General Equilibrium Impacts under Imperfect Agricultural Markets

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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 ginneries in sold to local and export markets

Methodology

- Integration of market structure and general equilibrium framework

Assumptions on Market Structure Model

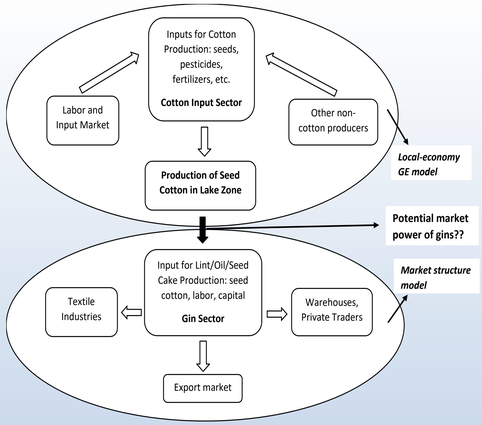
- Homogeneous agricultural crop produced by a large number of competitive farmers
- A downstream processing sector that procures the farm product to produce a final commodity
- Processors and retailers are integrated, and are identical. Technology is fixed proportions.
- *Index of Oligopsony power* is estimated using:

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

Methods cont.

Assumptions on General Equilibrium Framework

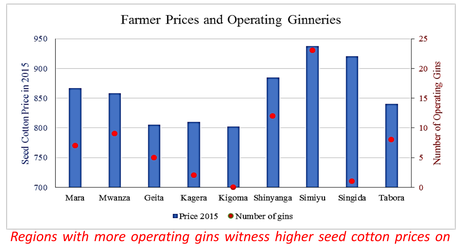
- Output and prices of our crop of interest are linked to others in the local economy through market linkages
- GE-LEWIE (Taylor and Filipski, 2014) model links local economy agents with producers of agricultural crop who are directly linked to the processing sector
- Using survey data, household economies 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

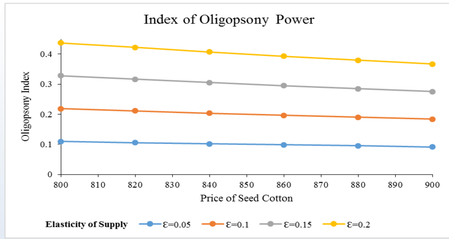
Results

- 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		Businesses/ Others	Laborers
	BPL (1)	APL (2)	(3)	(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
A. Total	5.5	(4.9, 6.2)	2.4	(1.4, 3.6)	3.3	(1.2, 6.3)
B. By Household						
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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