Farmer Incentives and Capacity to Invest: Finding a Path to Sustainable Growth in Rwanda’s Coffee Sector

David L. Ortega
Outline

- Background to AGLC
- Methodology
- Research findings: farmer typology
- The role of cooperatives
- Importance of coffee for agricultural growth
Background
Africa Great Lakes Coffee Support Program

• 3-year USAID-funded initiative that addresses 2 major challenges in the coffee sector in Rwanda (and the Africa Great Lakes region)
  • Raise coffee quality
  • Raise coffee productivity

• Partners
  • Numerous public and private sector partners
  • Components: • applied research • policy engagement • capacity building
Applied research component

• AGLC draws upon a broad mix of quantitative and qualitative methodologies, including:
  • Coffee farmer/household surveys (and CWS survey)
  • Experimental field/plot level data collection
  • Key Informant Interviews
  • Focus Group Discussions

• Comprehensive coffee sector data base
  • Goal to integrate information from these four data collection activities
  • Provide empirical basis for policy engagement and farmer capacity building
Methodology
Survey of coffee growers

• Geographically dispersed sample across four coffee growing districts: Rutsiro, Huye, Kirehe and Gakanke.

• 4 CWSs in each District (2 cooperatives, 2 private)

• 64 HHs randomly selected from listings of each of the 16 CWSs
  • \((64 \times 16 = 1,024\) HHs)
Fieldwork

AGLC Baseline survey interview with farmer in Gakenke

Focus group discussion with farmers at Buf Café washing station
Overview parameters of sample

- Head of HH 81.5% Male; 18.5% Female
- Head of HH completed primary school: 38.1%
- Mean age of head of HH: 51 years
- Median number coffee trees on farm: 400
- Head of HH member of cooperative: 55.4%
- Median cherry produced in 2015: 600 Kg
- Mean cherry price received in: 198 RWF (2015)/160 RWF (2016)
- Median HH cash income: 340,000 RWF
- Share of total cash income from coffee: 44%
- Percent of coffee farmers reporting antestia: 55%
Research Findings
Coffee prices

Rwanda Average Arabica Coffee Grower Prices Relative (% difference) to Other East Africa\(^1\) Prices by Year

\(^1\) East Africa includes: Burundi, Ethiopia, Kenya, Tanzania and Uganda
Source: International Coffee Organisation (ICO) and other official sources
Farmer investments

Value (RWF) of Household Investments in Coffee Production per Tree (HH Labor, Wage Labor & Purchased Inputs) by Number of Trees on Farm

- **HH Labor**
- **Wage Labor**
- **Purch. Inputs**
- **Purch. Equip.**

<table>
<thead>
<tr>
<th>Total Number of Trees on Farm</th>
<th>HH Labor</th>
<th>Wage Labor</th>
<th>Purch. Inputs</th>
<th>Purch. Equip.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 180</td>
<td>45</td>
<td>50</td>
<td>20</td>
<td>99</td>
</tr>
<tr>
<td>181 - 300</td>
<td>186</td>
<td>122</td>
<td>34</td>
<td>99</td>
</tr>
<tr>
<td>301 - 500</td>
<td>223</td>
<td>87</td>
<td>14</td>
<td>34</td>
</tr>
<tr>
<td>501 - 1,000</td>
<td>185</td>
<td>69</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>1001+</td>
<td>114</td>
<td>54</td>
<td>6</td>
<td>24</td>
</tr>
</tbody>
</table>

Investment (RWF/Tree)
Productivity and margins

Mean Productivity (KG cherry) per Tree by Number of Trees on Farm (ANOVA)

Mean Gross Margin* (RWF) per KG of Cherry by Number of Trees on Farm (ANOVA)

*Gross Margin = Value of Sales - Cost of production & transport
Farmer typology

Rwanda Coffee Farmer Typology: Capacity to Invest versus Incentive to Invest (in Low Cherry Price Scenario) by Size of Plantation

1. Smallholder Producer
   - High Productivity
   - Low Profits

2. Mid-range Producer
   - Medium Productivity
   - Higher Profits

3. Largeholder Producer
   - Low Productivity
   - Low Profits
Aging farmer population

Age Distribution of Sampled Coffee Growers vs All Rural HH Heads

Source of rural population data: Rwanda 2012 Census
Note: Age categories for coffee growers and all rural HHs differ by one year
The Role of Cooperatives
Effect of cooperative membership

- Matching cooperative members and non-members on observable characteristics
- Sensitivity analysis to non-observable characteristics
Cooperative members…

• Adopt best practices
• Are 14% more productive per tree
• Receive 52% more income from coffee
• Have 22% lower cost of production
Importance of Coffee to Rwanda’s Agricultural Growth
#1. Coffee is a longstanding source of export earnings and economic growth

- Despite recent struggles, this downward trend can easily be reversed under the right policy framework
#2. Coffee directly affects the lives of over 350,000 farmers and their families

- Rwanda’s coffee sector promotes food security and economic development
#3. Specialty coffee is in high and growing demand worldwide

- Rwanda is synonymous with high quality specialty coffee
- 250+ coffee washing stations
- Attracted major companies
#4. Specialty coffee has price stability in global markets (compared to ordinary)

- Ordinary coffee price has more fluctuations.
- Specialty coffee:
  - Higher price
  - More stable
  - Decoupled from NY C

![C Price vs. African Specialty Coffee](chart.png)
#5. Comparative advantage: Rwanda stands out in specialty coffee

Source: DT Coffee Club
#6. Coffee is environmentally superior to most other crops grown in Rwanda

![Crop Cover Value (C-Value) for Selected Crops in Rwanda](image)

Source: Clay & Lewis (1996); Lewis et al. (1988)
#7. Positive climate change effects for Rwanda coffee

Source: Bunn et al. 2015
#7. Positive climate change effects for Rwanda coffee
#8. Dedicated coffee producing households have better food security

<table>
<thead>
<tr>
<th>Regressors</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>Inverse Odds Ratio†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee share (%) of total HH Income</td>
<td>-1.077</td>
<td>0.421</td>
<td>6.524</td>
<td>1</td>
<td>0.011**</td>
<td>0.341</td>
<td>2.93</td>
</tr>
<tr>
<td>Member of coop</td>
<td>-0.289</td>
<td>0.200</td>
<td>2.085</td>
<td>1</td>
<td>0.149</td>
<td>0.749</td>
<td>1.34</td>
</tr>
<tr>
<td>Total land owned (Ha)</td>
<td>-0.297</td>
<td>0.110</td>
<td>7.325</td>
<td>1</td>
<td>0.007***</td>
<td>0.743</td>
<td>1.35</td>
</tr>
<tr>
<td>Income 2015 (not including coffee)</td>
<td>0.000</td>
<td>0.000</td>
<td>3.884</td>
<td>1</td>
<td>0.049**</td>
<td>1.000</td>
<td>1.00</td>
</tr>
<tr>
<td>Gender of HH head</td>
<td>0.866</td>
<td>0.265</td>
<td>10.680</td>
<td>1</td>
<td>0.001***</td>
<td>2.377</td>
<td>-</td>
</tr>
<tr>
<td>Age of HH head</td>
<td>0.000</td>
<td>0.010</td>
<td>0.000</td>
<td>1</td>
<td>0.994</td>
<td>1.000</td>
<td>-</td>
</tr>
<tr>
<td>Active adults in HH</td>
<td>0.081</td>
<td>0.066</td>
<td>1.511</td>
<td>1</td>
<td>0.219</td>
<td>1.084</td>
<td>-</td>
</tr>
<tr>
<td>Education of HH head</td>
<td>-0.209</td>
<td>0.096</td>
<td>4.776</td>
<td>1</td>
<td>0.029**</td>
<td>0.811</td>
<td>1.23</td>
</tr>
<tr>
<td>Years growing coffee</td>
<td>0.011</td>
<td>0.009</td>
<td>1.477</td>
<td>1</td>
<td>0.224</td>
<td>1.012</td>
<td>-</td>
</tr>
<tr>
<td>Elevation of HH (m)</td>
<td>0.000</td>
<td>0.001</td>
<td>0.268</td>
<td>1</td>
<td>0.605</td>
<td>1.000</td>
<td>1.00</td>
</tr>
<tr>
<td>Constant</td>
<td>0.608</td>
<td>1.182</td>
<td>0.265</td>
<td>1</td>
<td>0.607</td>
<td>1.837</td>
<td>-</td>
</tr>
</tbody>
</table>

* ** *** indicates significance at the 10%, 5% and 1% levels, respectively.
† For ease of interpretation inverse odds ratio computed for covariates with negative log odds (B).

N=508 households
Summary and Discussion Points
Commitment from all stakeholders to ensure that producers are compensated fairly, with prices commensurate with those paid elsewhere in East Africa, and set above farmer’s cost of production.

Coffee sector must once again become a high priority for strategic thinking and support in Rwanda.
Thank You!
Thank You!
Trends in coffee production

Rwanda Green Coffee Production by Year

Ethiopia Green Coffee Production by Year

Source: International Coffee Organisation (ICO)
<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Percent</th>
<th>Mean</th>
<th>Median</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender of head (% female)</td>
<td>1024</td>
<td>1</td>
<td>2</td>
<td>18.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of head (years)</td>
<td>1024</td>
<td>22</td>
<td>94</td>
<td>-</td>
<td>51.1</td>
<td>51</td>
<td>14.18</td>
</tr>
<tr>
<td>Education of head (% primary complete)</td>
<td>1024</td>
<td>1</td>
<td>10</td>
<td>39.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Member of coop (%)</td>
<td>1024</td>
<td>0</td>
<td>1</td>
<td>55.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative ownership of CWS (%)</td>
<td>1024</td>
<td>1</td>
<td>2</td>
<td>50.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income 2015 (not including coffee)</td>
<td>1023</td>
<td>0</td>
<td>4,350,000</td>
<td>-</td>
<td>318,726</td>
<td>180,000</td>
<td>452,385</td>
</tr>
<tr>
<td>Income 2015 from coffee</td>
<td>1021</td>
<td>0</td>
<td>2,945,000</td>
<td>-</td>
<td>200,286</td>
<td>125,000</td>
<td>256,166</td>
</tr>
<tr>
<td>Share of total income from coffee</td>
<td>1022</td>
<td>0</td>
<td>1</td>
<td></td>
<td>44.5</td>
<td>42.0</td>
<td>27.5</td>
</tr>
<tr>
<td>Nbr of productive coffee trees</td>
<td>1022</td>
<td>0</td>
<td>9,320</td>
<td>-</td>
<td>706</td>
<td>400</td>
<td>945</td>
</tr>
<tr>
<td>Total cherry production 2015 (KG)</td>
<td>1022</td>
<td>0</td>
<td>15,500</td>
<td>-</td>
<td>1,025</td>
<td>601</td>
<td>1,448</td>
</tr>
<tr>
<td>Total land owned (sq meters)</td>
<td>1024</td>
<td>0</td>
<td>80,000</td>
<td>-</td>
<td>11,986</td>
<td>9,449</td>
<td>10,673</td>
</tr>
<tr>
<td>Received premium (%)</td>
<td>1016</td>
<td>0</td>
<td>1</td>
<td>26.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price per kg of cherry 2015</td>
<td>1005</td>
<td>100</td>
<td>300</td>
<td>-</td>
<td>198</td>
<td>200</td>
<td>32.49</td>
</tr>
<tr>
<td>Applied fertilizers (%)</td>
<td>1024</td>
<td>0</td>
<td>1</td>
<td>71.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applied pesticides (%)</td>
<td>1024</td>
<td>0</td>
<td>1</td>
<td>68.8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applied manure (%)</td>
<td>1024</td>
<td>0</td>
<td>1</td>
<td>59.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevation of HH (m)</td>
<td>1024</td>
<td>1,310</td>
<td>2,179</td>
<td>-</td>
<td>1,712</td>
<td>1,721</td>
<td>165</td>
</tr>
</tbody>
</table>
Hypothesis: Cooperative members have lower costs of production
Hypothesis: Cooperative membership increases adoption of best management practices.

Percent of Household Applying Inputs

- **Fertilizers**
  - Coop Members (%)
  - Non Coop Members (%)

- **Pesticides**
  - Coop Members (%)
  - Non Coop Members (%)

- **Mulch**
  - Coop Members (%)
  - Non Coop Members (%)

- **Pruning**
  - Coop Members (%)
  - Non Coop Members (%)

- **Weeding**
  - Coop Members (%)
  - Non Coop Members (%)
Hypothesis: Cooperative membership increases adoption of best management practices.
Farmers' Reasons for not Participating in a Cooperative

- Initial fee is too high: 40%
- Not invited to participate: 30%
- No coops in the area: 20%
- Annual fee is too high: 10%
- Cost is not worth the benefit: 5%
- Prefers to process parchment: 0%
What if all coffee farmers attained the productivity of those with the fewest trees (<=180 trees)?

- Est Production based on Kg/tree of HH's with <=180 trees
- Total KG Cherry Produced 2015

<table>
<thead>
<tr>
<th>Number of Coffee Trees on Farm</th>
<th>Coffee Cherry Produced (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 180</td>
<td>42,824</td>
</tr>
<tr>
<td>181 - 300</td>
<td>101,702</td>
</tr>
<tr>
<td>301 - 500</td>
<td>201,355</td>
</tr>
<tr>
<td>501 - 1,000</td>
<td>331,934</td>
</tr>
<tr>
<td>1001+</td>
<td>477,570</td>
</tr>
<tr>
<td>Total</td>
<td>962,144</td>
</tr>
</tbody>
</table>
Primary Barriers to Investment in Coffee Identified by Coffee Growing Households

- Low cherry prices: 71%
- Unstable cherry prices: 46%
- Lack of inputs distribution: 35%
- High labor requirements: 28%
- High cost of inputs: 19%
- Access to mulch: 16%
- Lack of tools/equipment: 9%
- Low profits: 8%
- Lack of land: 7%
- Lack of capital: 7%
- Lack access to pre-finance serv.: 6%

Percent of Households Identifying Barrier
ANOVA: Estimated Productivity (KG/Tree) by Premium Received, Adjusted for Gender and Covariates*

<table>
<thead>
<tr>
<th>Productivity measure</th>
<th>Premium Received</th>
<th>N</th>
<th>Unadjusted</th>
<th>Adjusted for Factors (Gender of HHH)</th>
<th>Adjusted for Factors and Covariates*</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity (KG cherry) per tree</td>
<td>No</td>
<td>722</td>
<td>1.64</td>
<td>1.63</td>
<td>1.63</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>269</td>
<td>2.09</td>
<td>2.10</td>
<td>2.11</td>
<td></td>
</tr>
</tbody>
</table>

*Covariates: Nbr of trees on farm, Total HH non-coffee income, Total land owned, Age of HHH, Educ. of HHH, Active adults in HH, Elevation