AGRICULTURAL PRODUCTIVITY GROWTH IN AFRICA: NEW EVIDENCE FROM MICRODATA

P. WOLLBURG, T. BENTZE, Y. LU, C. UDRY, D. GOLLIN

ABCDE CONFERENCE, WASHINGTON DC
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BACKGROUND AND MOTIVATION

• Importance of smallholder agriculture for development: 2/3 of the world’s poor live in SSA, most in rural areas, and main economic activity is agriculture.
• SDGs 1 and 2: Target 2.3.1 ‘double agricultural productivity and incomes of small-scale food producers’
• Food security in the coming decades
• Increased spending on agricultural research to boost productivity
• So what do we know about productivity growth of smallholder agriculture in SSA? Examine trends in smallholder productivity using plot-level micro data
DATA AND VARIABLES

- LSMS-ISA from Ethiopia, Malawi, Mali, Niger, Nigeria, and Tanzania; 2008 to 2019, 130,000+ plot observations from 30,000 different farms.
- Longitudinal surveys, tracking of communities, households, individuals, parcels in some cases.
- Two-stage stratified sampling, representative of population.
- Outcome variable: value of production per hectare in constant USD, aggregated across crops on the same plot.
- Agricultural inputs: land area, family labor, value of hired labor, seeds, fertilizers, agricultural asset index.
- Plot, farmer, household characteristics.
- Weather data.
ANALYTICAL APPROACH I

• Estimation of productivity growth over time:
  • Model 1: Raw time trend
    \[
    \ln \left( \frac{Y_{it}}{L_{it}} \right) = \alpha + \beta year_t + C_i + \epsilon_{it}
    \]
  • Model 2: Plot level model with a full set of controls
    \[
    \ln \left( \frac{Y_{it}}{L_{it}} \right) = \alpha + \beta year_t + \sum_{j=1}^{J} \gamma_j \ln \left( \frac{L_{jit}}{L_{it}} \right) + \sum_{l=1}^{K} \delta_l (X_{lit}) + f(W_{it}) + \theta M_{it} + C_i + \epsilon_{it}
    \]
ANALYTICAL APPROACH II

- Additional models for productivity growth over time
  - Model 3: Farm-level (rather than plot-level)
  - Model 4: Farm-level with farm/household fixed effects
  - Model 5: Farmer-level (aggregate all variables to farmer) with farmer fixed effects
  - Model 6: cluster-level with cluster fixed effects
  - Model 7: current, time and region specific prices, rather than constant prices
- Models estimated in OLS, weighted by adjusted population weights.
RESULTS – PRODUCTIVITY GROWTH
RESULTS – PRODUCTIVITY GROWTH BY COUNTRY

<table>
<thead>
<tr>
<th></th>
<th>Ethiopia (1)</th>
<th>Malawi (2)</th>
<th>Mali (3)</th>
<th>Niger (4)</th>
<th>Nigeria (5)</th>
<th>Tanzania (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1: Simple time trend</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Annual time trend</td>
<td>0.00198</td>
<td>-0.0378***</td>
<td>0.00743</td>
<td>0.353***</td>
<td>-0.0862***</td>
<td>0.00176</td>
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<tr>
<td></td>
<td>(0.0138)</td>
<td>(0.00710)</td>
<td>(0.0225)</td>
<td>(0.0260)</td>
<td>(0.0108)</td>
<td>(0.0138)</td>
</tr>
<tr>
<td>Sample size</td>
<td>36,195</td>
<td>17,056</td>
<td>30,817</td>
<td>8,184</td>
<td>17,148</td>
<td>7,383</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.000</td>
<td>0.010</td>
<td>0.000</td>
<td>0.120</td>
<td>0.020</td>
<td>0.000</td>
</tr>
<tr>
<td>Model 2: Preferred plot-level model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual time trend</td>
<td>-0.00005</td>
<td>-0.0354***</td>
<td>-0.0174</td>
<td>0.303***</td>
<td>-0.0483***</td>
<td>-0.00371</td>
</tr>
<tr>
<td></td>
<td>(0.0131)</td>
<td>(0.00783)</td>
<td>(0.0251)</td>
<td>(0.0284)</td>
<td>(0.0108)</td>
<td>(0.0120)</td>
</tr>
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<td>Sample size</td>
<td>36,195</td>
<td>17,056</td>
<td>30,817</td>
<td>8,184</td>
<td>17,148</td>
<td>7,383</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.237</td>
<td>0.336</td>
<td>0.469</td>
<td>0.446</td>
<td>0.408</td>
<td>0.379</td>
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# RESULTS – OMITTED COUNTRIES

<table>
<thead>
<tr>
<th></th>
<th>Baseline (Model 2) (1)</th>
<th>Ethiopia (2)</th>
<th>Malawi (3)</th>
<th>Mali (4)</th>
<th>Niger (5)</th>
<th>Nigeria (6)</th>
<th>Tanzania (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual time trend</strong></td>
<td><strong>-0.0345</strong>* (0.00649)</td>
<td><strong>-0.0429</strong>* (0.00777)</td>
<td><strong>-0.0346</strong>* (0.00709)</td>
<td><strong>-0.0345</strong>* (0.00651)</td>
<td><strong>-0.0349</strong>* (0.00654)</td>
<td><strong>-0.00500</strong> (0.00784)</td>
<td><strong>-0.0399</strong>* (0.00757)</td>
</tr>
<tr>
<td><strong>Sample size</strong></td>
<td>115,628</td>
<td>79,433</td>
<td>98,572</td>
<td>84,811</td>
<td>108,599</td>
<td>98,480</td>
<td>108,245</td>
</tr>
<tr>
<td><strong>R-squared</strong></td>
<td>0.414</td>
<td>0.493</td>
<td>0.417</td>
<td>0.412</td>
<td>0.399</td>
<td>0.310</td>
<td>0.377</td>
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</tbody>
</table>
DISCUSSION AND CONCLUSIONS

• Summary
  • Negative overall time trend, holds across of range of specifications, with underlying country heterogeneity

• Limitations
  • Short panel
  • Household farms, household survey sampling

• Discussion/open questions
  • What could explain the absence of growth/negative growth?
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