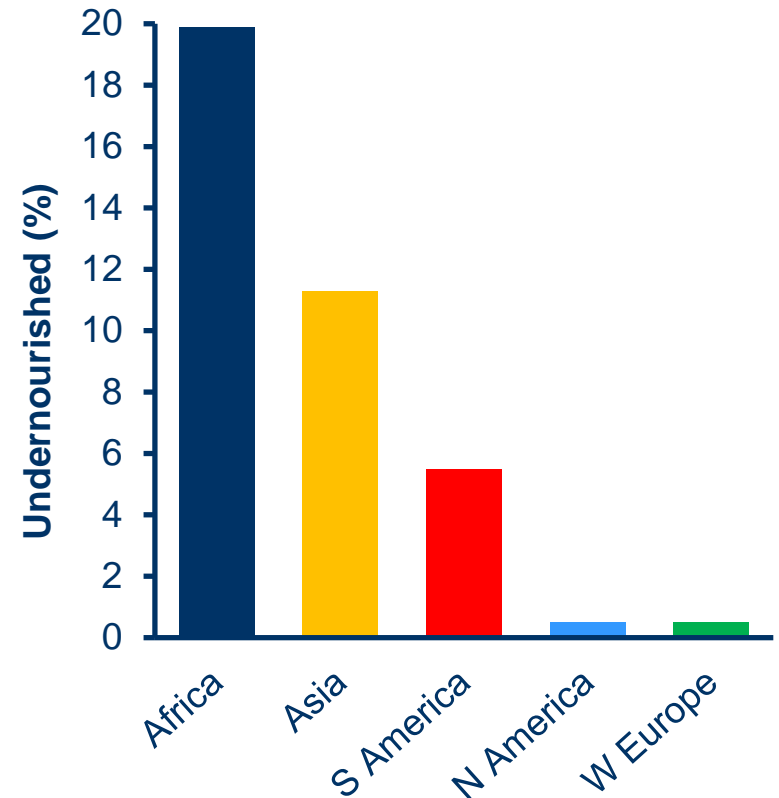
Role of agricultural productivity growth

Trends in cereal yields (1960-2018)



Sources: FAO, Qaim (2020)

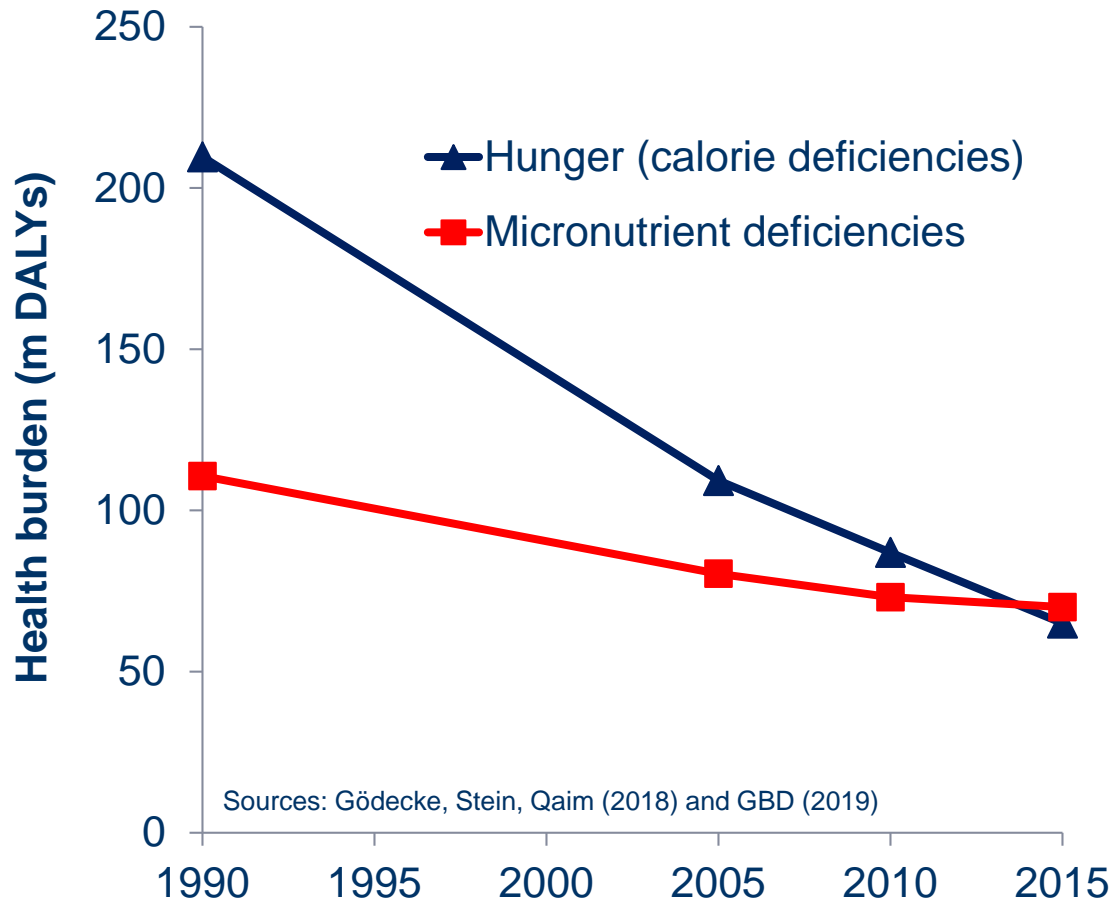
Prevalence of hunger (2018)



Yield and productivity growth remain important, due to further rising demand and scarce natural resources

Cereals alone are not enough

Global health burden of different types of malnutrition



- Cereals: cheap source of calories
- But low in MNs (micronutrients)



Biofortification

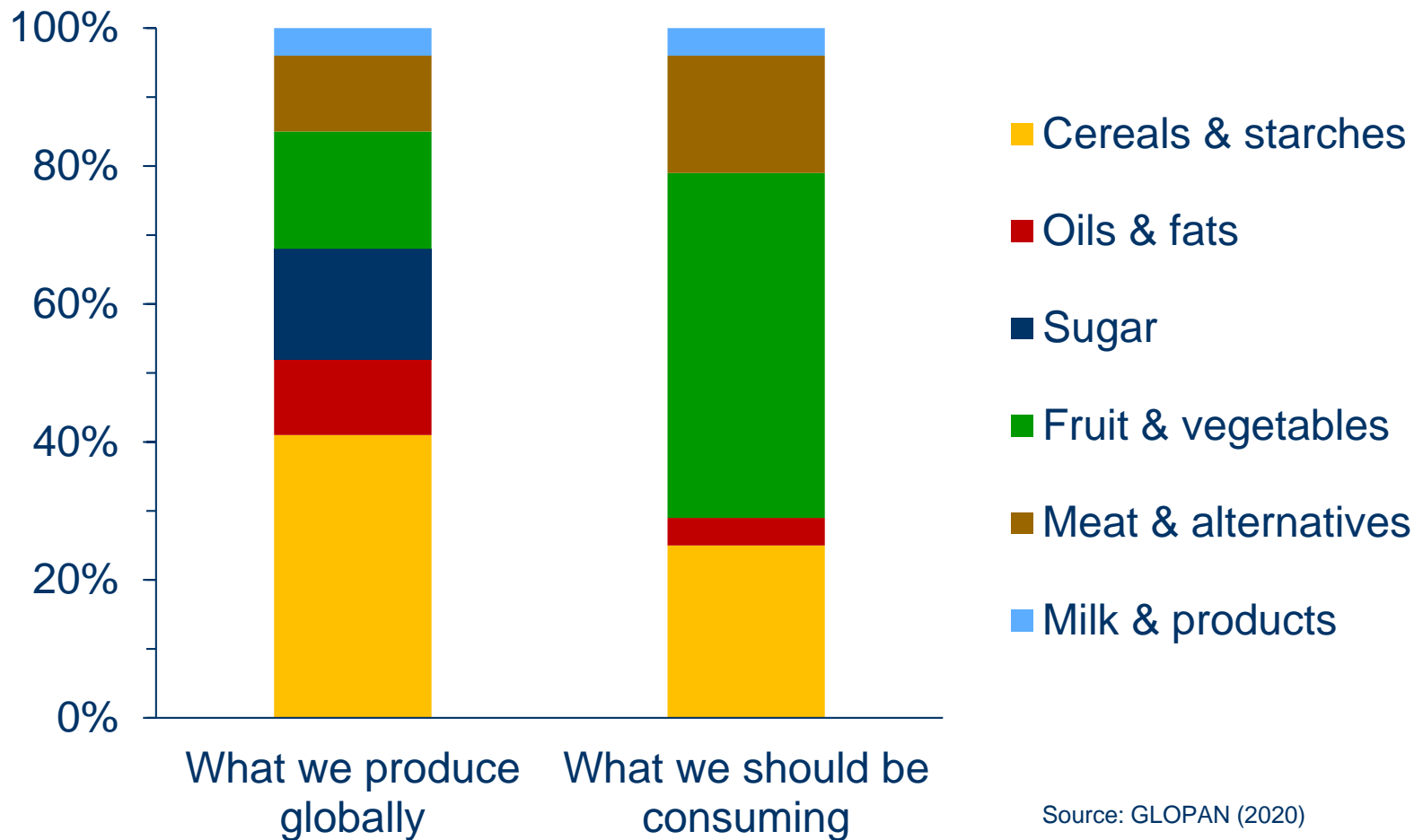
- Breeding of cereals (and other staples) for higher MN contents
- Examples are rice, wheat, and beans rich in zinc and iron developed by **HarvestPlus**



Countries in which HarvestPlus varieties have been released (2020)

- Another well-known example is Golden Rice (still waiting for approval under GMO regulatory procedures)
- Biofortified crops help improve MN-status and health, especially in poor rural population segments
- But not a substitute for much-needed diet diversification

Mismatch between global food production and healthy diets



Reasons for observed mismatch

- Most countries have defined **food security targets** in terms of cereals and calories
- **Production subsidies** (cereals, sugar, oil seeds)
- **Consumer subsidies** on cereals
- **Research focus** on cereals (Green Revolution)
- All of this led to distortions of prices and incentives

Policy implications

- Realign subsidy & research policies
- Cereals remain important, but much stronger focus required on fruits, vegetable, legumes to foster diversity
- New breeding technologies can help to speed up productivity progress in neglected crops

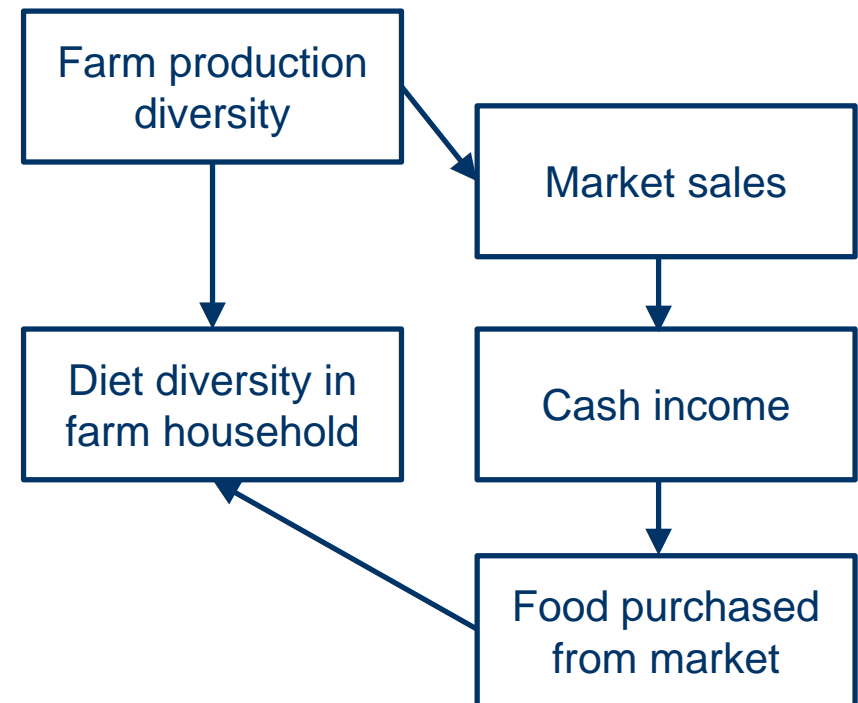
2. Micro-level perspective

- Smallholder farmers in developing countries account for 50% of the world's undernourished people
- They depend on agriculture not only as a source of food, but also as their main source of income
- Hence, one key question is what types of policies /interventions can help to make smallholder-farming more nutrition-sensitive



Smallholder farming and diversity

- Dietary diversity (number of food groups regularly consumed), is a widely-used indicator of diet quality and MN status
- A common assumption is that increasing small farm production diversity is a good strategy to improve smallholder diets
- Large project initiatives to foster farm diversification



Empirical evidence

Around 50 studies analyzed associations between farm production diversity and diets in many developing countries

$$DDS_i = \beta_0 + \beta_1 PD_i + \beta'_2 X_i + \varepsilon_i$$

Systematic review (Sibhatu and Qaim 2018)

	Main conclusion by original study authors	Our conclusion after careful reading
Clearly positive association	69%	11%
Mixed results	9%	65%
No positive association	22%	24%

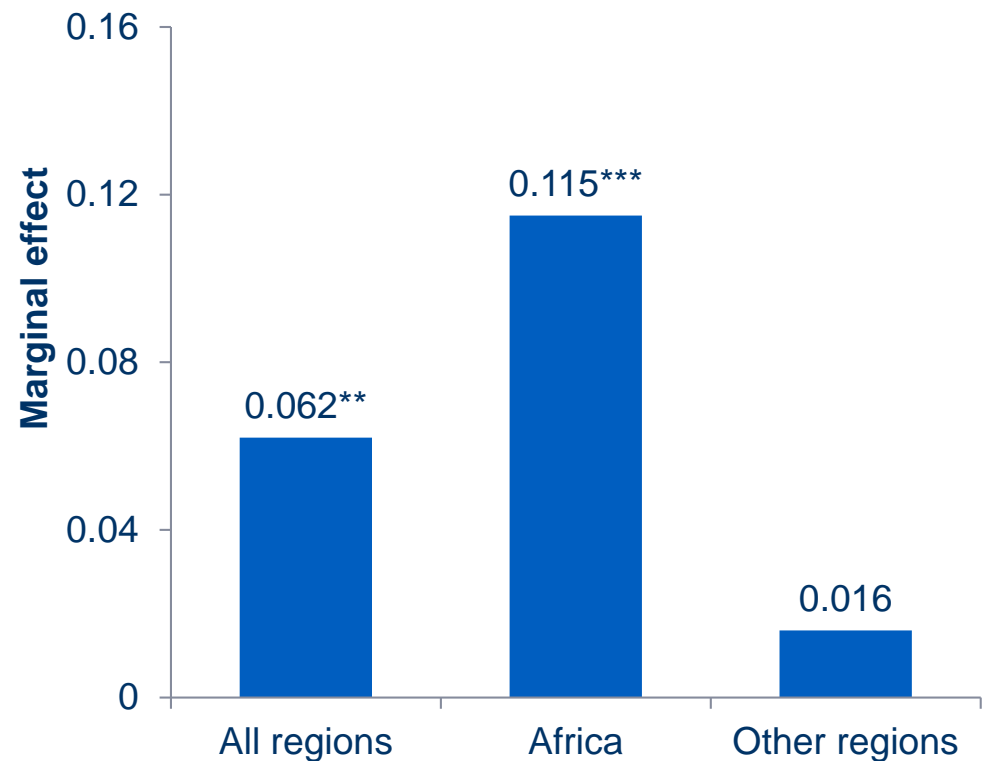
Hardly any of the studies interpret effect sizes

Meta-analysis of effect sizes

- In all studies: 213 regression models with different specifications and subsamples
- Positive and significant associations: 51% of models



Average effect sizes (production diversity on DDS)

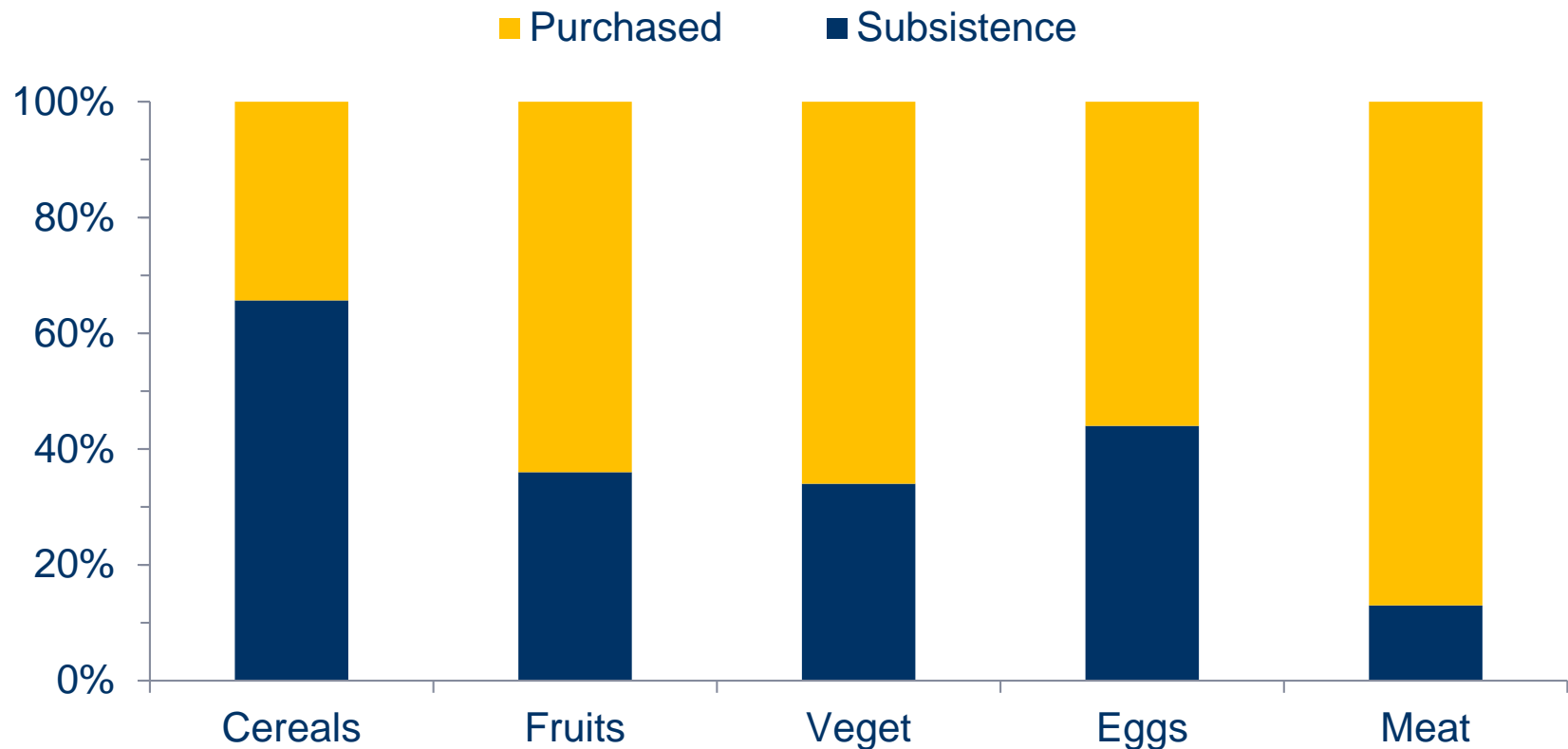


Source: Sibhatu and Qaim (2018).

Food sources of smallholders

They often buy more of their food in the market than we think

Rural households in Ethiopia



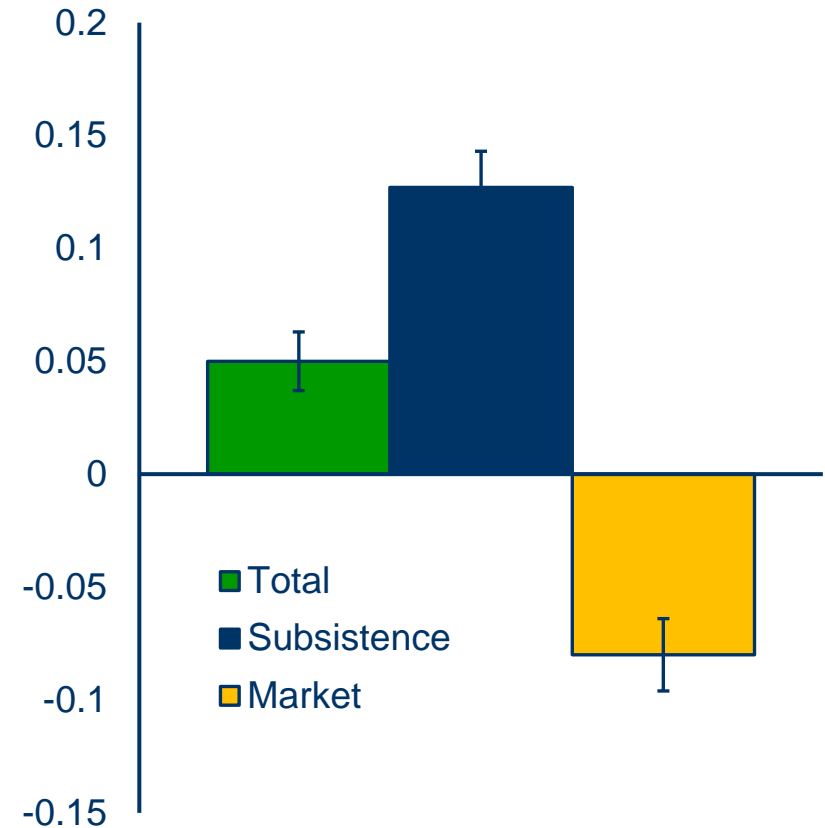
Source: Sibhatu and Qaim (2017)

Country examples

	Ethio- pia	Kenya	Ugan- da
Production diversity (PD)	10.19	11.31	9.99
Farm size (ha)	1.63	0.71	1.42

- High PD as risk-coping mechanism and because of limited market access
- Further increasing PD may thwart market potentials and perpetuate subsistence

Total and partial effects of PD on DDS (Kenya)



Source: Muthini, Nzuma, Qaim (2020)

What do we learn from this evidence?

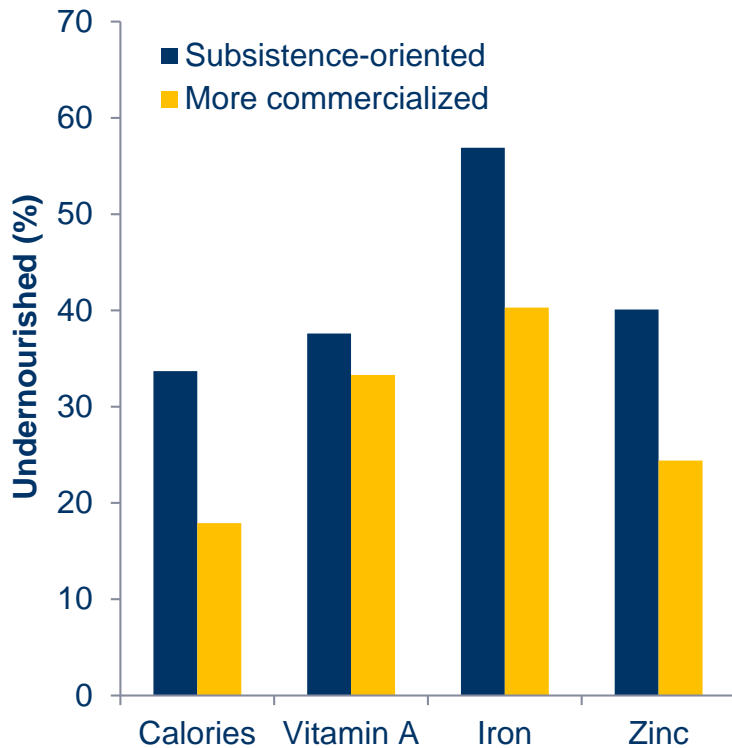
- We need more diverse food systems (macro perspective), but this does not mean that every single smallholder should maximize farm diversity (micro perspective)
- “Optimal” level of diversity is a question of scale
- How to make smallholder farming more nutrition-sensitive?
 - Market access and market functioning (commercialization)
 - Technological innovation



Commercialization and nutrition

Small farms in Kenya

Source: Ogutu, Gödecke, Qaim (2020)



Net effects of commercialization

	Calories (kcal)	VA (µg)	Iron (mg)	Zinc (mg)
Total intake	+680***	+137	+3.4**	+5.5**
Purchased	+459***	+279**	+3.0**	+3.9**
Subsistence	+246	-188*	+0.6	+0.9

- Important source of vitamin A: green leafy vegetables (GLV)
- Local markets for GLV not well developed; more commercialized households do not grow them much

$$Intake_i = \beta_0 + \beta_1 C_i + \beta'_2 X_i + \varepsilon_i$$

➔ Improve markets for GLV

Market-led incentives to grow GLV

- In some parts of Kenya, supermarkets buy GLV from farmers under marketing contracts
- Incentives to grow and sell more GLV
- Farmers with access to a contract benefit significantly (higher incomes)
- Improved nutrition in farm households, including higher consumption of GLV

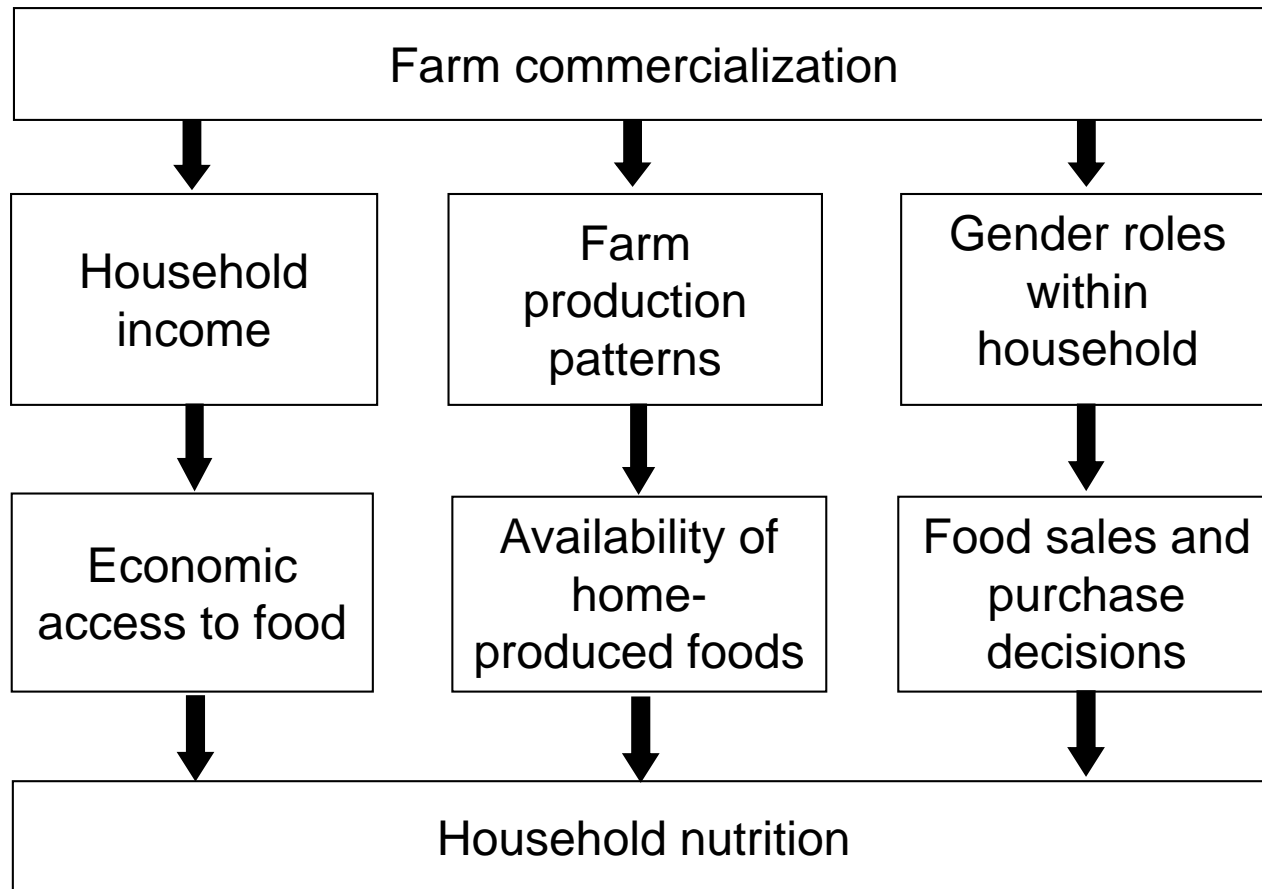


Net effects of supermarket contracts

	Calories (kcal)	Vitamin A (μ g)	Iron (mg)	Zinc (mg)
Total intake	597**	1302***	3.0**	3.2**

Source: Chege, Andersson, Qaim (2015).

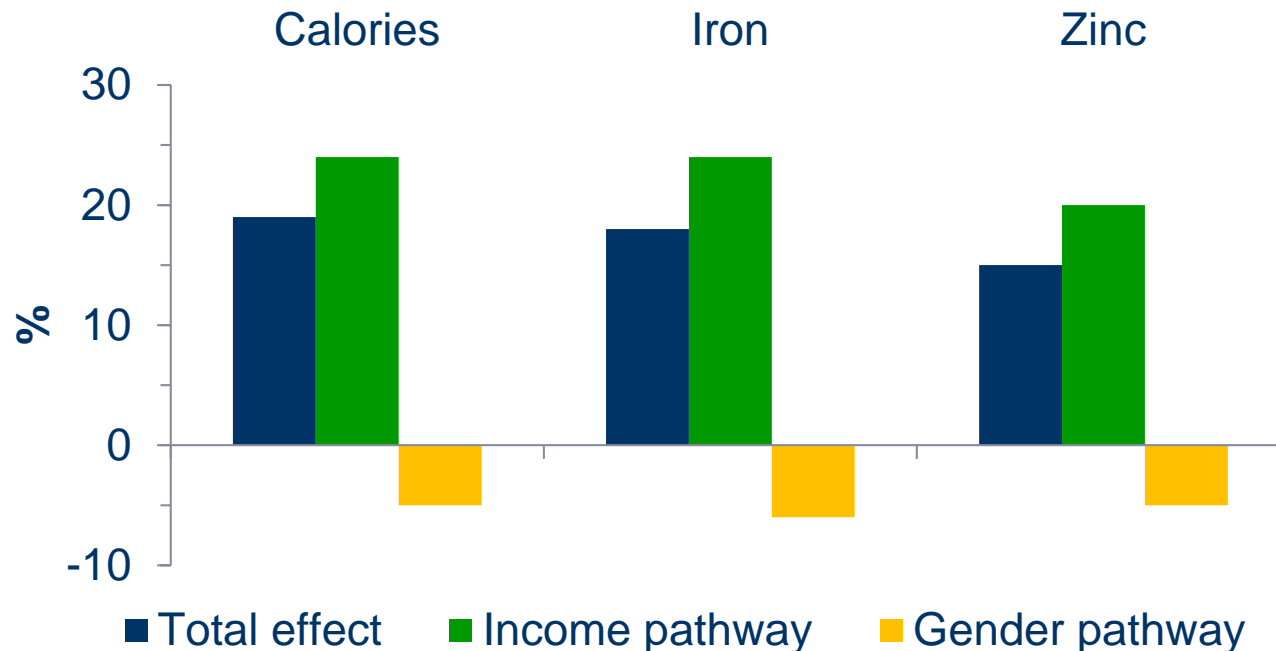
Nutrition effects of farm commercialization (conceptual pathways)



Supermarket contracts in Kenya

Supermarket contracts: income \uparrow vegetables \uparrow female control \downarrow

Total and partial effects of contracts on household diets



Source: Chege, Andersson, Qaim (2015).

Technologies, gender, and nutrition

Mobile phone (MP) revolution in Africa

- Adoption of MP >80% (leapfrog)
- Better information / market access
- Platform for other innovations



Effects on smallholders in Uganda

	Effect
Income	↑ +32%
Nutrition (DDS)	↑
Women's role	↑

	Income	Nutrition
Male MP use	0.19	0.08
Female MP use	0.53***	0.44**

Source: Sekabira and Qaim (2017)

Agricultural technologies

- Numerous studies have analyzed yield and income effects of agricultural technology adoption
- Explicit analysis of effects on diets and nutrition is new
- Recent evidence: If well adapted to smallholder conditions, new breeding and agronomic technologies are crucial to increase resilience and food security

Example of insect-resistant Bt cotton in India

	Net Bt effect
Pesticide use	-44%
Cotton yield	+24%
Household income	+18%
Calorie consumption	+5%
Micronutrient consumption	+7%



Source: Qaim (2020)

Conclusion

1. Agriculture needs to become more diverse: good for nutrition and also for the environment
2. But more diversity is not necessarily better at every scale; smallholder farms are often very (too) diverse anyway
3. Improving market access & functioning (for diverse foods) while strengthening women's roles are key strategies to improve food security and nutrition in the small farm sector
4. Better functioning markets will also help to speed up much-needed technological innovations
5. Analysis of diet/nutrition effects of agricultural interventions still new field that would benefit from more research
6. More integrated research on human and planetary health

Key references

- Chege, C.G.K., C.I.M. Andersson, M. Qaim (2015). Impacts of Supermarkets on Farm Household Nutrition in Kenya. *World Development* 72, 394-407, <https://doi.org/10.1016/j.worlddev.2015.03.016>.
- Gödecke, T., A.J. Stein, M. Qaim (2018). The Global Burden of Chronic and Hidden Hunger: Trends and Determinants. *Global Food Security* 17, 21-29, <https://doi.org/10.1016/j.gfs.2018.03.004>.
- Ogutu, S.O., T. Gödecke, M. Qaim (2020). Agricultural Commercialization and Nutrition in Smallholder Farm Households. *Journal of Agricultural Economics* 71, 534-555, <https://doi.org/10.1111/1477-9552.12359>.
- Muthini, D., J. Nzuma, M. Qaim (2020). Subsistence Production, Markets, and Dietary Diversity in the Kenyan Small Farm Sector. *Food Policy*, <https://doi.org/10.1016/j.foodpol.2020.101956>.
- Qaim, M. (2020). Role of New Plant Breeding Technologies for Food Security and Sustainable Agricultural Development. *Applied Economic Perspectives and Policy* 42, 129-150, <https://doi.org/10.1002/aepp.13044>.
- Sekabira H., M. Qaim (2017). Can Mobile Phones Improve Gender Equality and Nutrition? Panel Data Evidence from Farm Households in Uganda. *Food Policy* 73, 95-103, <https://doi.org/10.1016/j.foodpol.2017.10.004>.
- Sibhatu, K.T., M. Qaim (2018). Review: Meta-Analysis of the Association between Production Diversity, Diets, and Nutrition in Smallholder Farm Households. *Food Policy* 77, 1-18, <https://doi.org/10.1016/j.foodpol.2018.04.013>.
- Sibhatu, K.T., M. Qaim (2017). Rural Food Security, Subsistence Agriculture, and Seasonality. *PLOS ONE* 12, <https://doi.org/10.1371/journal.pone.0186406>.