Is Small Still Beautiful? The Farm Size-Productivity Relationship Revisited in Kenya

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Introduction

• Based on experiences from Asia, a smallholder-led growth strategy has been widely accepted as the pathway for achieving economic transformation and mass poverty reduction in Africa.

• Since smallholders also constitute the majority of farms in Africa, it is generally accepted that a smallholder-led strategy also holds the best prospects for economic development in Africa.
Doubts on the viability of a smallholder-led growth strategy in Africa

1. Small-scale farming in Africa has historically provided very LOW RETURNS to labor

   • Most rural Africans appear to be seeking ways to improve their livelihoods to the extent possible
   • Diversifying into higher-return non-farm employment or getting out of farming entirely
Doubts on the viability of a smallholder-led growth strategy in Africa

2. Mounting POPULATION pressure and shrinking FARM SIZES

- Farm sizes are close to those in much of Asia
- But unlike Asia, most African farms have little control over water, are prone to frequent droughts, and have only one growing season per year
- Signs of UNSUSTAINABLE forms of agricultural intensification
Doubts on the viability of a smallholder-led growth strategy in Africa

3. Changing FARM STRUCTURE -- rising proportion of land among medium-scale farms
   - Emergent farmers/medium scale farms
## Changing farm structure

### Table 2: Changes in farm structure among small- and medium-scale farmers in Zambia (2009 - 2012)

<table>
<thead>
<tr>
<th>Landholding size Category</th>
<th>Number of farms</th>
<th>% change (2001-2012)</th>
<th>% of total farmland</th>
<th>Share of landholding cultivated (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 2 ha</td>
<td>638,118</td>
<td>916,787</td>
<td>748,771</td>
<td>17.3%</td>
</tr>
<tr>
<td>2 – 5 ha</td>
<td>159,039</td>
<td>366,628</td>
<td>418,544</td>
<td>163.2%</td>
</tr>
<tr>
<td>5 – 10 ha</td>
<td>20,832</td>
<td>110,436</td>
<td>165,129</td>
<td>692.6%</td>
</tr>
<tr>
<td>10 – 20 ha</td>
<td>2,352</td>
<td>35,898</td>
<td>53,454</td>
<td>2272.7%</td>
</tr>
<tr>
<td>20 – 100 ha</td>
<td>--</td>
<td>9,030</td>
<td>13,839</td>
<td>53.3%**</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>820,341</td>
<td>1,438,779</td>
<td>1,399,737</td>
<td>70.6%</td>
</tr>
</tbody>
</table>

Motivation

• Renewed interest in the Inverse Farm Size-Efficiency Relationship (IR) among development economists

• Guiding land allocation policies for inclusive growth:
  • Are prevailing land policies promoting national goals of agricultural productivity, food security and poverty reduction?
Tests of the IR hypothesis take on even greater policy importance in light of recent studies questioning the viability and even the objectives of promoting small-scale agriculture in Africa
Contribution [I]

• Explore the IR hypothesis over a much wider range of farm sizes - a statistically representative sample of farms between 1 and 100 hectares

• Inform current policy discussions about how governments should allocate unutilized/underutilized land in order to achieve national equity and productivity goals

• Unutilized/underutilized land is being claimed and transferred at a very rapid pace in some countries
Contribution [II]

• Number of studies have conventionally measured productivity as yield and or net value of crop production per unit area of land

• Our study is based on a wider set of productivity measures:
  • Net value of total crop production per unit of area planted (land productivity)
  • Total factor productivity
  • Productivity index (gross production/total production costs)
  • Net value of crop production per adult labor unit (labor productivity)
Contribution [III]

• Account for both variable and fixed costs when computing the cost of production.
  • Most of the prior studies typically ignored fixed and labor costs
  • Led to overstated productivity of farms with high fixed and labor costs
Data sources

• Data on about 300 smallholder (0-5ha) farm households came from Egerton University/Tegemeo Institute collected in 2010 in 5 counties in Western Kenya

• A survey involving 200 medium scale (5-100ha) farmers in the same counties was collected in 2012
Results
Descriptive results

Figure 1: Land productivity

Net value of crop production per hectare planted

Figure 2: Total factor productivity

Production costs/gross value of output

Figure 3: Crop productivity index

Ratio of gross value of crop output over production costs

Figure 4: Labor productivity

Net value of crop production per unit of labor
Descriptive results

Figure 4: Labor productivity
Net value of crop production per unit of labor

Figure 6: Production costs per hectare planted by landholding size by input category

Figure 7: Labor costs by components
## OLS Regression results

<table>
<thead>
<tr>
<th>Dep. var.:</th>
<th>Full sample</th>
<th>Smallholder $ha \leq 5$</th>
<th>Medium-scale $ha &gt; 5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable of interest:</td>
<td>Coef.</td>
<td>P&gt;t</td>
<td>Coef.</td>
</tr>
<tr>
<td><strong>Land productivity -- net value of crop production per ha planted ‘000KSh</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landholding (ha)</td>
<td>0.15</td>
<td>0.06</td>
<td>-1.04</td>
</tr>
<tr>
<td>Planted land (ha)</td>
<td>0.21</td>
<td>0.28</td>
<td>-0.94</td>
</tr>
<tr>
<td><strong>Total Factor Productivity (KSh)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landholding (ha)</td>
<td>3.90</td>
<td>0.04</td>
<td>-23.19</td>
</tr>
<tr>
<td>Planted land (ha)</td>
<td>8.69</td>
<td>0.06</td>
<td>-29.05</td>
</tr>
<tr>
<td><strong>Ratio of gross value of farm output to total production costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landholding (0 ‘000ha)</td>
<td>7.81</td>
<td>0.01</td>
<td>-21.50</td>
</tr>
<tr>
<td>Planted land (‘000ha)</td>
<td>12.16</td>
<td>0.10</td>
<td>-172.44</td>
</tr>
<tr>
<td><strong>Labor productivity -- net value of crop production per unit of labor ‘000KSh</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landholding (ha)</td>
<td>7.68</td>
<td>0.00</td>
<td>-0.37</td>
</tr>
<tr>
<td>Planted land (ha)</td>
<td>27.73</td>
<td>0.00</td>
<td>7.41</td>
</tr>
</tbody>
</table>
### Post-estimation simulations

<table>
<thead>
<tr>
<th>Case</th>
<th>Small-scale</th>
<th>Medium-scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>[95% Conf. Interval]</td>
</tr>
<tr>
<td>Land productivity (‘000KSh per hectare planted)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>53.27 52.00 54.54</td>
<td>52.9 49.79 54.78</td>
</tr>
<tr>
<td>II</td>
<td>41.59 40.32 42.86</td>
<td>63.25 60.76 65.74</td>
</tr>
<tr>
<td>Total Factor Productivity (‘000KSh)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>1.90 1.88 1.92</td>
<td>2.00 1.94 2.06</td>
</tr>
<tr>
<td>II</td>
<td>0.41 0.39 0.43</td>
<td>3.13 3.06 3.19</td>
</tr>
<tr>
<td>Productivity index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>2.86 2.84 2.88</td>
<td>3.51 3.35 3.68</td>
</tr>
<tr>
<td>II</td>
<td>1.35 1.33 1.37</td>
<td>4.57 4.41 4.73</td>
</tr>
<tr>
<td>Labor productivity (‘000KSh per resident adult)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>19.18 18.63 19.74</td>
<td>266.41 219.36 313.46</td>
</tr>
<tr>
<td>II</td>
<td>-35.66 -36.22 -35.11</td>
<td>259.89 212.85 306.94</td>
</tr>
</tbody>
</table>
# Average and Marginal Value Products of Fertilizer and Land

<table>
<thead>
<tr>
<th></th>
<th>Kilogram of fertilizer</th>
<th>Hectare planted</th>
<th>Small-scale farms</th>
<th>Medium-scale farms</th>
<th>Full sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Value Product</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(<code>000KSh</code>)</td>
<td></td>
<td></td>
<td>0.04</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Hectare planted</td>
<td></td>
<td></td>
<td>0.54</td>
<td>7.39</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>Marginal Value Product</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0.18</td>
<td>1.52</td>
<td>1.68</td>
</tr>
<tr>
<td>Hectare planted</td>
<td></td>
<td></td>
<td>17.02</td>
<td>17.25</td>
<td>16.47</td>
</tr>
</tbody>
</table>
Policy implications
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1. Production efficiency, while relevant, should not be the ONLY factor in guiding agricultural and land policies
   - Which scale has the largest multiplier and employment effects?
   - Which scale has the highest marginal propensity to consume?

2. All depends on the government’s development objective:
   - Production for domestic food self sufficiency and export market?
   - Broad based growth for reduced food insecurity and poverty reduction?

3. In all, the changing farm structure is going to continue in the next 5-10 years
   - Drivers: political economy factors and market forces
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3. In all, the changing farm structure is going to continue in the next 5-10 years
   • Drivers: political economy factors and market forces
Looming employment challenge in SSA

Age pyramid: rural SSA, 2015

Male
Female

-10% -8% -6% -4% -2% 0% 2% 4% 6% 8% 10%

[0-4]
[5-9]
[10-14]
[15-19]
[20-24]
[25-29]
[30-34]
[35-39]
[40-44]
[45-49]
[50-54]
[55-59]
[60-64]
[65-69]
[70-74]
[75-79]
[80+]
Conclusion

• Land policies will determine whether millions of rural Africans will make a decent livelihood
  • How supportive the land allocation and agricultural policies are to smallholders
• African leaders may soon realize that political stability will depend on how the remaining land is distributed and the profitability of family farming
Acknowledgements