Why is this important?

Technological change is important for productivity growth

Key to livelihoods in poor economies where most households are connected to agriculture

Government and donors make substantial investment in agriculture

Agricultural interventions have contributed to poverty reduction (Datt and Ravallion, 1998; Dorward et al., 2004)

But there are obstacles that may prevent benefits from reaching small farmers and poor rural households
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Market power in the supply chain
Big Research Question

• How large are the benefits?

• Who benefits?
  • Direct benefits
  • Indirect benefits (spillovers)

• How does market power affect income spillovers?

• Could market power in agricultural supply chain prevent technology adoption?

How does market power affect the benefits from technology change in rural economies?
Research Context: Cotton in Tanzania

Tanzania, the 8th largest cotton producer in Africa

About half million smallholder farmers involved in cotton production

Farmers currently use traditional variety of cottonseed

About 20-25 spatially separated ginners operate annually

Ginners have spatial buyer power
Research Context (Supply Chain of Cotton)

Inputs in cotton production → Cotton Farmers → Ginners → Domestic & World Lint Market
Non-cotton producers

Inputs in cotton production

Cotton Farmers

Other Businesses

Ginners

Domestic & World Lint Market

Local Economy
Research Context (Direct Impacts)

Inputs in cotton production → Cotton Farmers → Giners → Domestic & World Lint Market

Non-cotton producers

Other Businesses

Local Economy

Buyer power
Research Context (Indirect Impacts)

Inputs in cotton production

Non-cotton producers

Cotton Farmers

Other Businesses

Ginners

Domestic & World Lint Market

Local Economy

Buyer power
Theory: GE Impacts of Market Power

Buyer power affects (local economy) welfare through three channels:

• Reduces the size of the pie (deadweight loss)
• Shifts benefits from cotton farmers to ginners
• Leaks economic surplus out of the local economy to absentee ginners

The cotton price links ginners to local economies, transmitting impacts

Randomized experiments are not useful to estimate ginners’ buyer power

We need a structural understanding of how buyer power affects welfare in local economies
Integration of two models

First, a market-structure model of cotton ginners to obtain an index of market power

- Use cost and production data of ginners from 2012-2015

Second, a local-economy general equilibrium model (LEWIE model)

- Use household data on cotton and non-cotton farmers, and local businesses
- Data from Western Cotton Growing Area
- 9 regions, 60 villages, 1534 households
Measuring Buyer Power

Buyer power ($\theta$) measured on the unit interval

$\theta$ is derived from a conjectural variations model of oligopsony

- $\theta = 0$ indicates perfect competition
- $\theta = 1$ indicates monopsony
- $\theta \in (0, 1)$ indicates cases of oligopsony
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Buyer power ($\theta$) measured on the unit interval

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- $\theta = 0.25$ indicates cases of four-firm symmetric Cournot oligopsony
Measuring Buyer Power

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- $\theta = 1$ indicates monopsony
- $\theta = 0.33$ indicates cases of three-firm symmetric Cournot oligopsony
Model of Cotton Farmers

Step 1: Model a Household Group

Data from Household and Business Surveys to model a Local Economy

Rich tradition of household-farm modeling in development economics
Step 2: Build Models of different Household Groups & Businesses

- Model of Non-cotton producers
- Model of Cotton Farmers
- Model of Retail and Services

Data from Household and Business Surveys to model a Local Economy

Step 3: Combine the Household Models into a Model of the Local Economy

Data from Household and Business Surveys to model a Local Economy

Nest different household groups and businesses in a GE framework

LEWIE Model
Step 4: Use the Model to Simulate Impacts of Market Power

- Model of Non-cotton producers
- Model of Cotton Farmers
- Model of Retail and Services
- Market Structure Model of Ginners
- Rest of World

Model of a Local Economy with Downstream Market Structure

Inputs in production activities

General Equilibrium Impacts of Ginner Market Power & Other Interventions
Non-parametric Estimate of Ginner Market Power

Oligopsony Index

At average price of cotton $\hat{\theta} = 0.28$  
*Bootstrapped CI: [0.27, 0.29]*

At price floor $\hat{\theta} = 0.49$  
*Bootstrapped CI: [0.47, 0.51]*

The overall ginning industry is oligopsonistic and has high degree of market power
General Equilibrium LEWIE Results
GE Impacts of Ginners’ Buyer Power

Inflation-adjusted Income Impacts of Buyer Power compared to Perfect Competition

In Percentage

- Average Price ($\theta = 0.28$)
- Price Floor ($\theta = 0.49$)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>BPL Cotton</th>
<th>APL Cotton</th>
<th>BPL Non-cotton</th>
<th>APL Non-cotton</th>
<th>Business</th>
<th>Laborers</th>
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<tbody>
<tr>
<td>Average Price</td>
<td>-16.0%</td>
<td>-15.5%</td>
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<tr>
<td>APL Non-cotton</td>
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<tr>
<td>Laborers</td>
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-7.0%   
-4.0%   
-1.0%   
2.0%
Cotton Technology Improvement: Income Effects

Real Income Impacts of 25% Improvement in Cotton Production

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<tbody>
<tr>
<td>Perfect Competition</td>
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<tr>
<td>Market Power (θ = 0.28)</td>
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<td>0.0%</td>
<td>0.0%</td>
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Total

0.0% 3.0% 6.0% 9.0% 12.0% 15.0%
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Cotton Technology Improvement: Income Effects
Conclusions

Market power mitigates welfare impacts of technology improvement in agriculture in local economies

• With heterogenous distributional effects
• Reduced spillovers for other crops, livestock, and businesses

Policy implications

• Introducing interventions to ensure elastic demand of farm product
• Laws that limit or proscribe anticompetitive behavior
• Minimum support prices could restore welfare in local economies