

General Equilibrium Impacts in Imperfect Agricultural Markets: Evidence from the Tanzanian Cotton Industry

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Anubhab Gupta

Department of Agricultural and Applied Economics

Virginia Tech

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Email: anubhab@vt.edu



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 ginneries operate annually

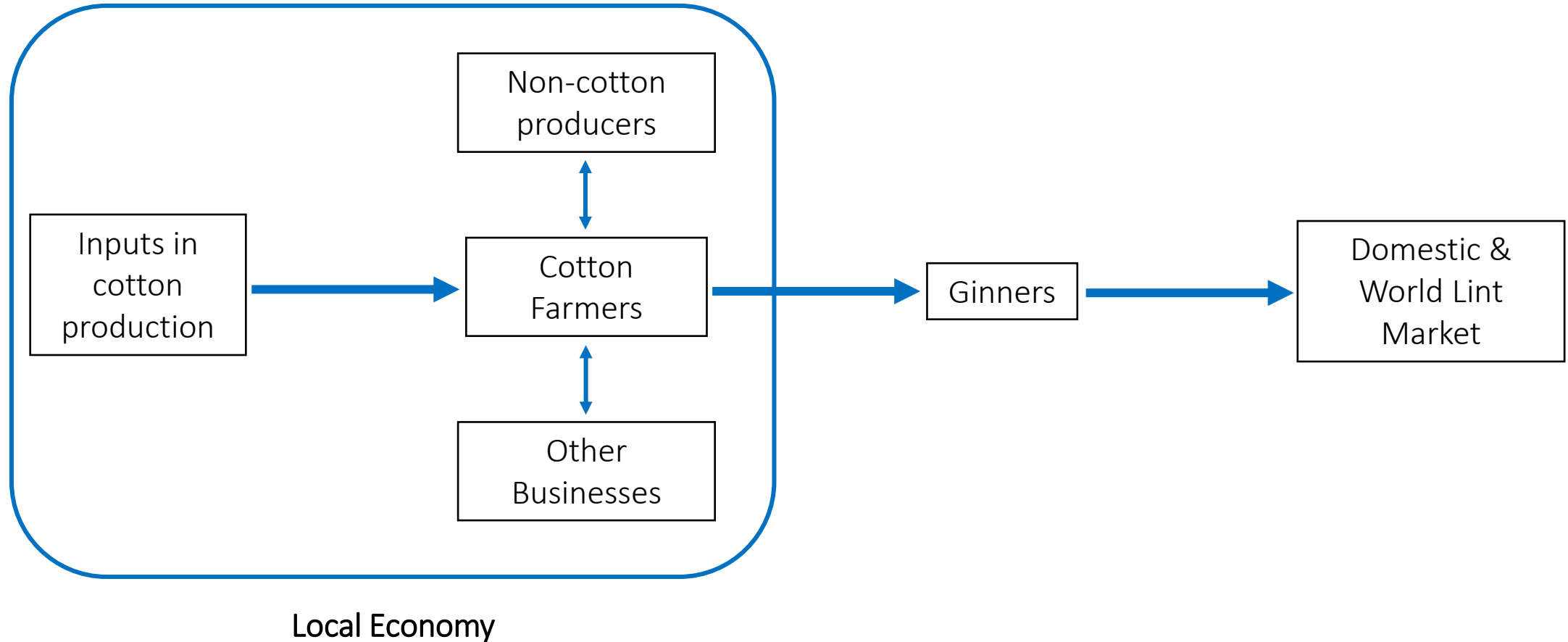
Ginneries have spatial buyer power



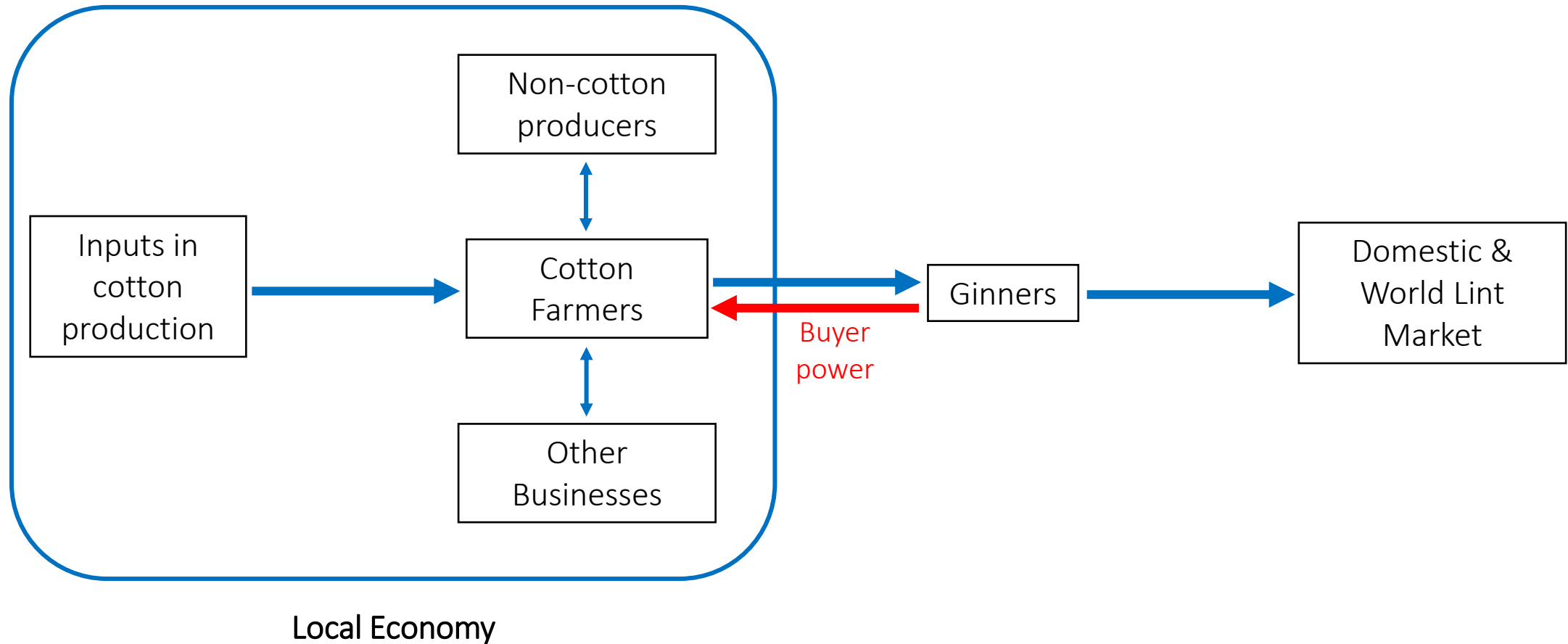
Research Context (Supply Chain of Cotton)



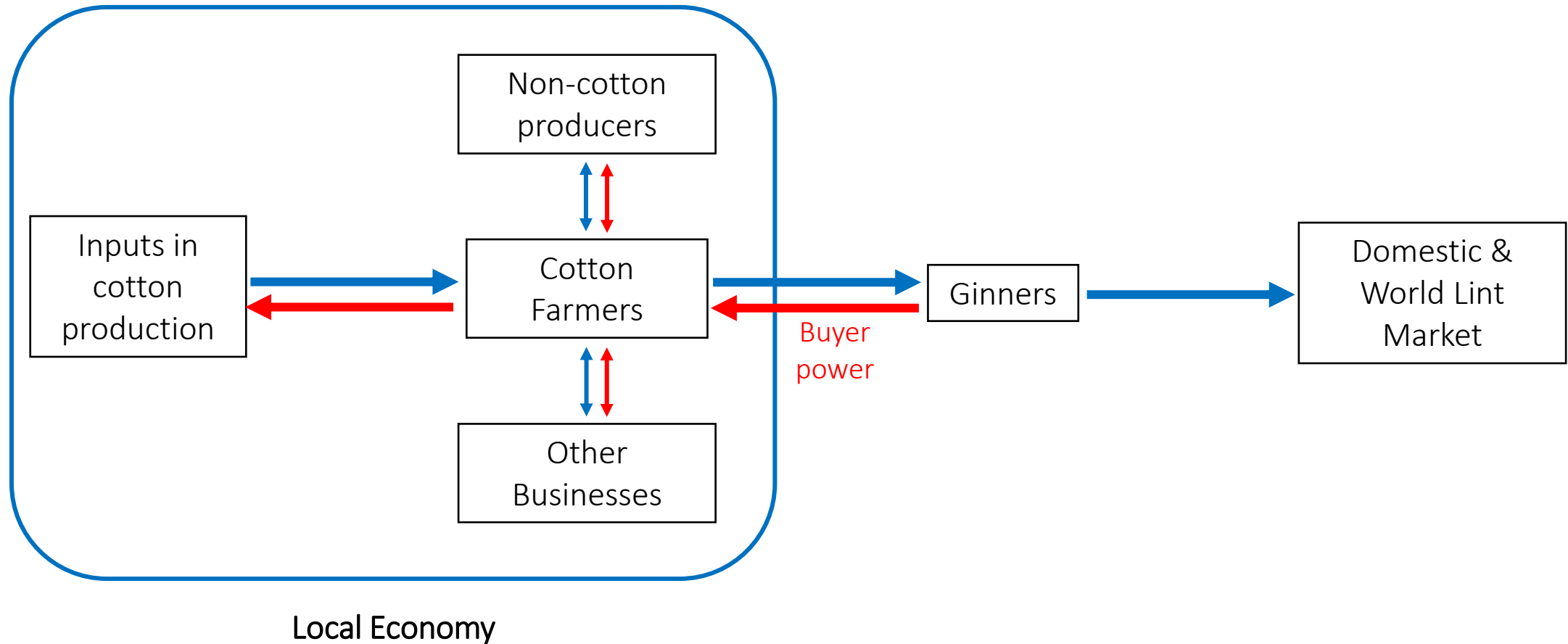
Research Context (Local Economy)



Research Context (Direct Impacts)



Research Context (Indirect Impacts)



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 ginneries
- Leaks economic surplus out of the local economy to absentee ginneries

The cotton price links ginneries to local economies, transmitting impacts

Randomized experiments are not useful to estimate ginneries' 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 ginneries to obtain an index of market power

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

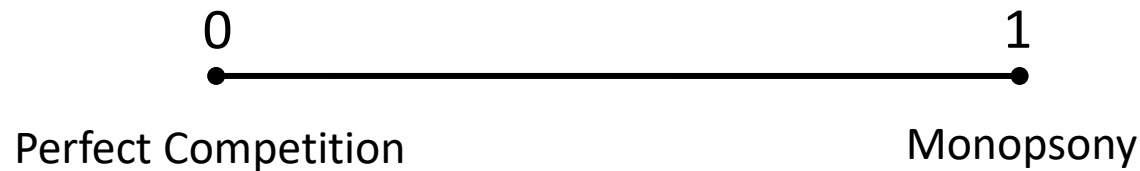
Second, a local-economy general equilibrium model (LEWIE model)

- 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 (θ) measured on the unit interval

θ is derived from a conjectural variations model of oligopsony

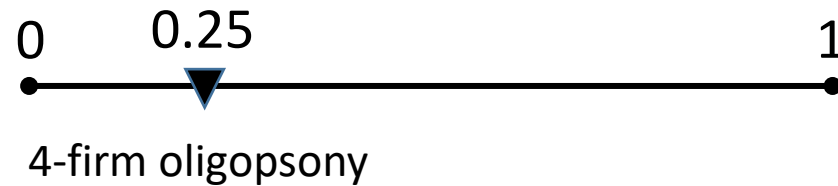


- $\theta = 0$ indicates perfect competition
- $\theta = 1$ indicates monopsony
- $\theta \in (0, 1)$ indicates cases of oligopsony

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Buyer power (θ) measured on the unit interval

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

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- $\theta = 0.33$ indicates cases of three-firm symmetric Cournot oligopsony

Step 1: Model a Household Group

Model of
Cotton
Farmers

Data from Household and Business Surveys
to model a Local Economy

Rich tradition of household-farm
modeling in development economics
(*Singh, Squire & Strauss, 1986; Taylor &
Adelman, 2003*)

[Detailed equations](#)

Step 2: Build Models of different Household Groups & Businesses

Model of
Non-cotton
producers

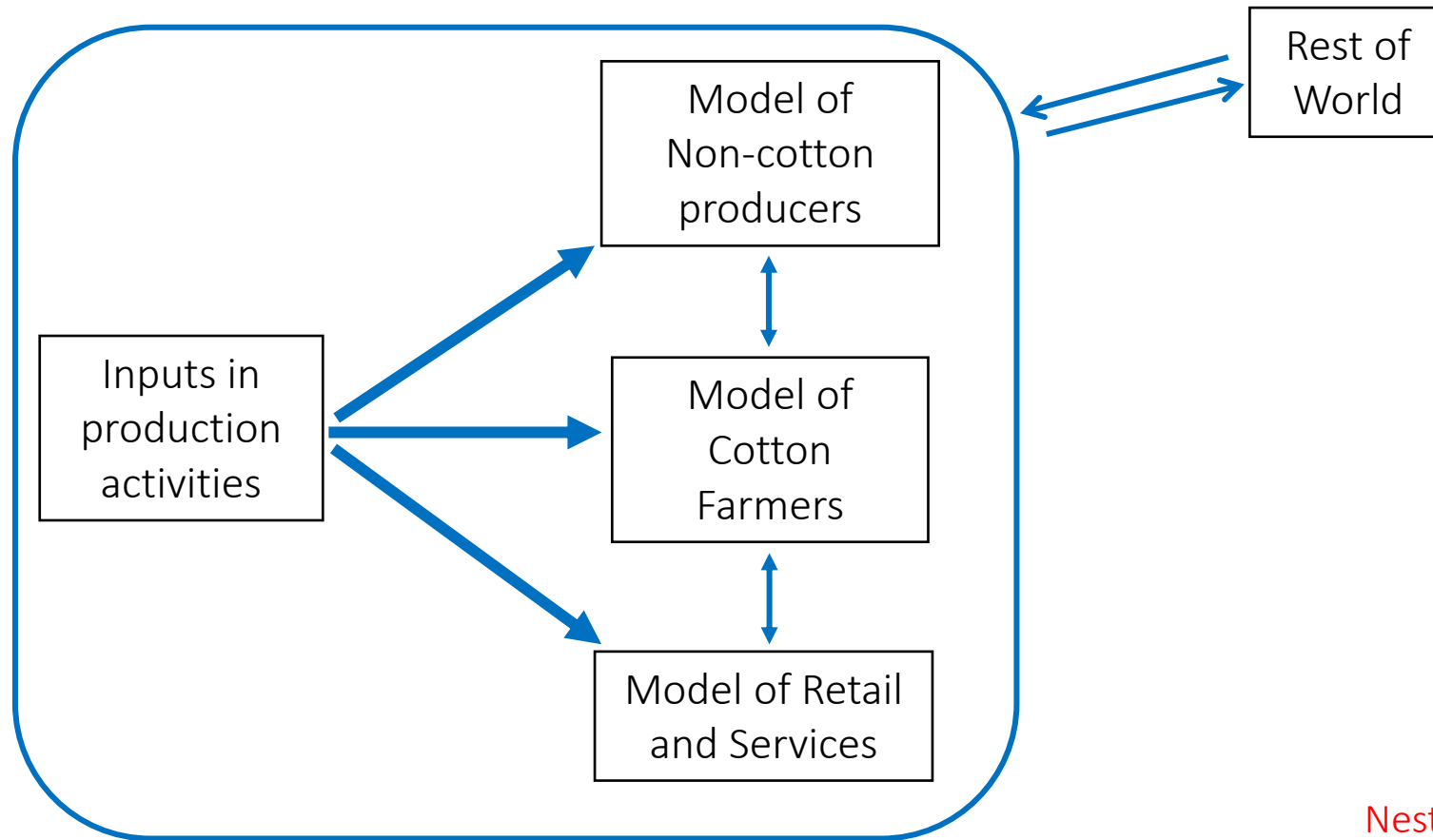
Model of
Cotton
Farmers

Model of Retail
and Services

Data from Household and Business Surveys
to model a Local Economy

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

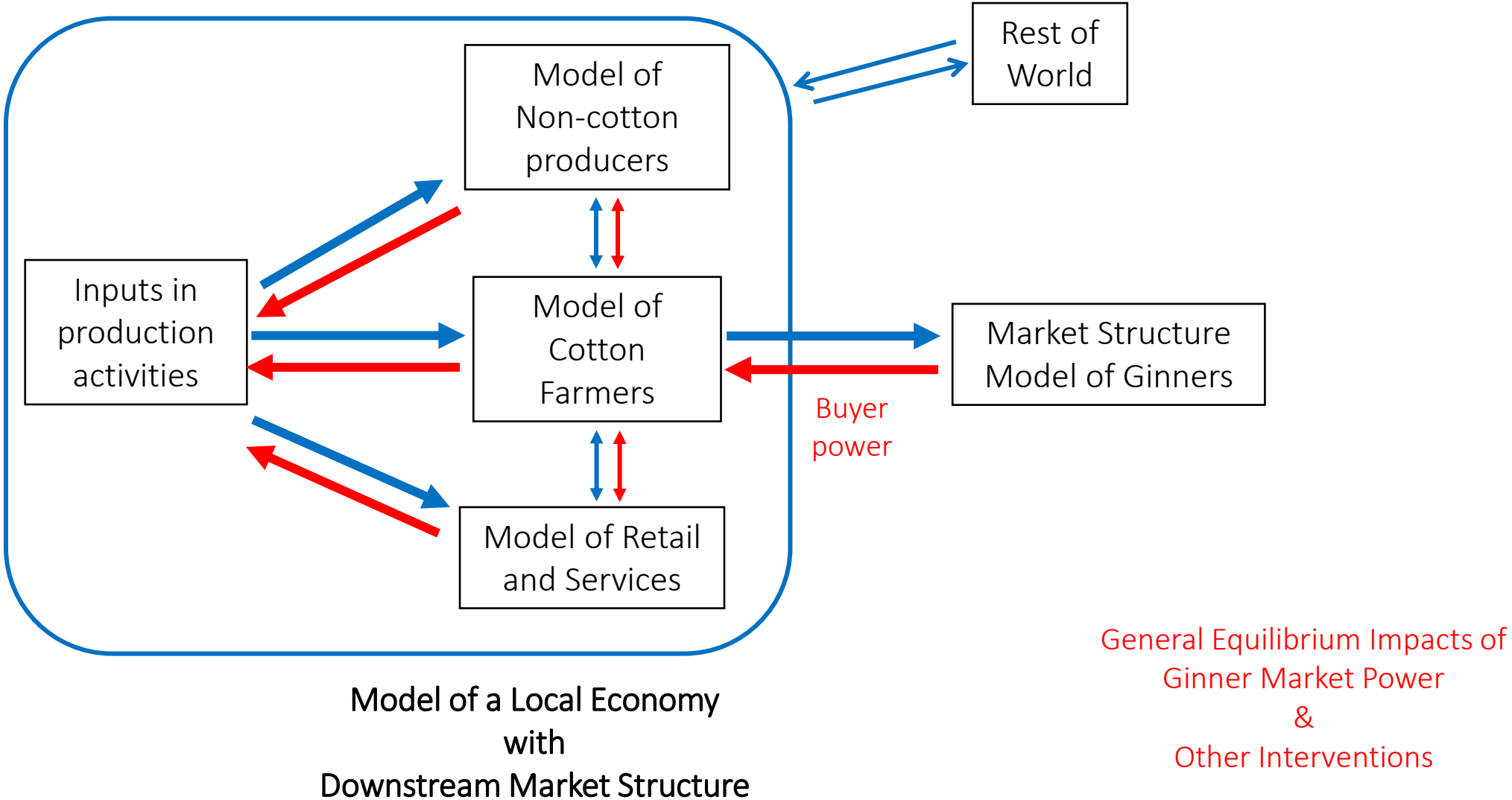


Data from Household and Business Surveys
to model a Local Economy

Nest different household groups and
businesses in a GE framework

LEWIE Model

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



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 $\hat{\theta} = 0.49$

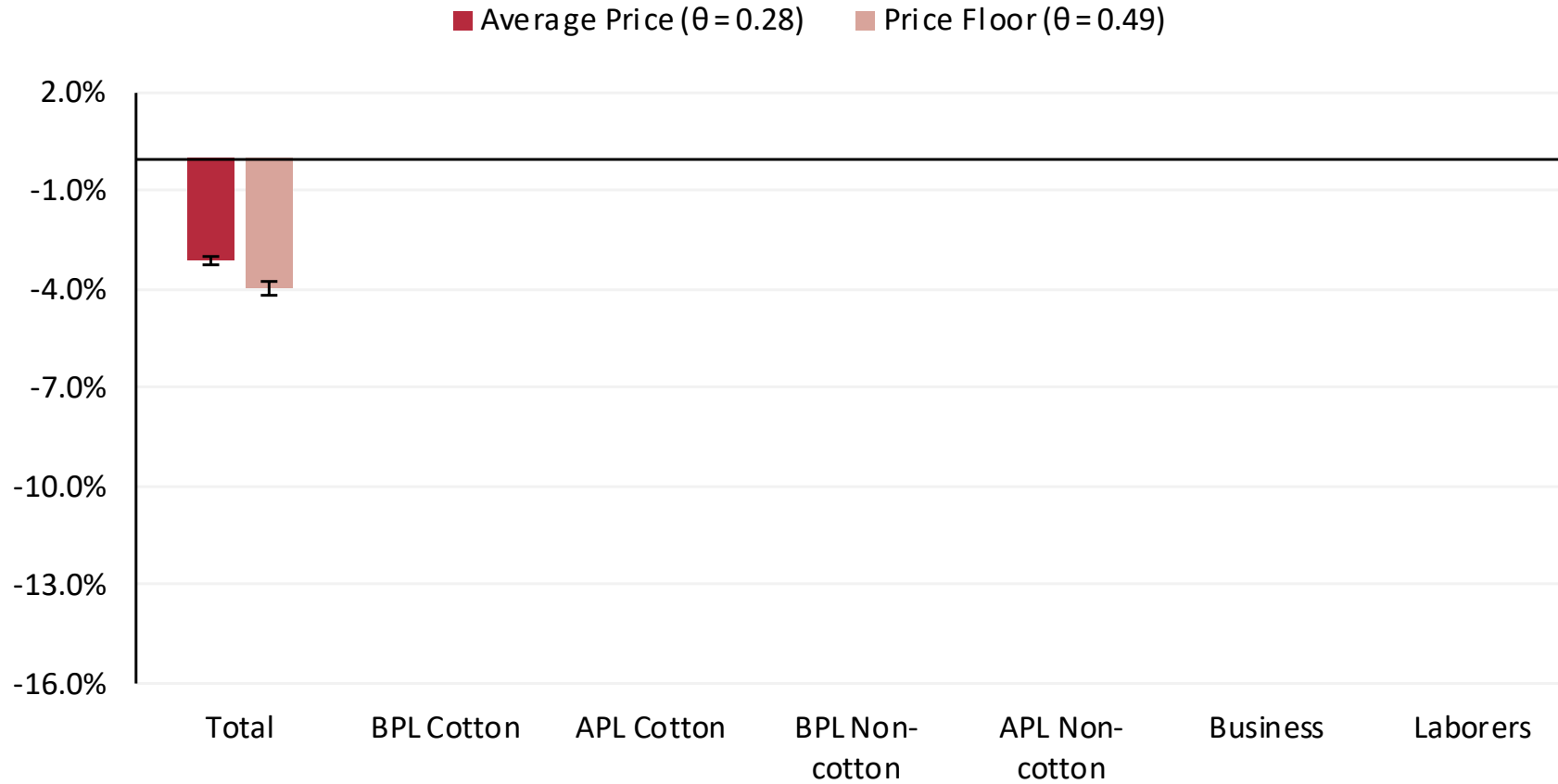
Bootstrapped CI: [0.47, 0.51]

The overall ginning industry is oligopsonistic and has high degree of market power

General Equilibrium LEWIE Results

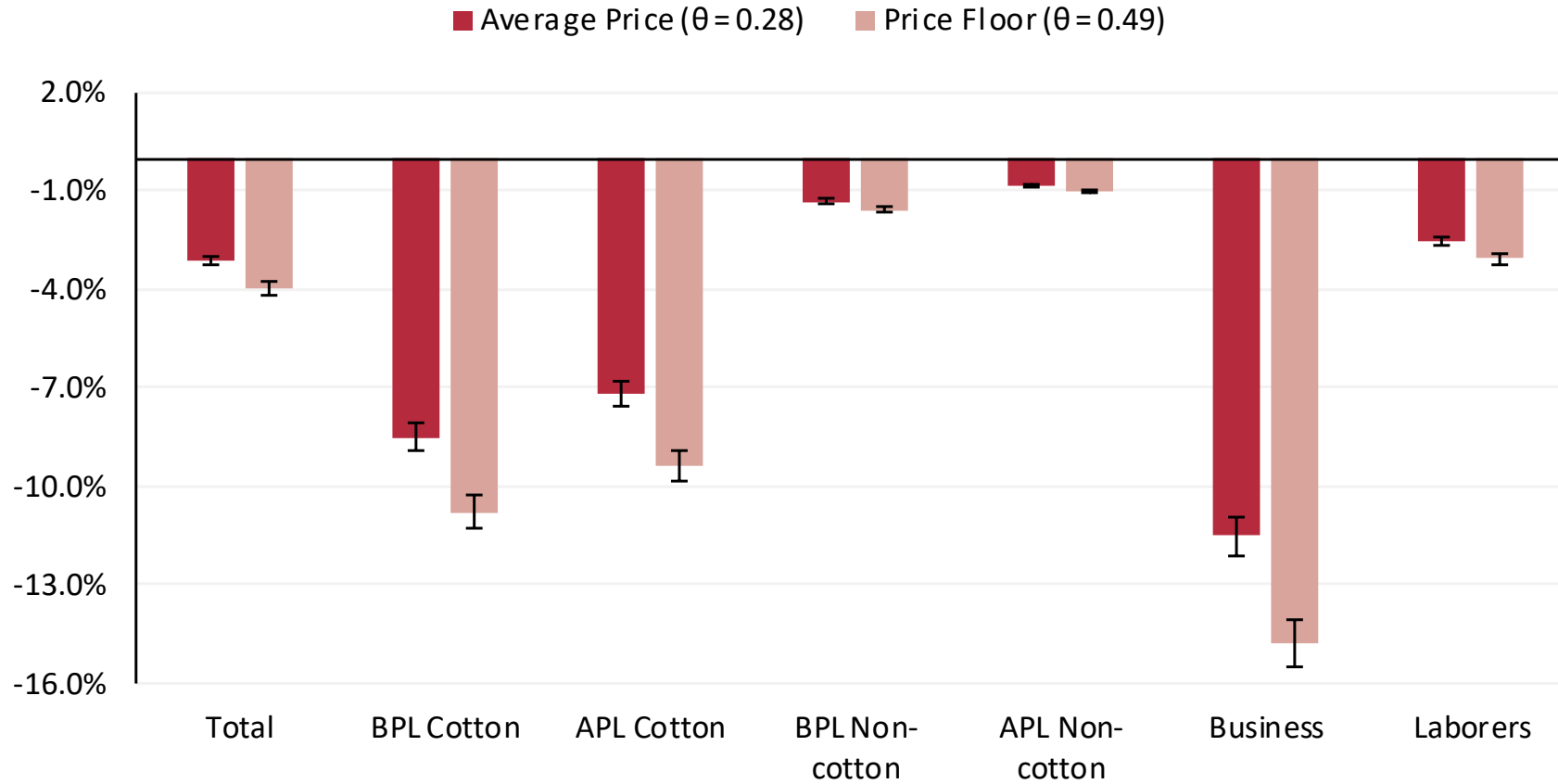
GE Impacts of Ginners' Buyer Power

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



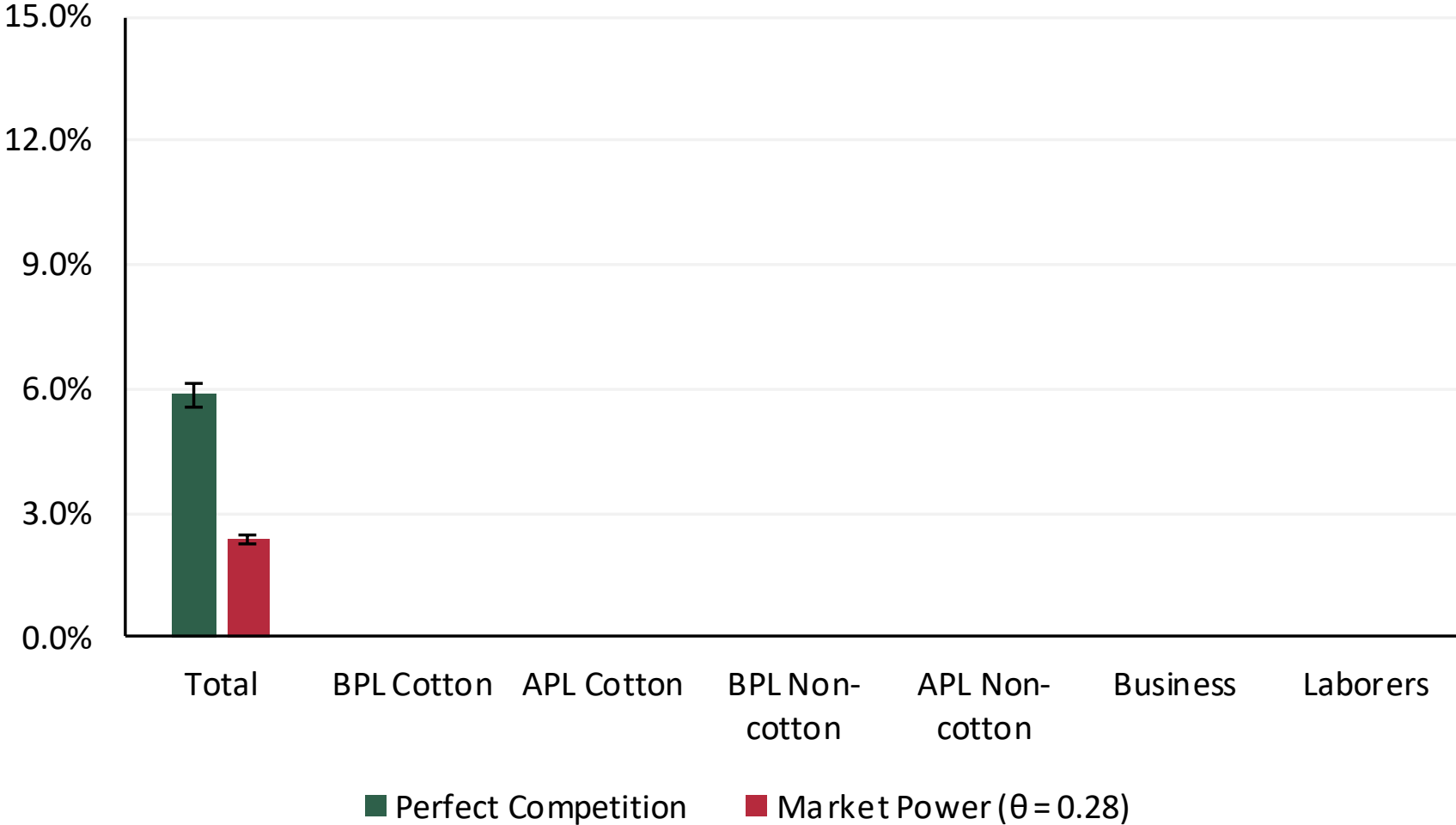
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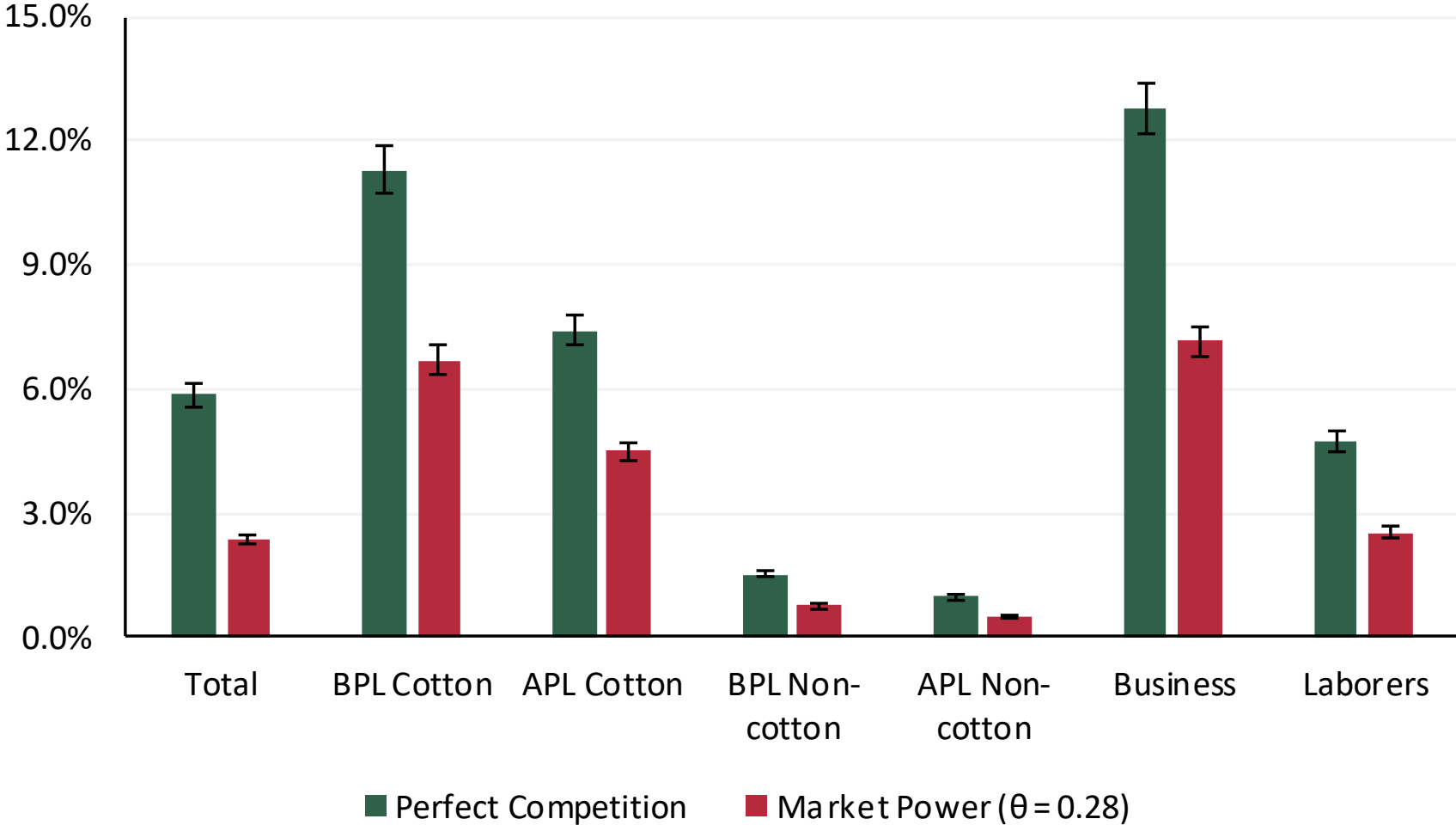
Cotton Technology Improvement: Income Effects

Real Income Impacts of 25% Improvement in Cotton Production
In Percentage



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Real Income Impacts of 25% Improvement in Cotton Production
In Percentage



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