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31ST TRIENNIAL

Exploring Adoption Effects of Subsidies and Soil Fertility Management in Malawi

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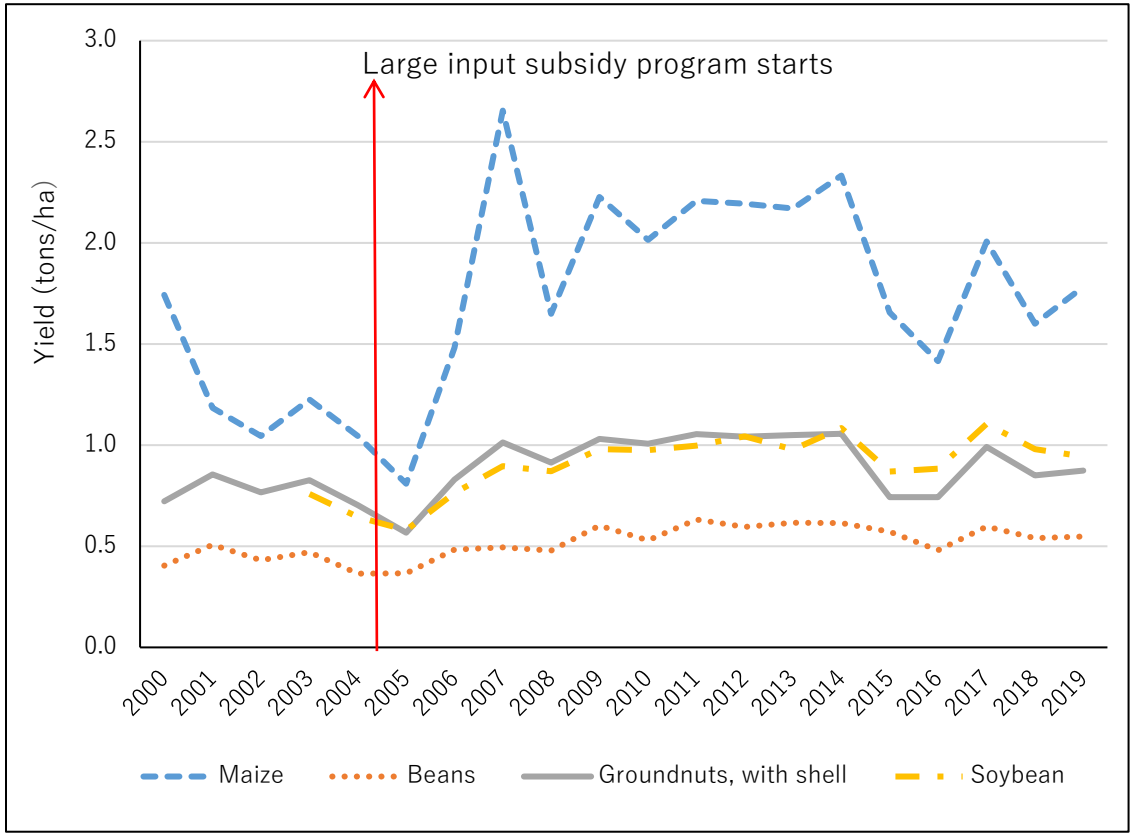
Why is SSA failing to attain food and nutritional security?

- Low use of modern agricultural technologies; e.g., improved seeds and fertilizer
- Soil fertility degradation from monocropping and soil acidification
- Shrinking farm sizes due to high population growth
- In responses, many African governments are:
  - **Subsidizing farm inputs** (e.g., **cereal seeds and inorganic fertilizers**) and
  - Promoting **integrated soil fertility management (ISFM)** technologies

Are farm input subsidies beneficial in SSA?

- Subsidies increase cereal yields but they are still low (Abman & Carney, 2020; Ricker-Gilbert & Jayne, 2017)
- Subsidies improves dietary quality (Smale et al., 2020; Harou, 2018)
- Subsidies crowd out commercial inputs (Ricker-Gilbert et al., 2011)

Maize/legume yields from 2000 to 2019 in Malawi



Data source: FAOstat; http://www.fao.org/faostat/en/#data/QC

Research gaps

- Examine how the Malawi's **farm input subsidy program (FISP)** is related to **ISFM technologies** and explore its (joint) adoption effects on welfare outcomes

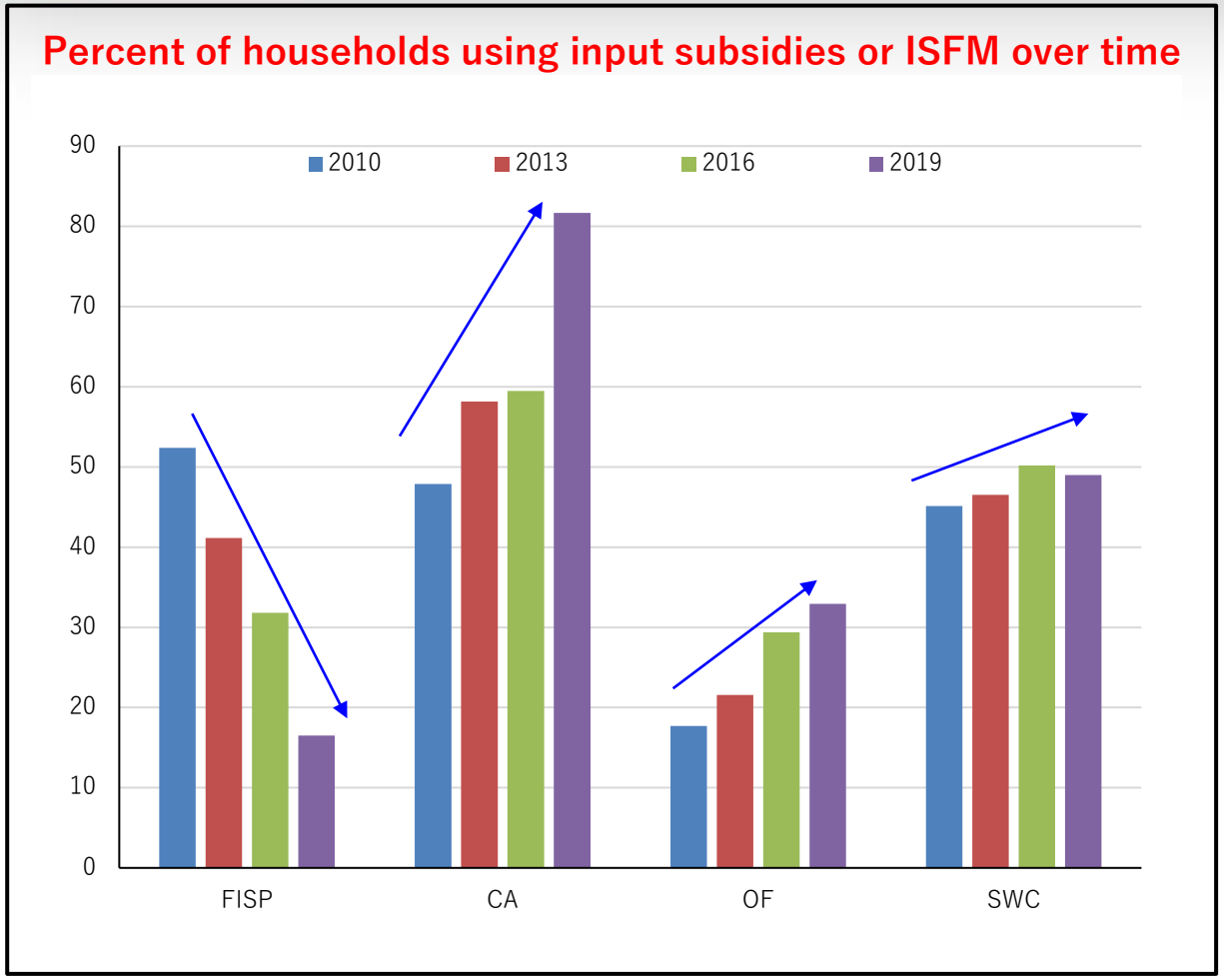
- Few studies have analyzed the link between input subsidies and ISFM:

  - But the evidence is mixed;
    - Subsidies increase/decrease adoption of maize-legume intercropping and organic fertilizers (OF) (Kim et al., 2021; Morgan et al., 2019; Koppmair et al., 2017; Holden & Lunduka, 2012)
  - Most previous studies did not use nationally representative samples
  - None of the studies analyzed joint adoption effects on income and nutrition

Background on Malawi`s FISP

- FISP started in 2004/05 and ended in 2019/20 (GoM, 2021)
- Targeted 0.9-1.5 million smallholder farmers
- Subsidized (64-93% of the market price) inputs like:
  - **Inorganic** (NPK & Urea) **fertilizer** (Two 50 kg bags)
  - **Improved** (hybrid/OPV) **maize seeds** (2-5 kg)
  - **Improved legume seeds** (1-2 kg)
- Now it is called ***Affordable Inputs Program (AIP):***
  - Targeting 3.6 million smallholder farmers
  - Subsidizing cereal seeds only but not legume seeds
  - Use electronic system vs paper voucher for input redemption

Use of ISFM technologies has increased over time



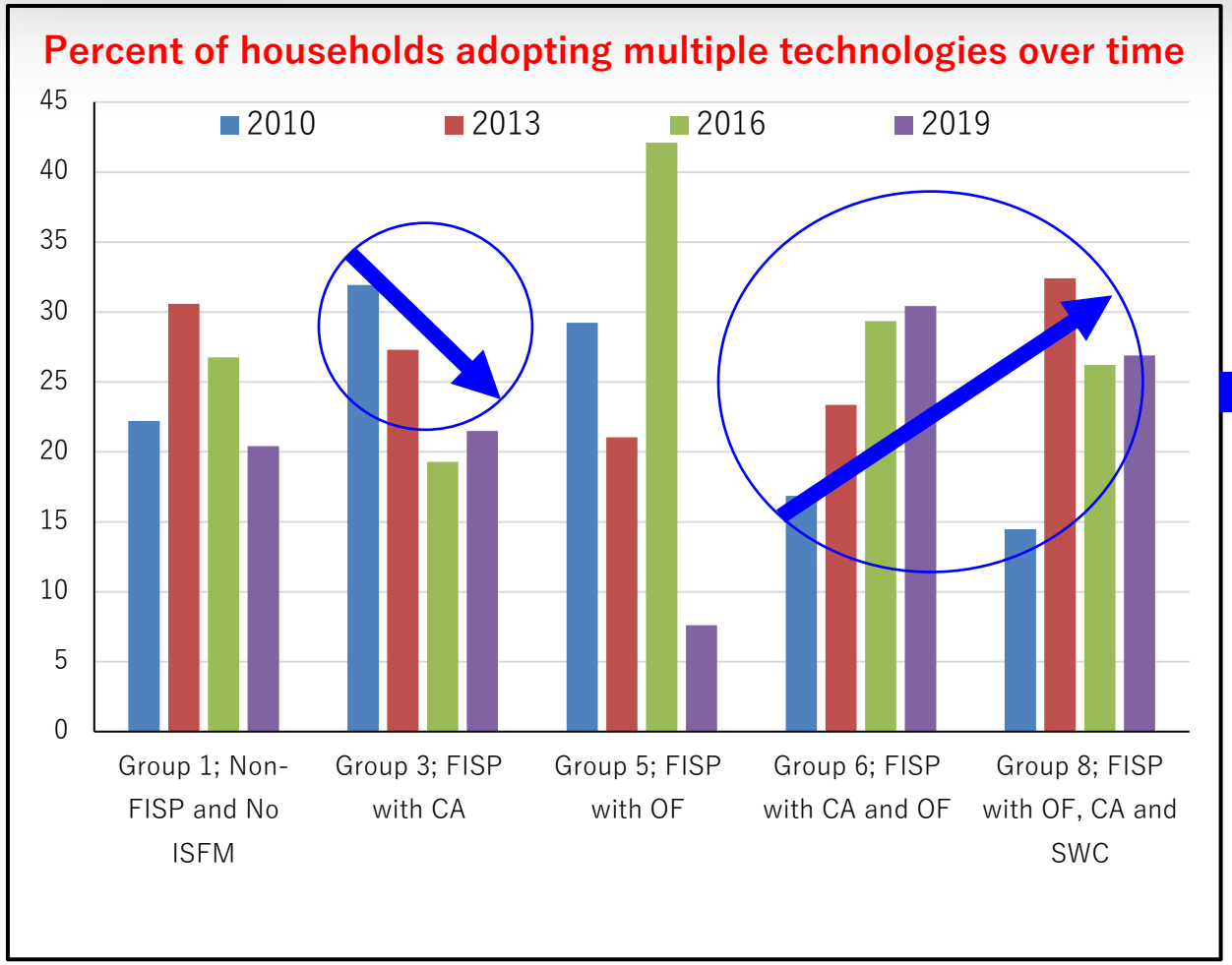
Data source: World Bank Integrated Household Panel Survey (IHPS) data collected in 2010, 2013, 2016 and 2019. N=7034.

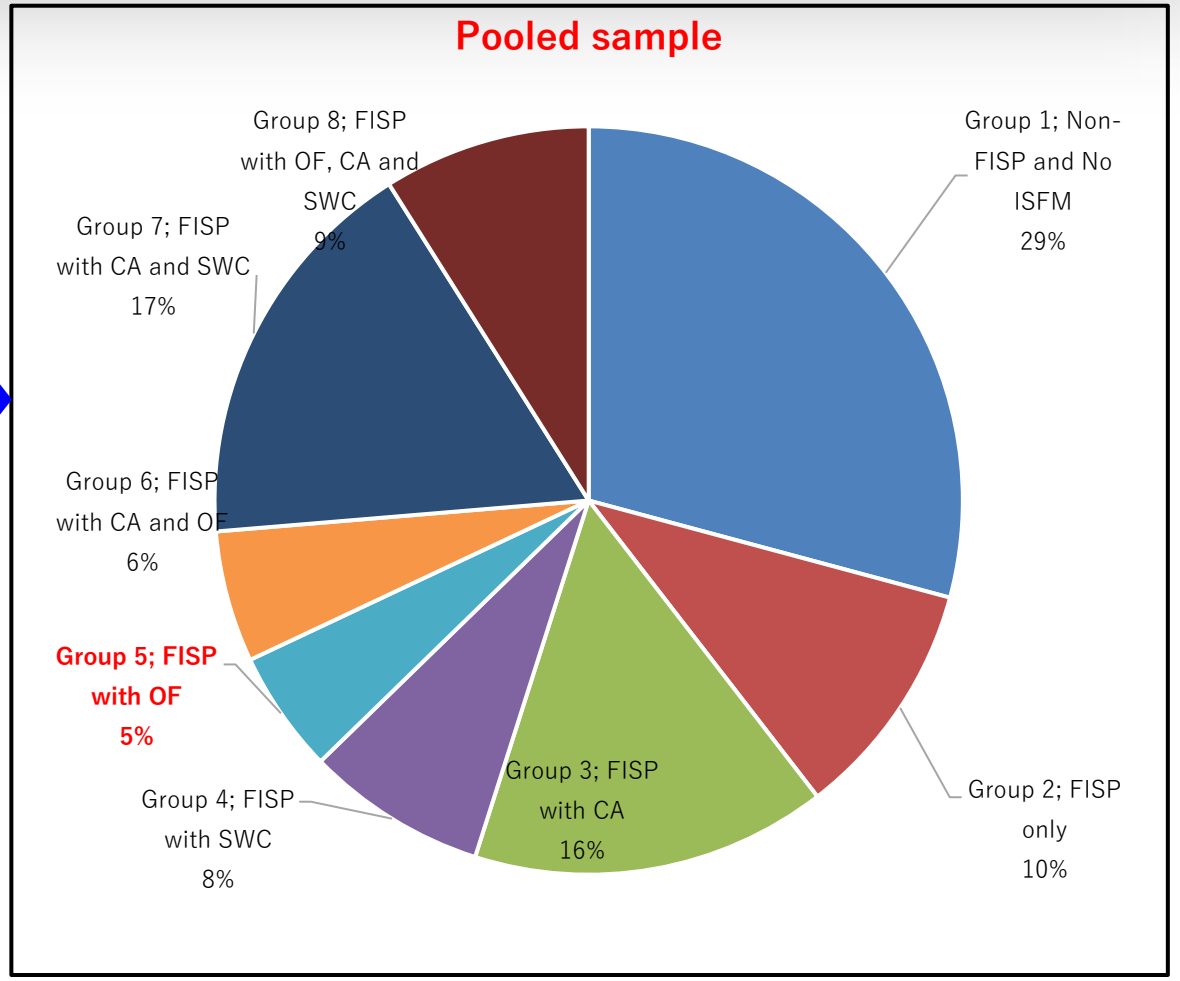
Conservation agriculture (CA)

Organic fertilizer (OF)

Soil & water conservation (SWC)

Use of input subsidies with ISFM is mixed over time





Data source: World Bank Integrated Household Panel Survey (IHPS). N=3238.

Do subsidies increase or decrease use of ISFM? Model specification

- Model specification (generic):

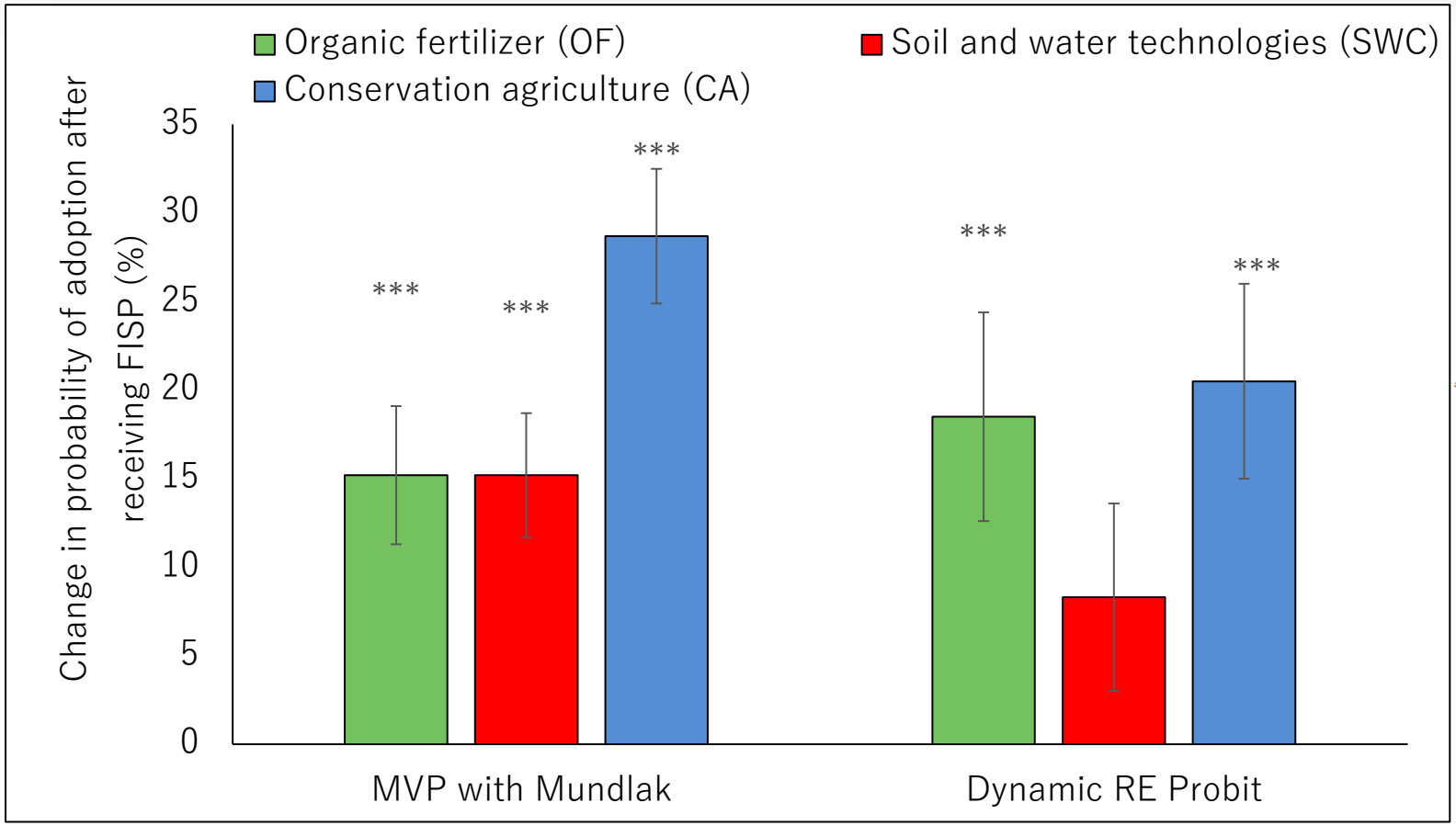
$$\boldsymbol{y}_{ht} = \alpha + \beta \boldsymbol{FISP}_{ht} + \gamma X_{ht} + \varepsilon_{ht}$$

  - where $\boldsymbol{y}_{ht}$ is either CA or SWC technology or OF for household h at time t
  - Participation in $\boldsymbol{FISP}_{ht}$; =1 if a household had redeemed subsidized inputs and zero otherwise
  - Household (X_{ht}) characteristics: e.g., assets value (MK/ha), extension (1/0)

- We used two models: Multivariate probit and dynamic random effects probit

Input subsidies increase use of ISFM technologies

Effects of participating in farm input subsidies on use of ISFM



Notes: Coefficient estimates from multivariate probit (MVP) with mundlak and dynamic random effects (RE) probit are shown with standard error bars. *** p < 0·01. N=7029. Data source: IHPS data.

- Input subsidies increased use of CA practices; 20-29%
  - Subsidized legume seeds increased land under maize-legume intercropping
- Input subsidies increased use of SWC; 15%
  - SWC are used as complements
- Input subsidies increased use of OF; 15-18%
  - OF are used as complementary inputs

Effects of using subsidies with ISFM on income and nutrition? Model specification

- Model specification (generic):

$$\boldsymbol{y}_{ht} = \alpha + \beta \sum_{j=2}^{j} \boldsymbol{Group}_{ht} + \gamma X_{ht} + \varepsilon_{ht}$$

  - $\boldsymbol{y}_{ht}$ is crop income/nutritional outcome for household h at time t
  - $\boldsymbol{Group}_{ht}$ is adoption combinations for FISP with ISFM as shown in slide # 6
  - Household (X_{ht}) characteristics: e.g., assets value (MK/ha), extension (1/0)

- We used two models: Multinomial endogenous treatment effects (METE) and Mundlak regression

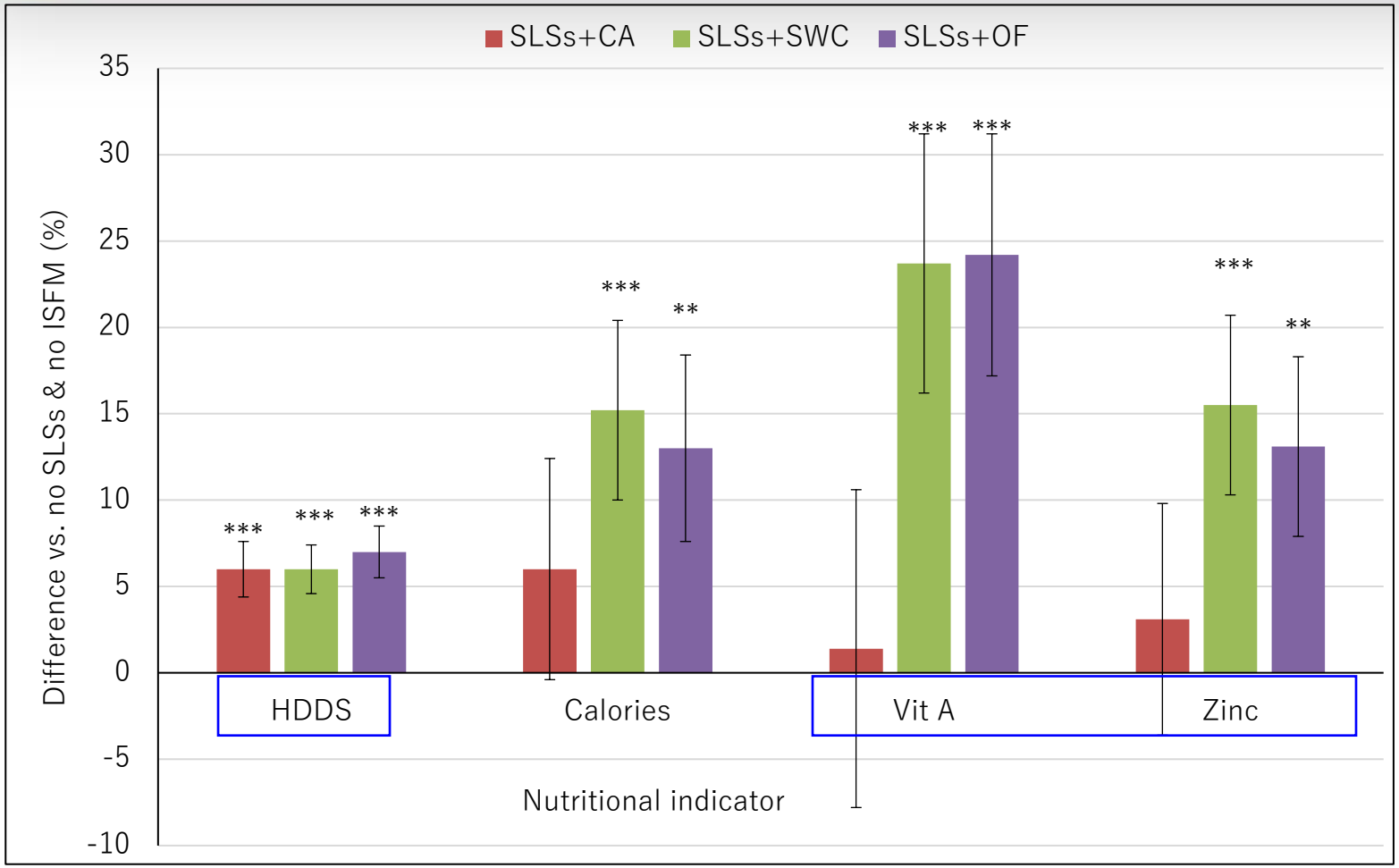
Use of input subsidies with ISFM increases income

Dependent Variable (IHS)	Maize Income (MK/ha)		Gross Value of Production (MK/ha)	
Estimator	Mundlak	METE	Mundlak	METE
	(1)	(2)	(3)	(4)
Group 2; Input subsidy (FISP) only	2.36***	3.76***	2.02***	3.12***
	(0.25)	(0.56)	(0.23)	(0.55)
Group 3; FISP+CA	2.87***	4.07***	2.46***	3.65***
	(0.22)	(0.32)	(0.21)	(0.31)
Group 4; FISP+SWC	2.63***	2.61***	2.20***	2.10**
	(0.24)	(0.78)	(0.22)	(0.95)
Group 5; FISP+OF	2.57***	3.34***	2.03***	2.65***
	(0.28)	(0.41)	(0.24)	(0.32)
Group 6; FISP+CA+OF	3.14***	3.42***	2.51***	2.94***
	(0.23)	(0.38)	(0.21)	(0.29)
Group 7; FISP+CA+SWC	2.95***	2.56***	2.59***	2.28***
	(0.22)	(0.41)	(0.20)	(0.36)
Group 8; FISP+CA+SWC +OF	3.28***	3.73***	2.78***	3.02***
	(0.25)	(0.42)	(0.22)	(0.38)
Household controls	Yes	Yes	Yes	Yes

Notes: CA, SWC, and OF, denotes conservation agriculture, soil and water conservation technologies and organic fertilizer, respectively. IHS, inverse hyperbolic sine transformation. Coefficient estimates from Mundlak regressions and METE with the Mundlak approach are shown with robust standard errors clustered at household level in parenthesis . *** $p < 0.01$. N=3235. Data source: IHPS data.

- Input subsidies with ISFM increased crop income
  - FISP with SWC increased maize yield by 21-35%
- Maximum benefits are from joint use of input subsidies and three ISFM

Use of input subsidies with ISFM improves nutrition



Notes: HDDS, household dietary diversity score. Vit A, Vitamin A. Coefficient estimates from Mundlak and Poisson (for HDDS) regressions are shown with standard error bars. *** $p < 0{\cdot}01$, ** $p < 0{\cdot}05$. N=1678. Data source: IHPS data.

- Subsidized legume seeds (SLSs) with ISFM increased dietary diversity; 6%
- SLSs with ISFM increased micronutrient consumption; 13-24%
  - **Subsidized maize seed and fertilizer with ISFM** increased Vit A consumption; 9%

Take home message

- Farm input subsidies are associated with higher use of ISFM technologies
- Joint use of FISP and ISFM increased income and micronutrient consumption
- Promoting use of input subsidies with ISFM is key to improve nutrition

Possible policy interventions

- Enhance use of organic inputs in input subsidy programs (ISPs)
- Include improved legume seeds in ISPs to improve household nutrition
- Promote use of ISFM technologies concurrently with ISPs
- Invest in agricultural productivity through soil health programs

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Thank you

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