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## General Equilibrium Impacts under Imperfect Agricultural Markets

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## Motivation

- Impacts of **technological improvements** in agricultural sector only evaluated for **direct beneficiaries**
- In most rural settings, **market linkages** exist between other farm and non-farm households
- Implications of ignoring **spillovers in local economy** of agricultural policies could lead to potential underestimation of program benefits
- Many agricultural markets are characterized by **agricultural market power**

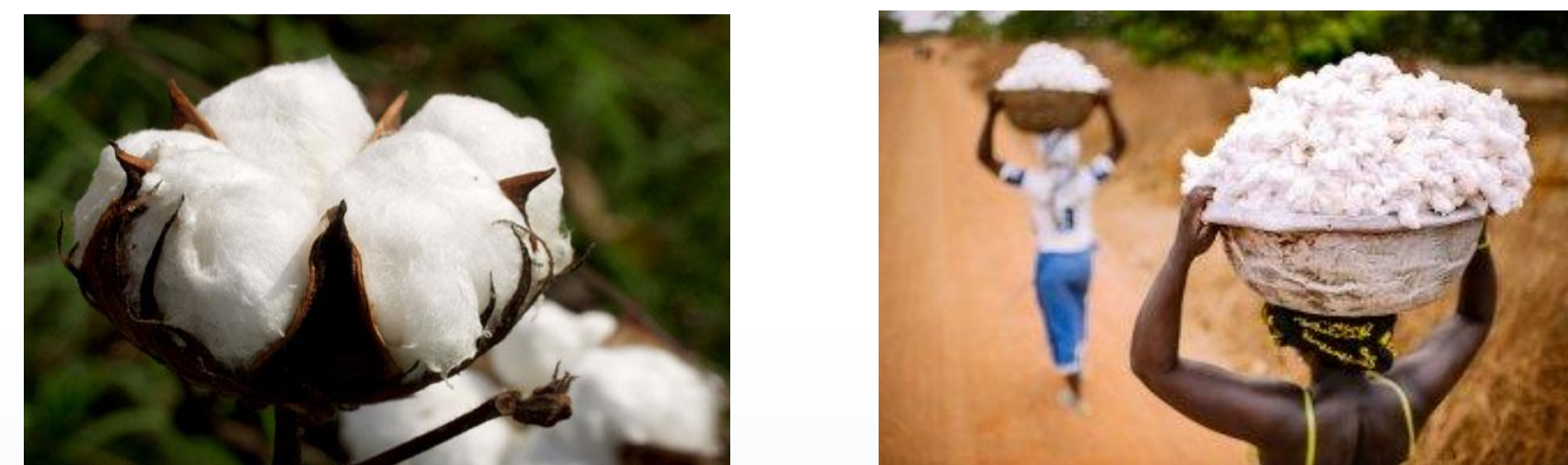
## Contribution

- No existing research **integrates** the **general equilibrium impacts** of agricultural policies in presence of **market power**
- A crop that requires **intermediary processing**
- Processing Units could have **market power** in **output and input markets**
- Producers of crop are linked to other producers in the local economy via **market linkages**
- Evaluate the impact of **increased productivity** of our crop of interest
  - Impacts of **imperfect competition** on **direct beneficiaries**, the targeted crop producers
  - Spillover impacts** of processor market power on **indirect beneficiaries** in the local economies



## Data (Tanzania Cotton Sector)

- Almost half million people are involved in cotton production in the **WCGA of Tanzania**
- Other activities in the WCGA include production of **maize, rice**, and other ag and non-ag items
- Cotton farmers sell seed cotton to a gin sector (**mid-June to September end**)
- The ginners use **seed cotton** to produce **cotton lint**
- The final product from the gineries in sold to **local and export markets**



## Methodology

- Integration of **market structure** and **general equilibrium framework**

Assumptions on **Market Structure Model**

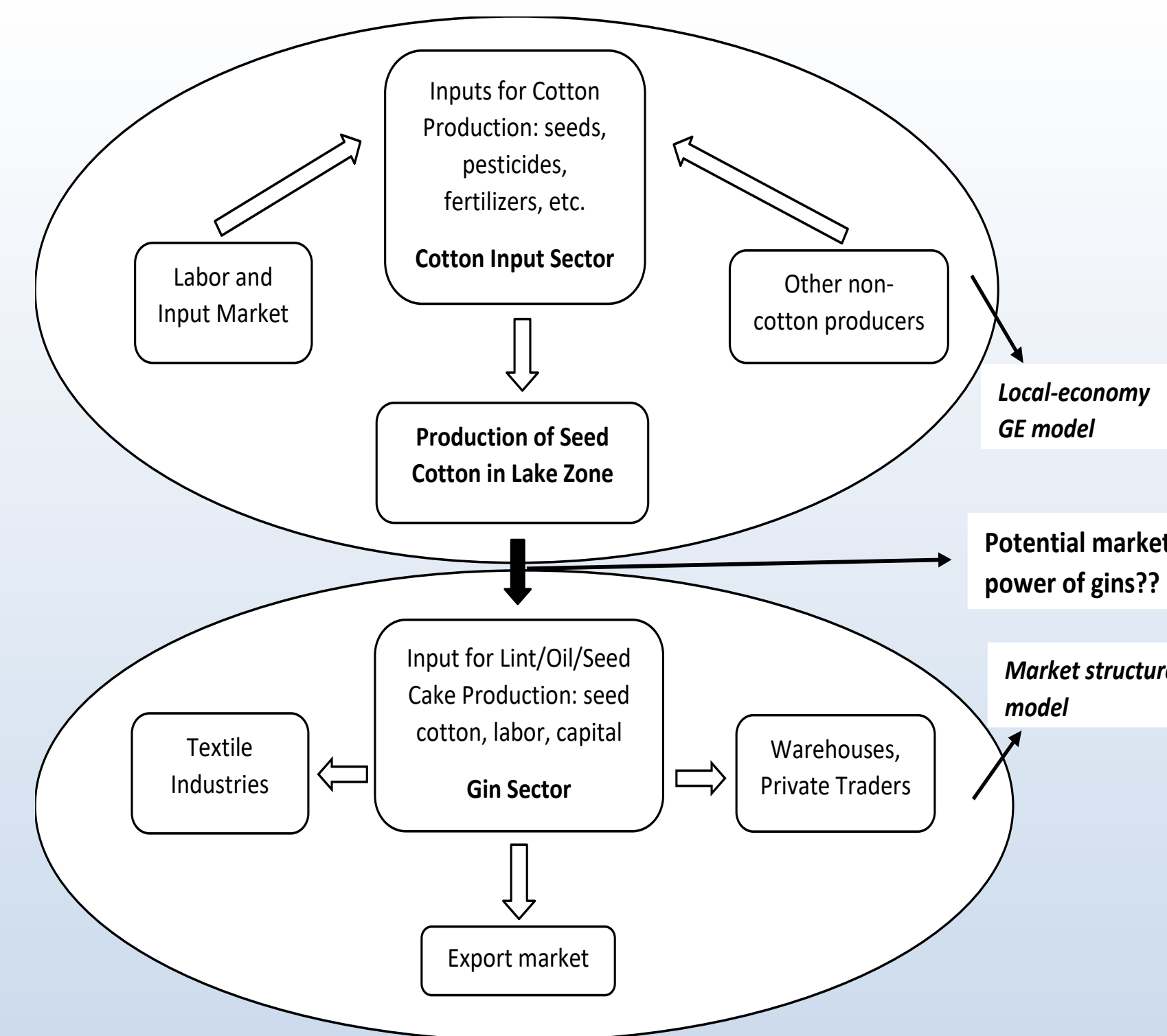
- Homogeneous agricultural crop** produced by a large number of competitive farmers

- A downstream **processing sector** that procures the farm product to produce a final commodity
- Processors and retailers** are integrated, and are **identical**. Technology is **fixed proportions**.
- Index of Oligopsony power** is estimated using:

$$\theta = \frac{\epsilon_c}{P_c} (P_g - c(V) - P_c)$$

## Methods cont.

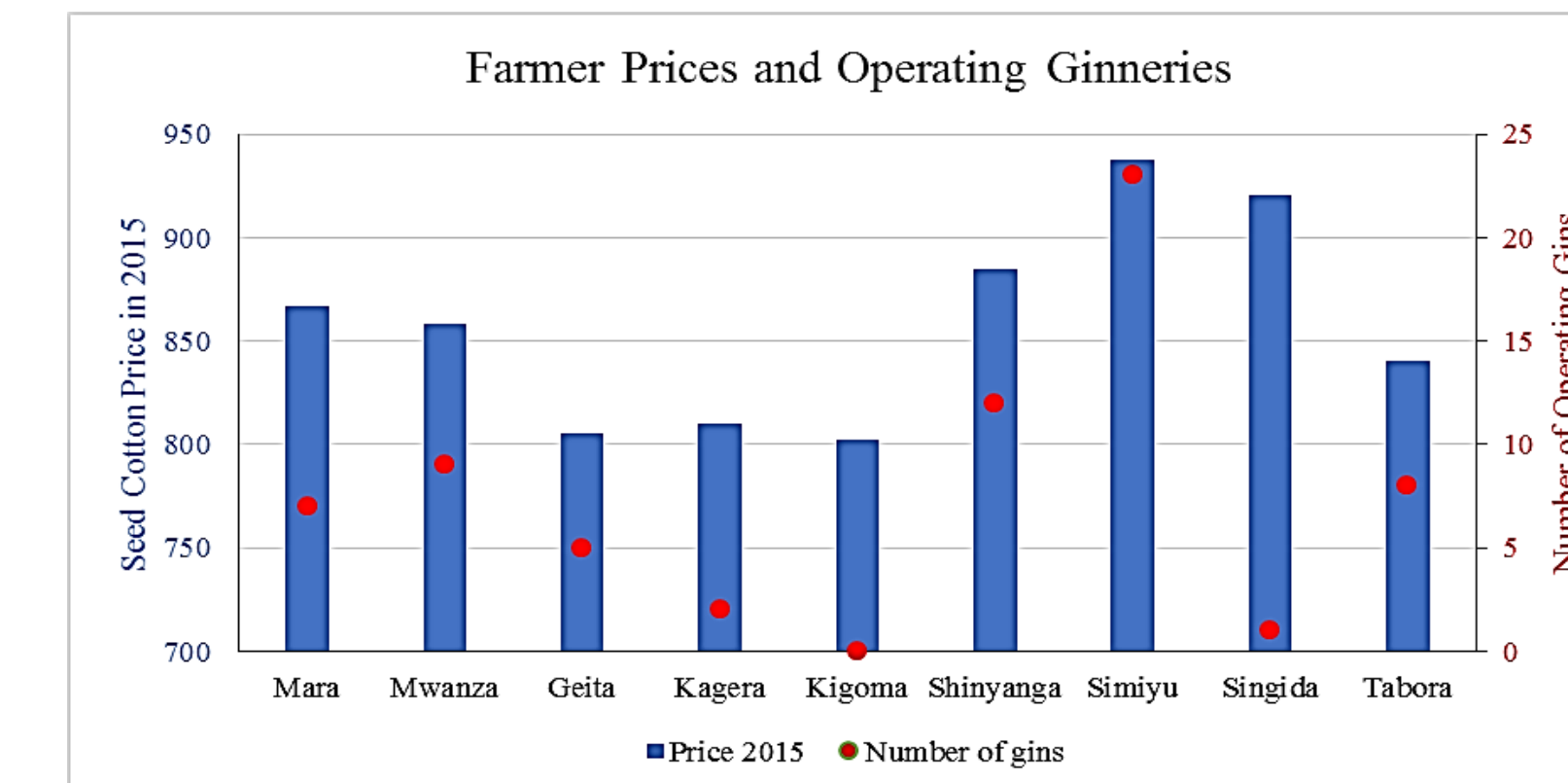
- Assumptions on **General Equilibrium Framework**
- Output and prices of our crop of interest are linked to others in the local economy through **market linkages**
  - GE-LEWIE** (Taylor and Filipski, 2014) model links local economy agents with producers of agricultural crop who are directly linked to the processing sector
  - Using survey data, **household economies** are modeled
  - Transformation takes place through activity specific **CRS Cobb-Douglas production functions**
  - Household consumption demands are modeled as **linear expenditure systems**
  - All **input and output markets** clear



Flow Diagram of Cotton Market Structure in Tanzania

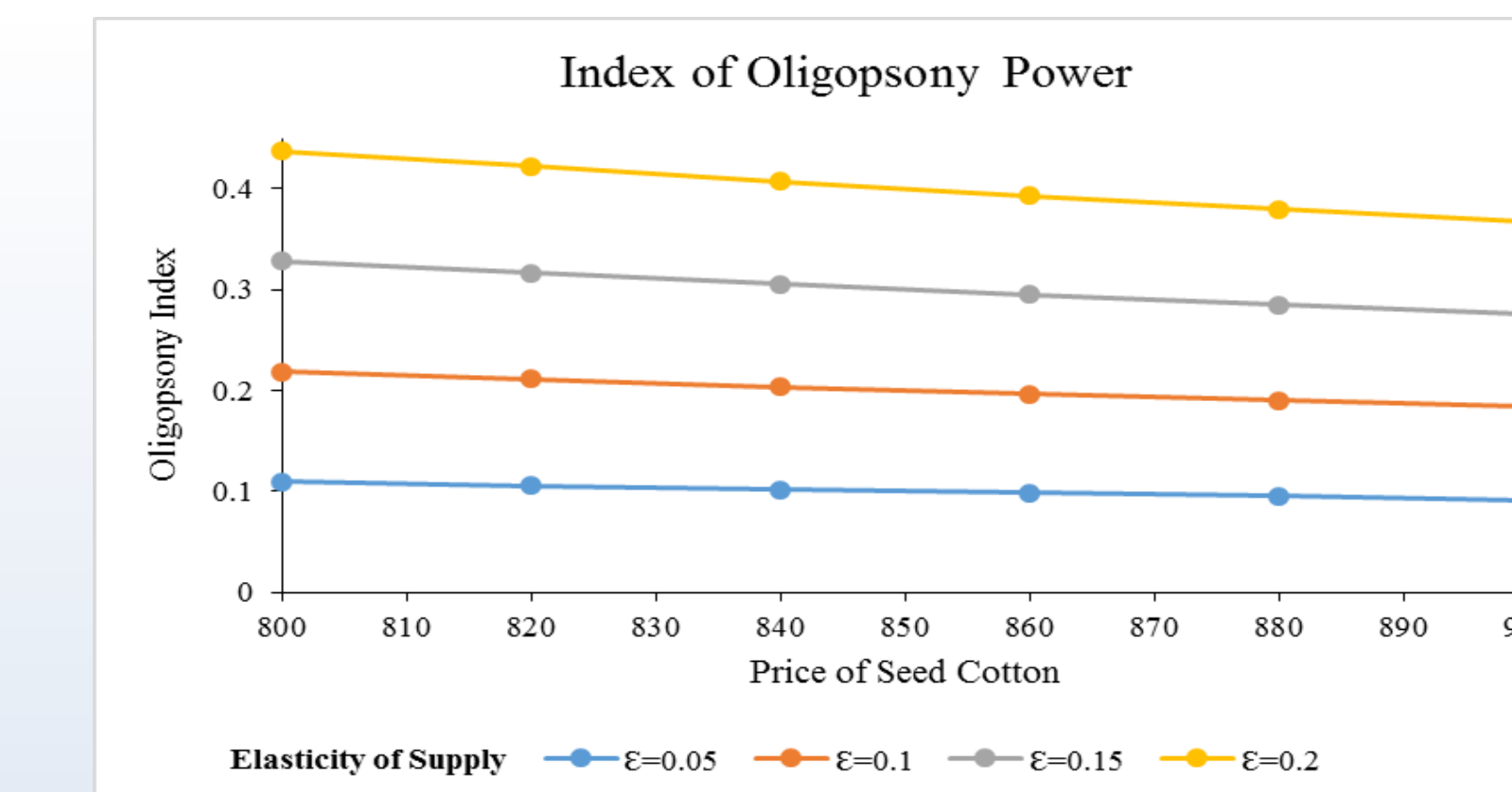
## Results

- The estimates of **cotton supply elasticity** is in the range of **0.05-0.2** in East Africa (Poonyth et al. (2004), Gilson et al. (2004))
- Marginal Cost is estimated to be **TSH 977.3**



Regions with more operating gins witness higher seed cotton prices on average

- The **index of oligopsony power** in gin input market is in the range of 0.09-0.41



## Cotton Production Function Estimation by Household Groups

	Cotton CRS Cobb-Douglas production function estimation			
	Cotton Producers BPL (1)	APL (2)	Businesses/ Others (3)	Labors (4)
Log of land	0.676*** (0.0816)	0.686*** (0.0954)	0.532*** (0.184)	0.486** (0.186)
Log of Household Labor	0.140*** (0.0490)	0.0738** (0.0313)	0.109* (0.0619)	0.111 (0.0722)
Log of Hired Labor	0.0798*** (0.0271)	0.0474** (0.0197)	0.182* (0.0944)	0.0643 (0.0816)
Log of Purchased Inputs	0.0964*** (0.0367)	0.175* (0.105)	0.0892 (0.172)	0.205* (0.108)
Log of Capital Stock	0.00756 (0.0108)	0.0180 (0.0128)	0.0880* (0.0441)	0.134*** (0.0416)
Constant	10.33*** (0.407)	10.13*** (0.946)	9.846*** (1.639)	8.669*** (1.312)
N	453	372	42	64
F	274.8	2088.9	92.93	190.5

The estimates are value-added shares in production

## Results cont.

Real Income Impacts of 25% Increase in Cotton Productivity						
% Change in income	$\theta = 0$ (Perfect Competition)		$\theta = 0.18$ (Tanzanian Case)		$\theta = 1$ (Monopoly)	
	% Change	90% CI	% Change	90% CI	% Change	90% CI
<b>A. Total</b>	5.5	(4.9, 6.2)	2.4	(1.4, 3.6)	3.3	(1.2, 6.3)
<b>B. By Household</b>						
BPL Cotton	14.4	(12.5, 16.6)	-1.3	(-4.0, 1.9)	-6.0	(-10.0, 0.4)
APL Cotton	9.6	(8.6, 10.5)	-3.3	(-4.3, -2.1)	-8.7	(-10.7, -5.5)
BPL Non-Cotton	1.8	(1.2, 2.4)	1.1	(0.3, 1.9)	1.8	(0.6, 3.6)
APL Non-Cotton	1.5	(1.2, 1.9)	0.9	(0.5, 1.5)	1.5	(0.7, 2.7)
Business	18.2	(17.7, 19.3)	24.8	(22.1, 28.4)	43.7	(34.3, 55.2)
Labourer	6.5	(5.2, 8.0)	1.7	(0.1, 3.9)	1.7	(-0.9, 5.9)

- Distribution impacts are **unequal** among groups, with businesses being the largest gainers
- Spillovers of technological change** in cotton production
- Market power of 0.18 in Tanzanian cotton ginners diminish **direct and indirect benefits** of productivity increase

## Conclusion

- Spillovers of benefits exist in **local economies** via linkages in consumption, production and input markets
- Market power** in intermediary processing sector **dampen** benefits of technological change
- The **indirect impacts** of technological change are affected by market structure
- This research provides **comprehensive understanding** of interventions in agricultural markets

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