



AGRICULTURE Sector Seminar

Alison Fahey | Islamic Development Bank
13 October 2015

Overview

- Constraints in Agriculture
- Policy Lessons I: **Credit**
- Policy Lessons II: **Risk**
- Coffee break
- Policy Lessons III: **Information**
- Policy Lessons IV: **Input/Output Markets**
- Conclusion

Constraints

Credit

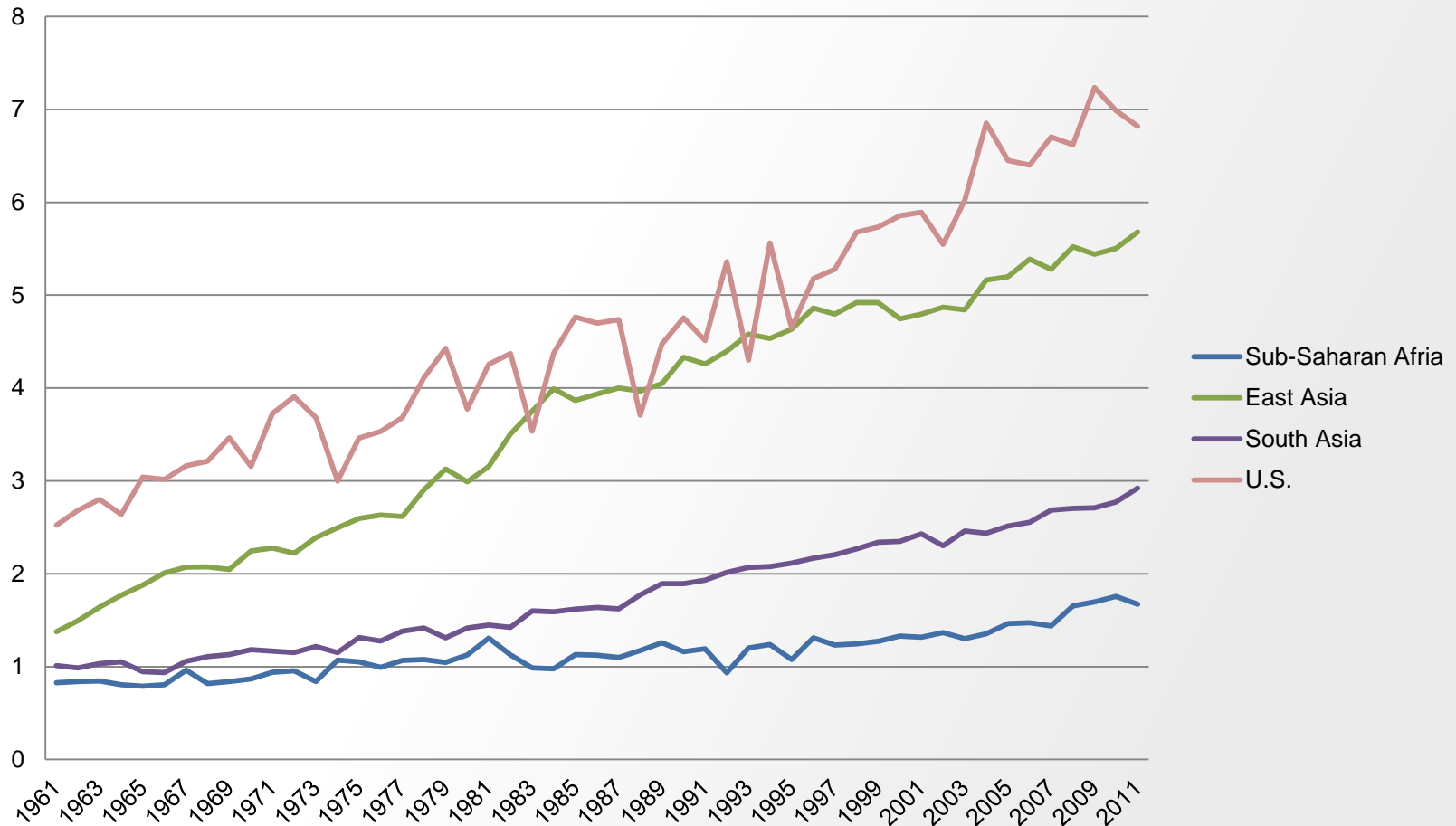
Risk

Information

Inputs &
Outputs

Conclusion

Cereal Yields (Metric Tons/Hectare)



Constraints

Credit

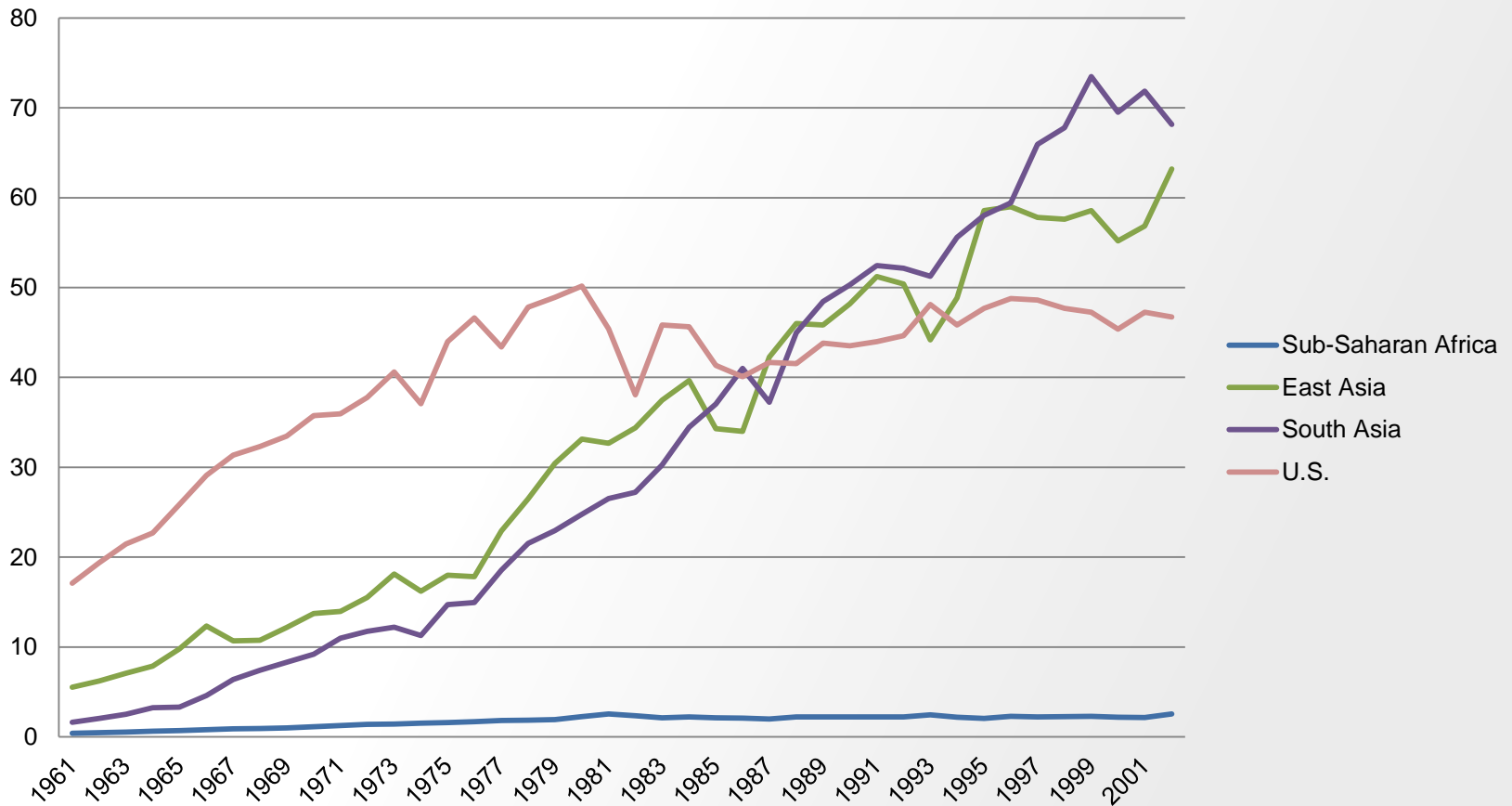
Risk

Information

Inputs &
Outputs

Conclusion

Fertilizer Use (Metric Tons/Hectare)



Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

What is hampering technology adoption?

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Market Inefficiencies

1. Credit markets
2. Risk markets
3. Information
4. Input and output markets
5. Externalities
6. Labor markets
7. Land markets

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Overview

- Constraints in Agriculture
- Policy Lessons I: **Credit**
- Policy Lessons II: **Risk**
- Coffee break
- Policy Lessons III: **Information**
- Policy Lessons IV: **Input/Output Markets**
- Conclusion

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Preview: Credit

- Farmers' credit needs are **different** from non-agricultural microcredit customers
- Successful credit interventions
 - Reduce risk for lenders
 - Account for seasonal variation in income (and prices)
- Credit constraints exist, but may not be the primary barrier to increasing **profitability**

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Agricultural credit is different

- Traditional microfinance model is inappropriate
 - Immediate repayment
 - Group liability
 - Mostly women
- Few self-sustaining agricultural credit markets have emerged
 - Few agriculture-specific products
 - Low demand from farmers

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Credit constraints in action



There is **no credit available**



Farmers **struggle to save income** from one harvest to the next



Farmers don't have **collateral** to back a loan



Farmers lack **financial literacy**

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Take-up is low



17%

Morocco: 17%, with no other lenders in the area

Sierra Leone: 25%, 50% lower than break-even rate



25%



21%

Mali: 21%, compared to full take-up of cash grants

Beaman et al. 2014; Casaburi et al 2014; Crepon et al 2015;

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

So how can we make credit work?

- Supply side
 - Reduce risk for lenders
- Demand side
 - Provide products that account for seasonality in production cycle

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Reducing risk for lenders

- Provide **improved information** about borrowers
 - Credit bureaus
 - Biometric identification (e.g. fingerprinting)
- Offer **flexible** collateral arrangements
 - Asset collateralization
 - Crops held in storage

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Fingerprinting borrowers in Malawi

- Lack of information makes banks unwilling to lend
 - Cannot credibly threaten to cut off future credit
- Treatment group fingerprinted during application process
 - Biometric identification cannot be lost, forgotten, stolen



Gine, Goldberg, and Yang 2011

Constraints

Credit

Risk

Information

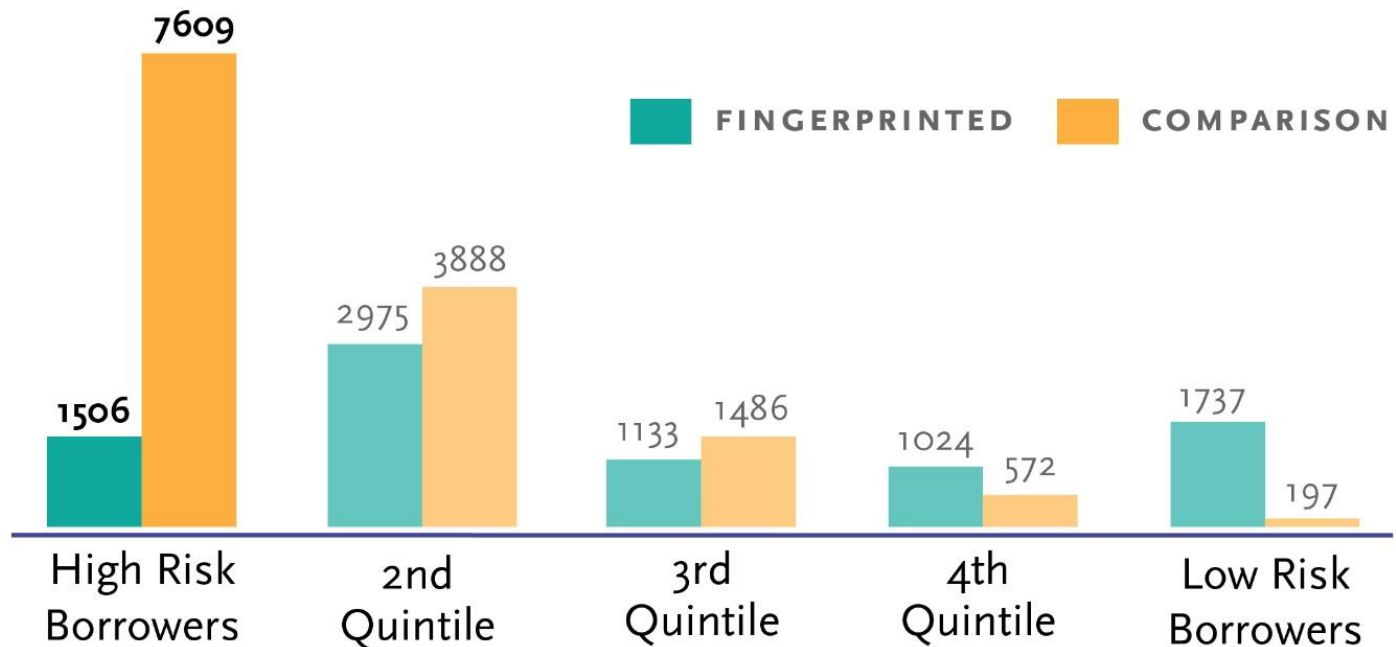
Inputs &
Outputs

Conclusion

Particularly effective for high risk borrowers

UNPAID BALANCE (MWK) 2 MONTHS AFTER LOAN WAS DUE

STATISTICALLY SIGNIFICANT DIFFERENCES ARE BOLD



Gine, Goldberg, and Yang 2011

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Rainwater harvesting tanks in Kenya

- Tanks for dairy farmers to collect water for cattle
- Variations in loan offers to purchase tank
 - Standard: 100% secured
 - 25% deposit, tank as collateral
 - 4% deposit, 21% pledge from guarantor, tank as collateral
 - 4% deposit, tank as collateral



De Laat et al. forthcoming

Constraints

Credit

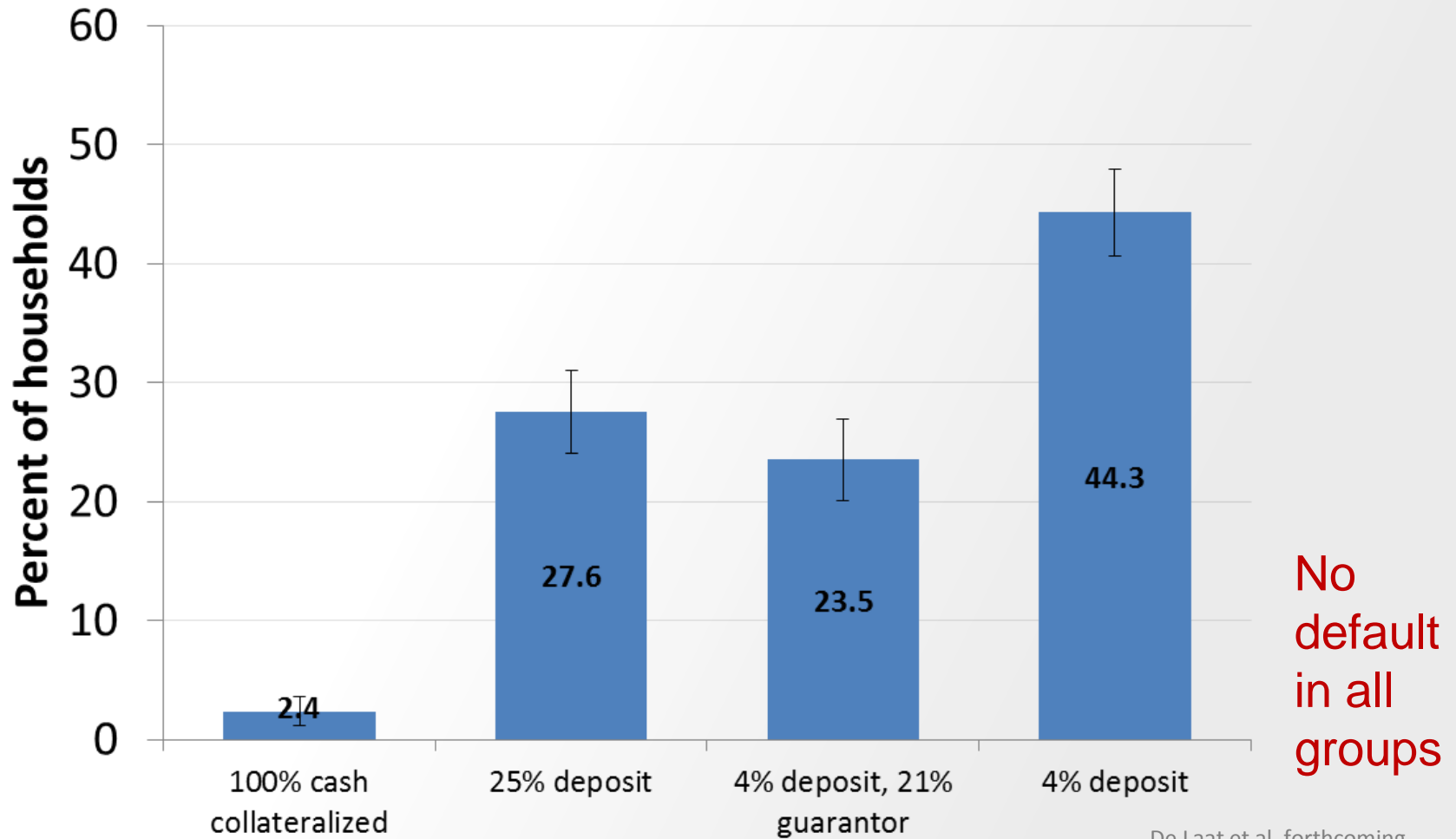
Risk

Information

Inputs &
Outputs

Conclusion

Increased take-up with no change in default



Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Rainwater harvesting tanks in Kenya

- Improved milk production, specifically for those without access to water
- Changes in time use
 - Girls spent less time fetching water
 - Boys spent less time tending livestock
 - Girls' **school enrollment** increased by 4% from base of 95%
- Testing concept in Rwanda

De Laat et al. forthcoming

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Designing products for seasonality

- Delaying **repayment** of loan until after harvest
- Loans for **consumption** during “hungry season”
- **Storage loans** to allow farmers to take advantage of price fluctuations
- **Savings products** to save from harvest until planting time

Constraints

Credit

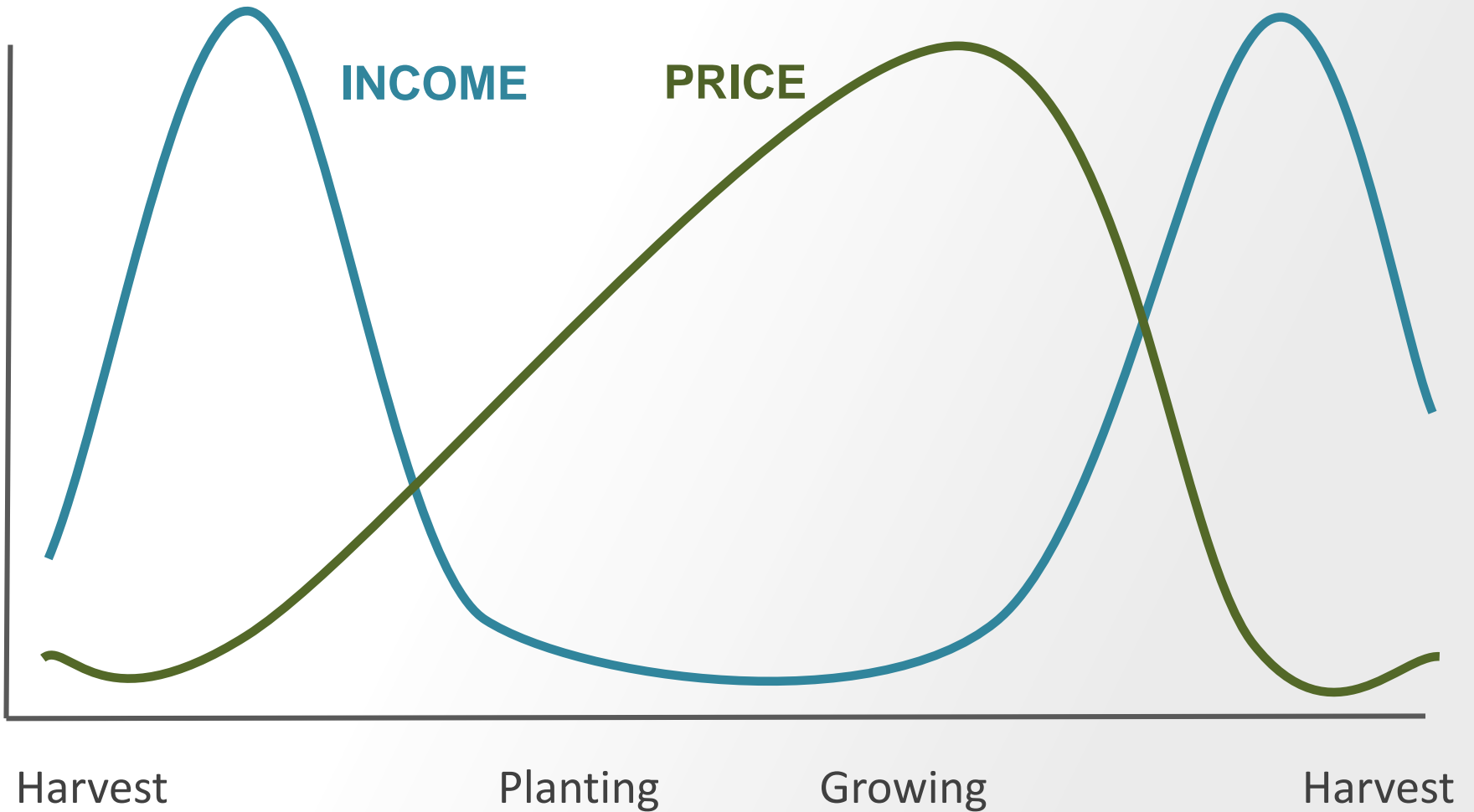
Risk

Information

Inputs &
Outputs

Conclusion

Seasonal cycles to production and prices



Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Harvest-time loans in Kenya

- Loans allowed farmers to:
 - Buy/keep maize at low prices
 - Store while prices rose
 - Sell later at higher prices
- Led to increased profits
 - Concentrated in areas where fewer farmers offered loans



Burke 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Credit can affect agricultural activity...

- Mali
 - Households offered loans **spent more** on fertilizer, insecticides
- Morocco
 - Loans used to **invest** in agriculture and husbandry (purchase cattle or sheep)
- Kenya
 - Farmers switched to **higher-value** export crops
- Malawi
 - Farmers allocated **more land** to paprika, a cash crop

Ashraf et al 2009; Beaman et al 2014; Crepon et al 2015; Yang et al 2012

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

...but inconclusive evidence on profits

- Mali
 - Cash grants **increased** farm profits; loans increased value of output but not profits
- Morocco
 - Agricultural income increased, other sources decreased
- Kenya
 - Temporal arbitrage **increased profits**
- Sierra Leone
 - Storage loans had **no effect** on profits

Beaman et al 2014; Crepon et al 2015; Burke 2014; Casaburi et al 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Maybe credit is not the binding constraint

- Compared cash grants, weather index insurance, or combination
 - Northern Ghana
- Investment and activity increased about equally in groups given cash and groups given insurance
 - When risk constraint relieved, farmers were able to find credit from other sources



Karlan et al 2013

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Digging for Answers

ABDUL LATIF JAMEEL
Poverty Action Lab
TRANSLATING RESEARCH INTO ACTION

Abdul Latif Jameel Poverty Action Lab



Karlan et al 2013

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Summary: Credit

- Farmers' credit needs are **different**
- Take-up is often **low**
- Promising interventions
 - **Reduce risk** for lenders
 - Account for **seasonal distribution** of income
- Access to credit affects farm activities, but mixed evidence on profit
 - Other constraints may be binding

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Overview

- Constraints in Agriculture
- Policy Lessons I: **Credit**
- Policy Lessons II: **Risk**
- Coffee break
- Policy Lessons III: **Information**
- Policy Lessons IV: **Input/Output Markets**
- Conclusion

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Preview: Risk

- Risk matters
 - Farmers make **conservative** production decisions to self-insure
- Low demand for **micro-insurance**
 - In particular weather index insurance
- Search for alternative approaches to risk mitigation
 - Promising early results on **risk-mitigating crops**

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

How does risk constrain adoption?

- Agriculture is inherently risky activity
 - Farmers may lose large portion of harvest to extreme weather event
 - Weather and disease risks are **aggregate**, affecting all farmers in geographic area
- Without any way to mitigate or insure risks, investment in crops or technologies appears to be an unsafe gamble
 - Higher-value crops may also be more sensitive to weather
- Exacerbated by behavioral barriers: **risk aversion** and **ambiguity aversion**

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Formal insurance could protect farmers

- Agricultural insurance to hedge risk ubiquitous in developed countries
 - Large number of small farmers, poor regulatory environments make most traditional products **ill-suited** to smallholders
- Weather index insurance as innovation to insure smallholders
 - Payouts made on observable variable (e.g. rainfall)
 - Avoids some **disadvantages** of conventional insurance: lengthy claims process, higher cost per insured farmer, opportunity to for policyholder to manipulate
 - But has **basis risk**: official observation does not accurately predict farmers' losses

Constraints

Credit

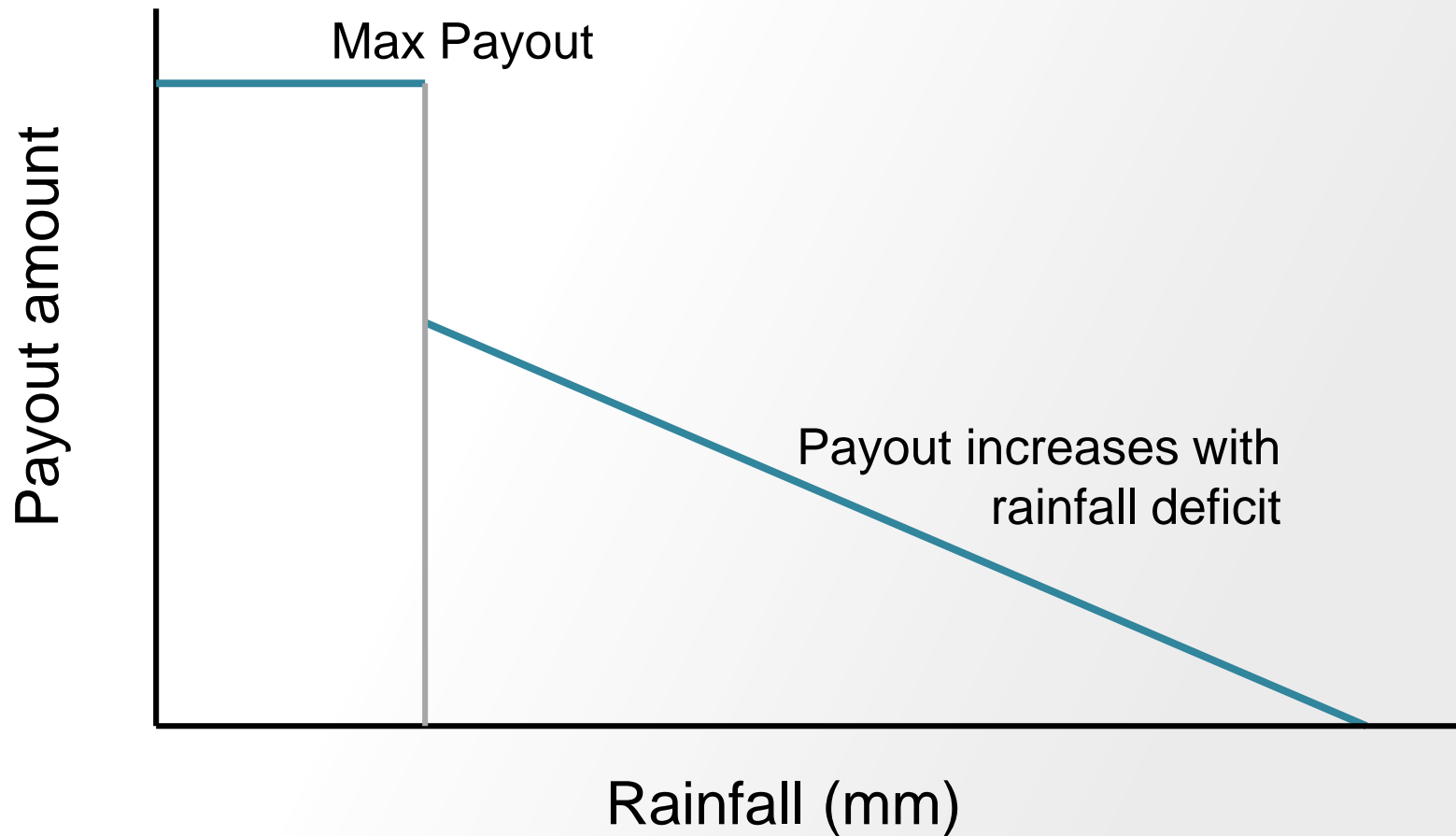
Risk

Information

Inputs &
Outputs

Conclusion

Stylized index insurance payout schedule



Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

High commercial prices limit demand

- Take-up 6-18% at market prices
 - Those who purchase insure small portion of land
- Few examples of commercial weather index insurance products
 - Most insurers receive large subsidies or technical assistance
- But (very) **large subsidies** increased demand
 - India: over 60% of farmers purchased insurance with 75% discount

Gaurav et al 2011; Karlan et al 2013; Mobarak & Rosenzweig 2012

Constraints

Credit

Risk

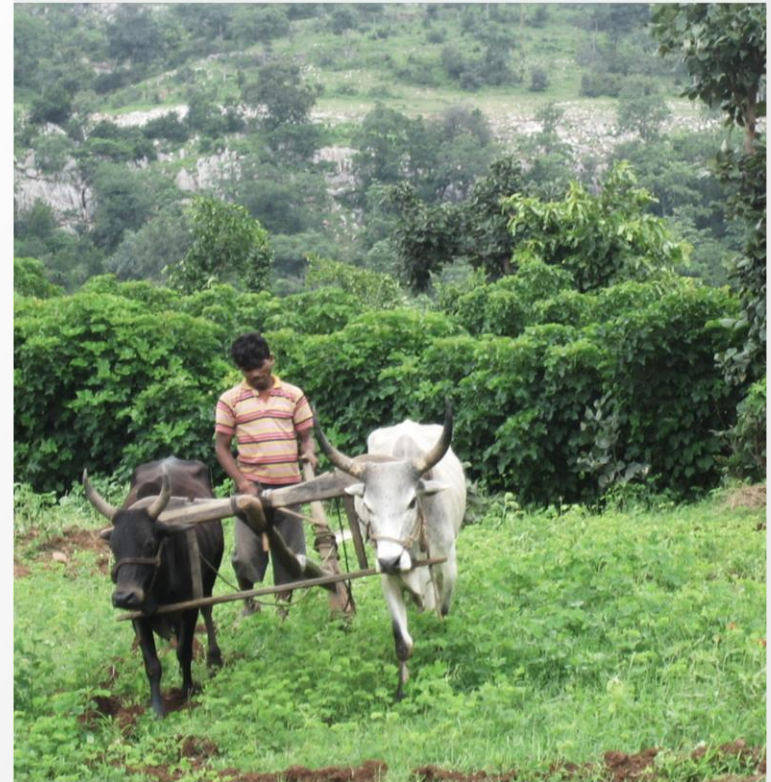
Information

Inputs &
Outputs

Conclusion

Marketing, training had limited effects

- In series of experiments in Gujarat and Andhra Pradesh researchers tested:
 - Demand for insurance under a number of marketing techniques
 - Effect of financial literacy training
 - Demand for insurance over several seasons



Cole et al 2013; Gaurav et al 2011; Cole et al 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Marketing, training had limited effects

- Relatively low take-up with flyer and video marketing techniques
 - 24-29 percent (with various discounts)
 - No differences by content (NGO endorsement, positive v. negative framing of payouts, individual v. group benefits)
- Financial literacy training had **small effect**
 - Expensive compared to product price, profit margin
- Demand for insurance increased when there were payouts in a household's village in the previous year
 - Learn from experience, gain trust in product over time

Cole et al 2013; Gaurav et al 2011; Cole et al 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Insured farmers changed production

- When given free insurance, farmers took on greater production risks
 - In Andhra Pradesh, farmers who received insurance were 6pp more likely to plant **cash crops**
 - In Ghana, farmers increased the share of land planted to maize, **fertilizer use**

Cole et al 2014; Karlan et al 2013; Mobarak & Rosenzweig 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

An alternative: Risk-mitigating crops

- Agricultural R&D on varieties that tolerate flood, drought, salinity
 - Increasingly important with **climate change**
- Swarna-Sub1 is a flood-tolerant rice variety
 - Researchers tested effect on yields and farmer behavior in **real-life conditions** in Odisha, India



Dar et al 2015

Constraints

Credit

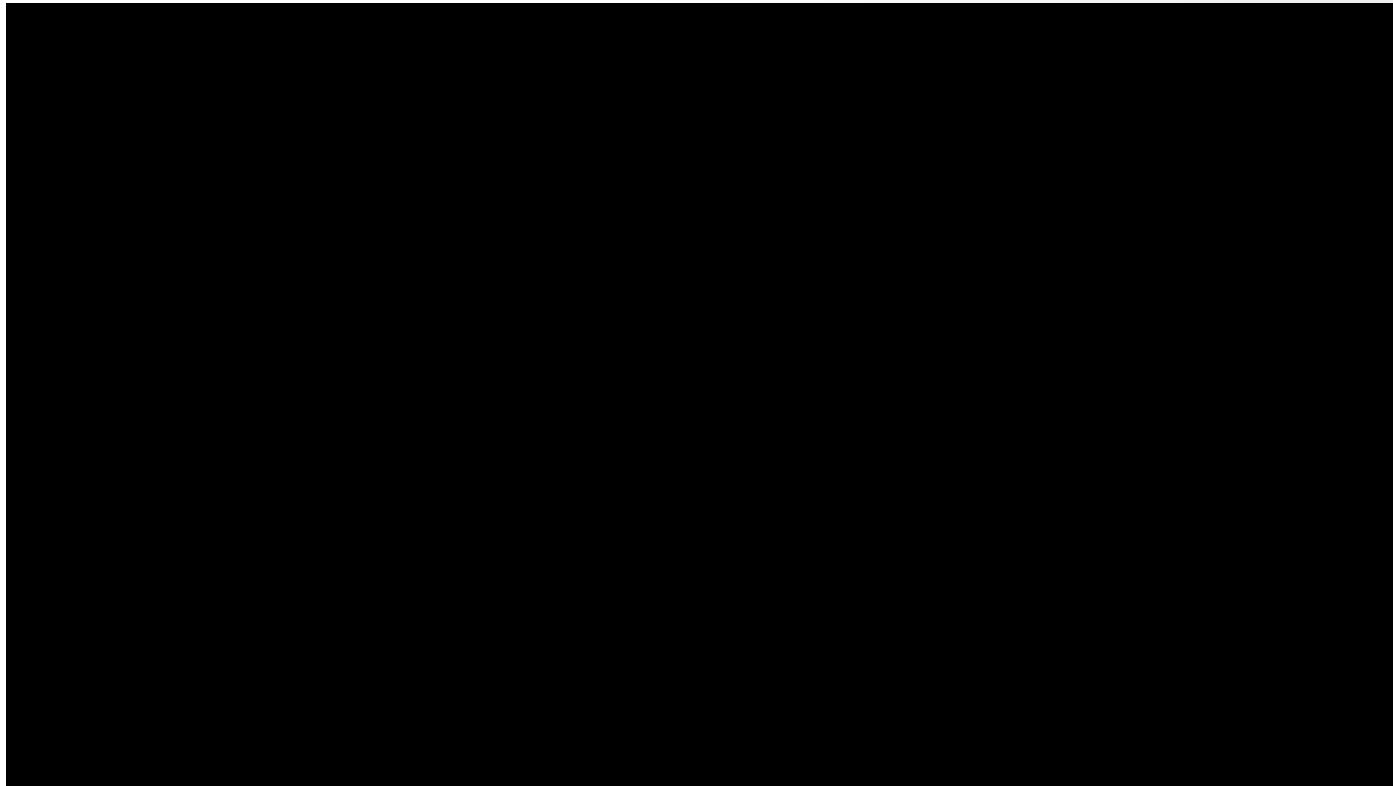
Risk

Information

Inputs &
Outputs

Conclusion

Swarna-Sub1



Dar et al 2015

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Farmers given Swarna-Sub1 invested more

- Farmers given Swarna-Sub1 had higher yields in 2011 floods
- Farmers **invested more** in their farms
 - Cultivated more land
 - Applied more fertilizer
 - Switched to more effective, but higher-labor techniques
- Scale-up would benefit **marginalized populations** the most, as they are more likely to hold flood-prone land
 - IRRI has already distributed stress-tolerant seeds to over 10 million farmers in India

Dar et al 2015

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Summary: Risk

- Risk is a constraint for smallholder farmers
 - Especially weather risk
- **Low demand** for weather index insurance as commercial product
 - Price, distrust, lack of financial literacy, basis risk
- Alternatives to help farmers manage risk
 - Rethink insurance: provide subsidized policies as cash transfer or sell to institutions
 - Promising preliminary results on **risk-mitigating crops**

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Overview

- Constraints in Agriculture
- Policy Lessons I: **Credit**
- Policy Lessons II: **Risk**
- Coffee break
- Policy Lessons III: **Information**
- Policy Lessons IV: **Input/Output Markets**
- Conclusion

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Overview

- Constraints in Agriculture
- Policy Lessons I: **Credit**
- Policy Lessons II: **Risk**
- Coffee break
- Policy Lessons III: **Information**
- Policy Lessons IV: **Input/Output Markets**
- Conclusion

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Preview: Information

- General extension is often ineffective
- Information given to farmers may be wrong
- Extension may be improved
 - Incentives
 - Feedback
 - Leveraging social networks
- Successes
 - ICT
 - New crops
 - Behavioral barriers

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Profits vs. Yields



Governments and NGOs provide advice is designed to maximize **yield**, rather than maximize farmer profit

Farmer decisions are based on **profit**, not yield

Duflo et al 2008, Hanna et al 2013

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Why do farmers need information?

- Information helps farmers assess technologies, their risk profile and potential profitability
- If a farmer is to use a new technology effectively they need to know:
 1. That it **exists**
 2. Something **about its benefits and costs**
 3. How to **use it effectively**

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

How do farmers receive information?

- Government or NGO extension services
 - Test plots
 - Trainings
- Social learning
- Direct to farmers
 - Door-to-door
 - ICT

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Extension does not change behavior

- Traditional extension has little effect
 - Test plots
 - Farmer field schools
 - Train and visit
 - Training seed farmers

Duflo et al 2008, Blair et al. 2013, Kondylis et al. 2014, Beaman et al. 2015, Duflo and Suri, forthcoming

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Improving extension services

- Small incentives may improve adoption
 - Extension officers
 - Lead farmers
- Feedback on extension may help
 - Improves satisfaction
 - Improves knowledge in certain circumstances

BenYishay and Mobarak 2013, Ben Yishay et al. 2015, Jones and Kondylis 2015, Masset and Haddad 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Social learning

- The messenger matters
 - A farmer is more likely to demand a new technology if a greater proportion of his/her network is demonstrating it
 - Lead farmers most closely resembling target farmers were more effective at promoting a new technology

Ben Yishay et al. 2015, Beaman et al. 2015, Tjernstrom 2015, BenYishay and Mobarak 2013, Tjernstrom 2015

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

What is working?

ICT

New crops

Behavioral barriers

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

ICT to reach farmers directly

- Interventions using mobile phones to provide information to farmers have been shown to increase adoption and improve yields

Cole and Fernando 2012, Casaburi et al. 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Mobile Phone-Based Agricultural Extension

- Gujarat, India
- 2011-2012
- Center for Microfinance
- Awaaz.De



Cole and Fernando 2012

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Mobile Phone-Based Agricultural Extension

- High take up and use of mobile platform
- Switch to more effective pesticides
- Increased adoption of cumin
- Some evidence of increased yields in cotton and cumin

Cole and Fernando 2012, Cole and Fernando 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Information about a new crop



Hotz et al 2011, Glennerster and Suri forthcoming

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Addressing behavioral barriers

Behavioral barriers may block technology adoption

- Procrastination
- Adoption when learning is hard

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Solving procrastination with timing

Giving farmers a way to prepay for fertilizer when they had cash on hand was effective in Kenya

- High demand for ability to purchase fertilizer in advance
- Prepayment had an impact on fertilizer use comparable to a 50% discount during the growing season

Duflo et al. 2011

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Simple tools can aid learning

- Cheap and simple tools + information:
 - Blue spoons to measure profit-maximizing fertilizer amount
 - Leaf chart to determine if rice needs more fertilizer
- Simple and visual tools improved efficient use of inputs and increased yields in Bangladesh

Hanna et al. 2012, Duflo et al. forthcoming, Islam 2014

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Summary: Information

- General extension is often ineffective
- Information given to farmers may be wrong
- Extension may be improved
 - Incentives
 - Feedback
 - Leveraging social networks
- Successes
 - ICT
 - New crops
 - Behavioral barriers

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Overview

- Constraints in Agriculture
- Policy Lessons I: **Credit**
- Policy Lessons II: **Risk**
- Coffee break
- Policy Lessons III: **Information**
- Policy Lessons IV: **Input/Output Markets**
- Conclusion

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Preview: Input/Output Markets

- Price information has no positive effects on farmers, though other members of the value chain may benefit
- Infrastructure investment can decrease transport and input costs—does this reduce prices farmers receive?
 - Even if it does reduce prices, is that a problem?

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Input and output market inefficiencies

Farmers may be unable or unwilling to adopt new technology due to barriers within:

Input Markets

- Missing or incomplete supply chains
- Unprofitably high input prices

OR

Output Markets

- Lack of access to additional markets
- Low prices for yields, including high quality crops

Constraints

Credit

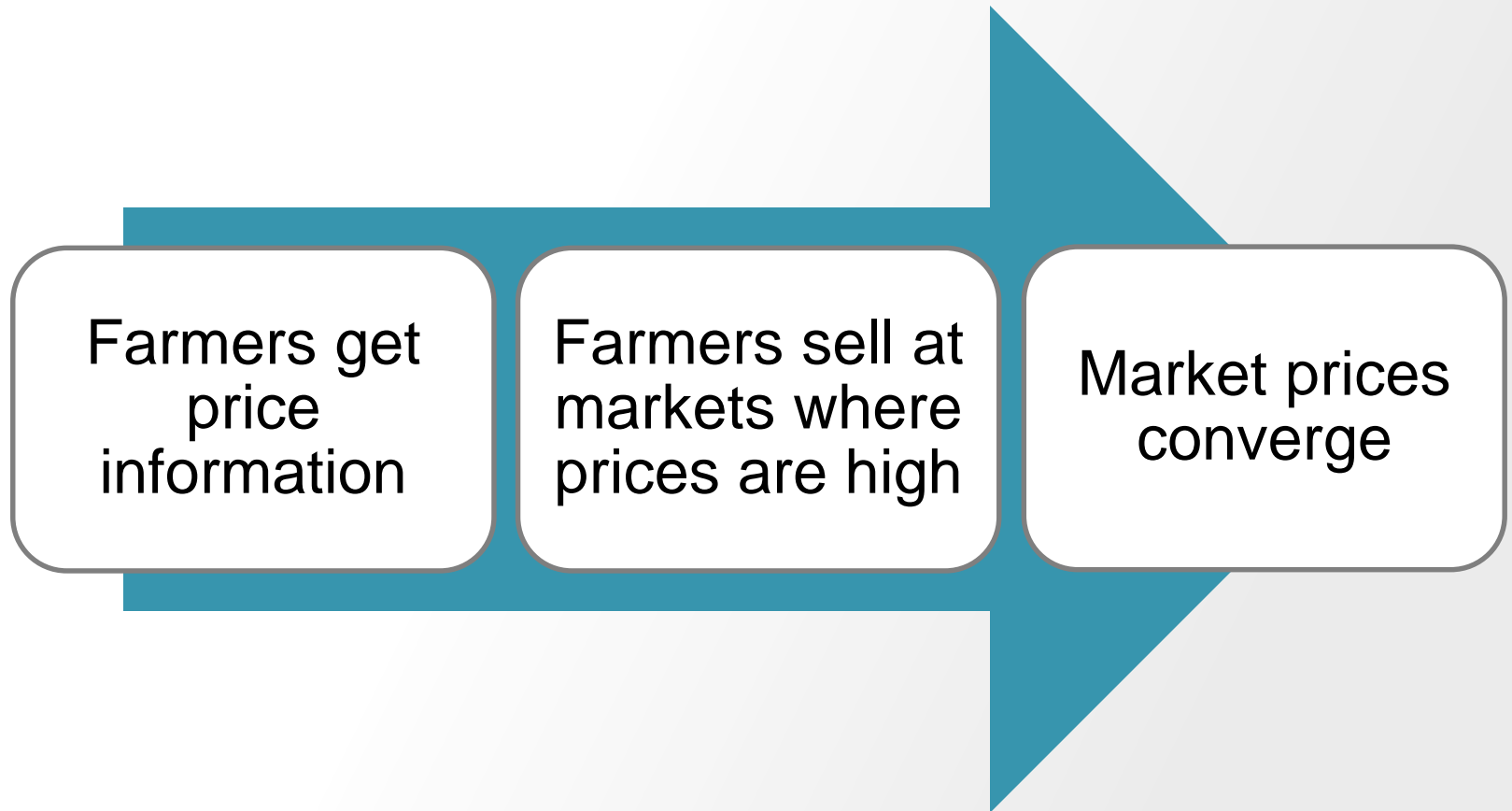
Risk

Information

Inputs &
Outputs

Conclusion

Theory of price information



Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Price information to farmers

- Limited effect on prices
- Farmers may change behavior
- No gain in average prices received by farmers

Goyal 2010, Minten & Fafchamps 2012, Mookherjee et al 2013

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Price information to others

- Price information is actionable
 - Traders
 - Fishermen
- Reductions in price dispersion
- Potential improvement in profits

Aker 2010, Jensen 2007

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Price information and the market

- Farmers are unlikely to benefit from price information
- Members of value chains who can take action on the information can see benefits

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Road Development in Sierra Leone



Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Road Development in Sierra Leone



Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Infrastructure: Road Development



Investment in roads lowers transportation costs and may increase access to and use of inputs

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Summary: Input/Output Markets

- Price information has no positive effects on farmers, though other members of the value chain may benefit
- Infrastructure investment can decrease transport and input costs

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Overview

- Constraints in Agriculture
- Policy Lessons I: Credit
- Policy Lessons II: Risk
- Policy Lessons III: Information
- Policy Lessons IV: Input/Output Markets
- Conclusion

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion

Take-aways

- The farmer's problem
 - Maximizing profit with limited labor, land, information, and capital within a restrictive market
- No silver bullets
 - Credit and insurance suffer from low uptake
 - Social networks not spreading information completely
- Silver lining
 - Mobile technology is a promising way to deliver timely information to farmers
 - Risk reduction can increase investment

Constraints

Credit

Risk

Information

Inputs &
Outputs

Conclusion