



Agricultural labor, technological change and structural transformation: a measurement agenda

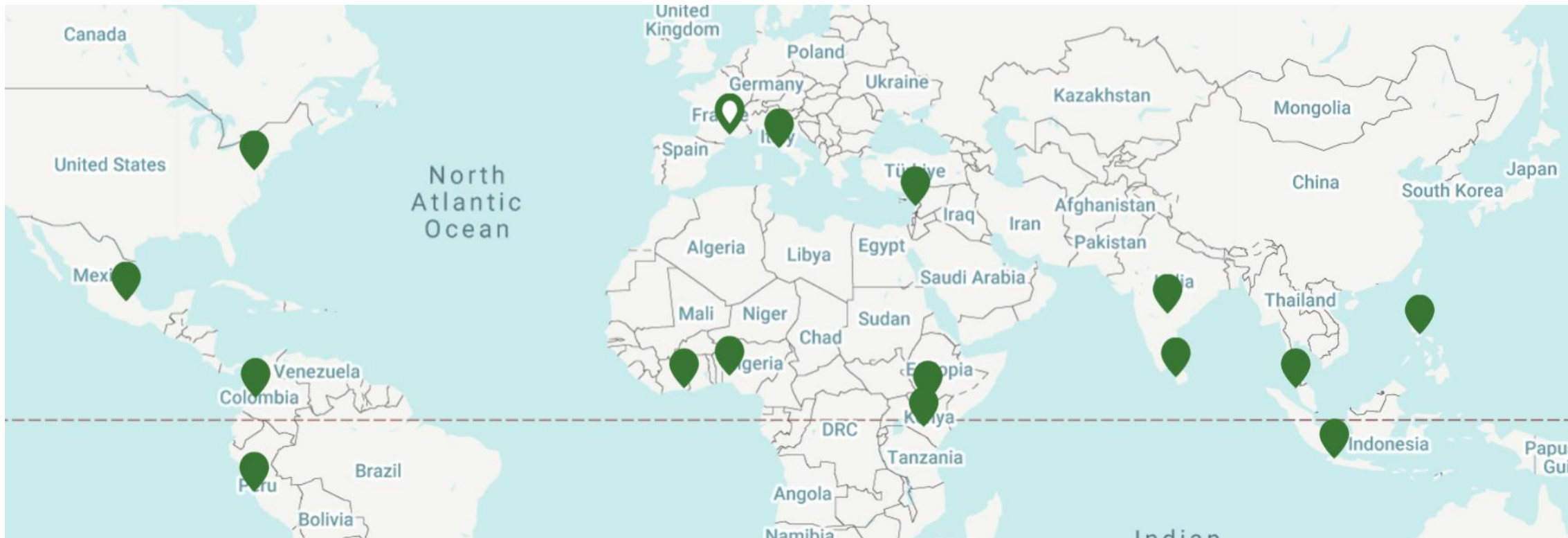
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CGIAR Standing Panel on Impact Assessment

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Better Data for Better Jobs and Lives: Innovations in Survey Measurement in the Age of AI

- CGIAR is a *global research partnership for a food-secure future dedicated to transforming food, land, and water systems in a climate crisis*
- SPIA is an independent body of academics, supported by small full-time staff, and reporting directly to highest level authority (“System Council”) of CGIAR
- CGIAR centers distributed throughout the world (IFPRI being the closest...)

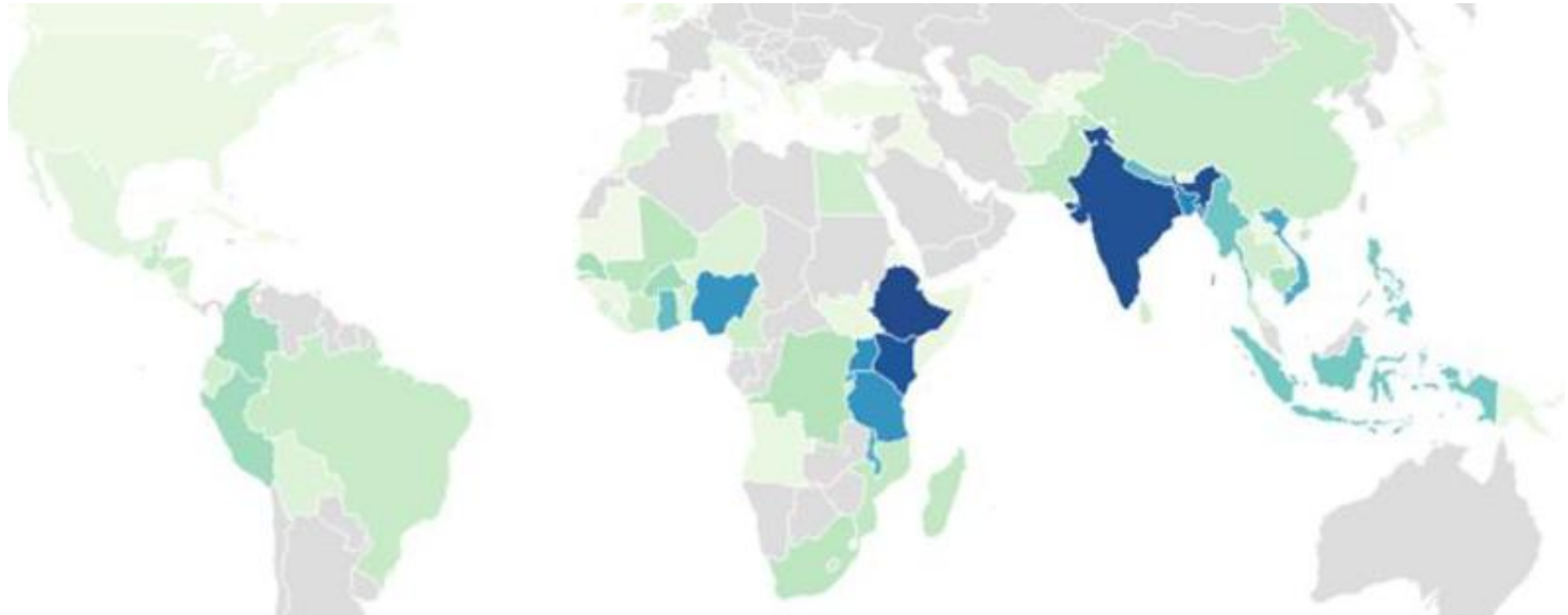


CGIAR Country studies

Research effort is not randomly distributed throughout the world

Locations of self-reports of outcomes from centers / programs 2017-2020

Zero to fewest to **most**



Main idea: Embed data collection protocols about **use of CGIAR-related innovations** into existing, well-institutionalized, nationally-representative household surveys

CGIAR Country studies

Ethiopia

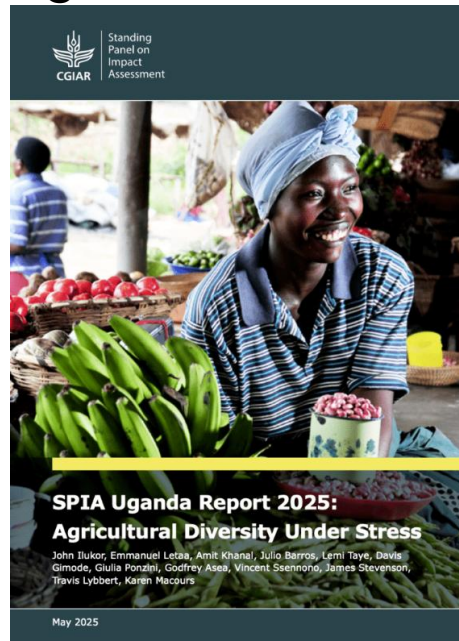


With CSA/ESS via LSMS-ISA

ESS waves 4 and 5

Data online

Uganda



With UBOS via LSMS-ISA

1st wave of new UHIS

Waiting for UBOS

Viet Nam

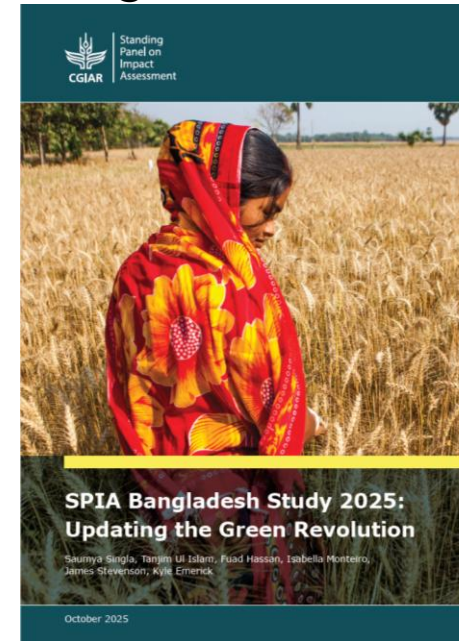


With GSO

Multiple waves of VHLSS

Limited public data available

Bangladesh



With IFPRI

4th wave of BIHS

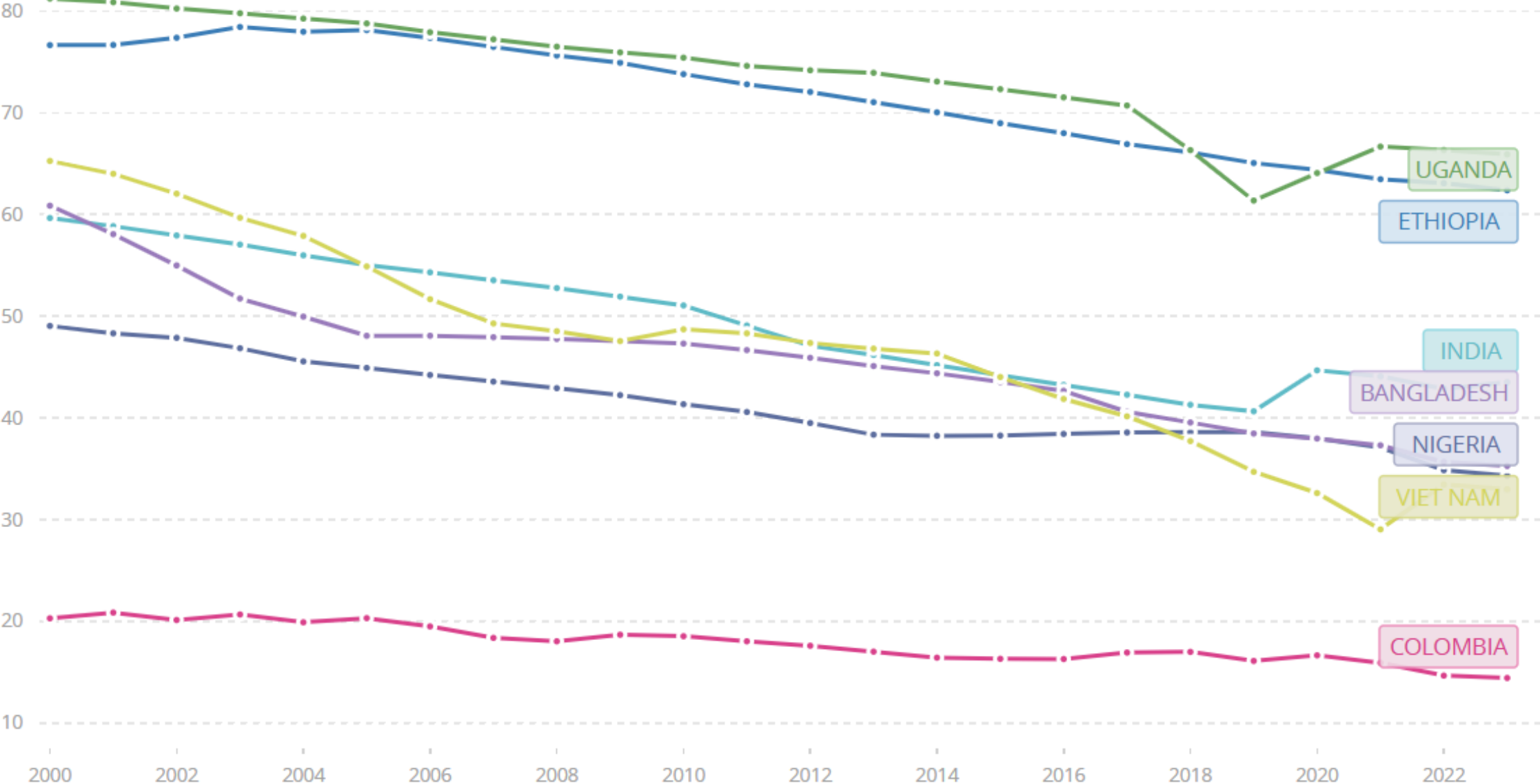
Data coming soon

CGIAR Country studies

- Starting Jan 2025, new model via research consortia
- Initial 3-year contract for min. one round of nationally-representative data (2026/27)
- Building on prior panel waves or setting stage for new panels
- **Unique opportunity** to partially standardize labor modules across multiple countries simultaneously

Country	PIs	Lead Institutions
Ethiopia	Tanguy Bernard Kaleab Baye	U Bordeaux Addis Ababa University
Uganda	Leah Bevis Jeff Michler	Ohio State U Arizona
Bangladesh	Andrew Bell Martina Occelli M. Saiful Islam	Cornell ETH Zurich BAU
Viet Nam	Matin Qaim Tung Nguyen	U Bonn
Nigeria	Yonas Alem	U Cape Town
India (cluster of states in North-East)	Madhura Swaminathan Gaurav Datt	Indian Statistical Institute Monash
Colombia	Rachid Laajaj	U de los Andes

% total employment in agriculture (ILO estimates, data.worldbank.org)



Agriculture's role in structural transformation?

Following de Janvry and Sadoulet (2019)

Stages of transformation	Underlying processes
1. Asset building	Access to land and human capital for the landless and for smallholder farmers
2. Green Revolution	Adoption / diffusion of new seeds and fertilizers for staple crops
3. Agricultural transformation	Access to water for irrigation Agricultural diversification toward higher-value crops Development of value chains and contracting
4. Rural transformation	Mechanization and land concentration Growth of the rural non-farm economy
5. Structural transformation	Rural-urban migration Urban-based industrialization and services

Agriculture's role in structural transformation?

Stages of transformation	
1. Asset building	Uganda <ul style="list-style-type: none">• Stuck. Few signs of progress in agriculture• Fragmentation of land
2. Green Revolution	Ethiopia <ul style="list-style-type: none">• Intensification of production of main staple crops is happening• Successful diversification in high-value crops (horticulture, fruit trees, poultry)
3. Agricultural transformation	Bangladesh <ul style="list-style-type: none">• Mechanization service sector booming• Aquaculture for urban markets• Movement in and out of agriculture over time
4. Rural transformation	Viet Nam <ul style="list-style-type: none">• Combine harvesters now dominate rice production (75% adoption in 2023)
5. Structural transformation	

Why Africa's story will be different (Gollin, 2021)

- No single commodity in Africa matches the **importance of rice** in Green Revolution Asia
- Africa's cities far **less dependent on their agricultural hinterlands** than in Green Revolution Asia
 - Dietary shifts linked trade in processed / prepared foods
- Urban growth **may not create** strong linkages to rural areas
 - Rural and urban areas may become quite economically separated
- Agricultural technologies need to be **very specifically geographically** targeted
 - A problem for Africa given its deep heterogeneity in agroecology
 - Only very limited examples of farmers exerting high degrees of control (i.e. greenhouses / irrigation) over the production environment

Quiet quitting on agriculture?

Quiet quitting: “the practice of doing the minimum amount of work required for one’s job” (Merriam-Webster)

Stagnation or decline in agricultural yields over past two decades across favorable agricultural lands close to cities in six LSMS-ISA countries (Wollburg et al, 2024, PNAS)

- Ethiopia, Malawi, Mali, Niger, Nigeria, Tanzania
- Driven by reduction in allocation of farmers’ **own labor** to their farms (Udry, 2024, Kuznets Lecture):
 - Number of days worked in agriculture
 - Number of hours per day worked on farms
- Options outside agriculture are improving – substituting work in agriculture for something better
- Yield declines most rapid in:
 - areas that have more active labor markets
 - better connected to growing urban areas
 - closer to increases in population density
- Traditional view would suggest these things all increase agricultural yields
- Find that growth outside agriculture leads to declining yields in agriculture. Off-farm employment opportunities – jobs, informal self-employment – taking people at least partially out of agriculture.

But... lasting ties to agriculture

- Sectoral transitions by individuals (Hossain and Michelson, 2025)
 - **Individuals cycle in and out** of agriculture over time
 - Ethiopia, Uganda, Tanzania: Low ag exit rates
 - Malawi, Nigeria: Higher movement out of ag, particularly for males
- Backward ties from urban dwellers to agriculture are not severed – **informal insurance** (Michuda, 2024)
 - Matches Uber drivers in Kampala to rural weather events
 - Stronger shocks in growing period of three main crops associated with working 20% more in the week of a shock; hours decline steeply the following week
 - Drive more intensively, increase income if a drought event occurs
 - Leave the platform in the case of a flood
- **Remittances** received from a migrated family member
 - Ambiguous, heterogenous effects on agricultural participation and production
- **Preferences** for ag-related work vs non-ag work by laborers
 - Heterogenous across countries
 - For landless manual laborers, ag work may be preferable to work in other sectors (as in Baysan et al, 2024) so people need to be paid more for non-ag work for the disamenity

Cross-cutting research questions

For Ethiopia, Uganda, Nigeria, India, Bangladesh, Viet Nam, Colombia...

- 1. Do we observe reductions in farm HH's own labor to agriculture?** (following Udry, 2024)
 - a. Over multiple waves of a panel
 - b. Over space, in proximity to centers of employment
 - c. By individuals age and gender

 - We have dataset from Wollburg et al (2024) to build on for ETH, UG and NG.
 - Add round(s) for those, while bringing contrast to India and Bangladesh.
 - Colombia and Viet Nam likely already past an inflection point in their structural transformation (at least for parts of the country) so make useful comparisons.
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- 2. Do we observe increased adoption of labor-saving innovations over time?**

RQ 1. Farmers' own labor allocation to agriculture

Need to protect the **individual-household** panels WITH rich agricultural data
Serious headwinds

i.e. labor modules with combination of:

- 7-day recall on days and hours for MAIN JOB (intensive margin)
- 12-month recall on all economic activities (extensive margin)

But, **intra-year dynamics**

- Peaks – farming household's ability to meet periods of peak labor demand
- "Slack" times?

High frequency data on labor demand and labor supply on a **sub-sample** of our panels?

Intra-household allocation

- Whose work?

Proxy / objective measure:

- Weed pressure in agricultural fields
- Lots of commercial AI-powered applications for detecting weeds in fields (for targeting pesticide applications)
- Enumerator photos at multiple points in time

RQ 2. Adoption of labor-saving innovations

Agricultural research and development processes... often focused on increasing productivity through yield-enhancing technologies. But such technologies may not be adopted, simply because they are not profitable or because farmers are maximizing other objectives [such as] labor productivity.

Macours (2019, ARRE)

One clear RCT example in the ag adoption literature: Rainwater harvesting tanks for dairy farmers in Kenya (Jack et al, 2019)

Asset collateralization of loans took take-up from 2% to 42%

No more travelling to collect water

- *Ex-ante* coding of innovations as potentially labor-saving based on targeted qualitative data collection
- Explore temporal and spatial patterns of adoption as RQ1

Reducing peak demand

Pesticides (immediate substitute for weeding)

Mechanization (only after long lag times)

Creating more slack time

Early maturing crops (shorter season can free up family members to supply off-farm labor)

Agroforestry replacing annual crops (pruning and harvesting peaks with lots of downtime between)

Thanks

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Labor-related insights from SPIA reports

Viet Nam

1977: Viet Nam imported five Russian CBHs. Each weighed 11 tonnes, so struggled with soft soil

1980 – 1999: Attempts to make local models faced similar issues (breakdowns, long repair times)

2000 – 2005:

Economic growth unleashed from earlier Doi Moi reforms (1986), increasing rural labor shortage
Renewed efforts by government but CBH models still struggled with soft soils, lodged crops, poor machine reliability

2006 – 2011:

Five annual contests organized by Ministry of Ag.
CBHs judged on field capacity, losses, paddy cleanliness, reliability, harvesting cost, stability
Contests spurred significant improvements.
Influx of imported Chinese models with some innovations (e.g. rubber tracks for soft soils)
Reliability problems remained

2011 – 2014: Kubota (Japanese) CBH came in, soon became dominant, quickly attaining 85% of CBH market share

2023: Combine harvesters used by 75% of all rice-growing households