Off-farm Work and Fertilizer Use among Smallholder Farmers in Kenya

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Outline

- Introduction and Motivation
- Data
- Methods
- Findings
- Conclusions
- Policy Implications
Introduction & Motivation

- Rural development strategies and policies in Kenya have emphasized on increasing farm productivity as a way out of poverty.

- The effectiveness of this strategy is a subject of debate as:
  - Poverty rates continue to be high among rural communities esp in SSA.
  - Agricultural productivity has stagnated over time.
  - Poverty rates high in low agricultural potential areas that are difficult to reach directly with interventions targeted towards the farm sector.

Q. Could the off-farm sector be a potential entry point for such areas ??

- Indeed multiple job-holding (combining farming and off-farm work), though uncommon outside of agriculture has been the norm rather than exception.
Introduction & Motivation

Q. Why do households diversify into the off-farm sector?

- Mixed evidence on the reasons rural households diversify into off-farm work (O FW)

Push factors
- Low farm earning (high input prices and low output prices)
- Weather shocks - drought
- Market imperfections (credit and crop insurance)
- Lack of land/poor quality
- Human and physical asset endowments (capacity)

Pull factors
- Wages or earnings from OFW labor market compared to the farm earnings
- Availability of employment opportunities-local labor market characteristics and public investment (capacity)

Most studies generally agree that OFW helps to supplement family incomes in rural areas of developing countries
Introduction & Motivation

- From the concept of agricultural transformation increased agric productivity
  1. stimulates the development of the rural non-farm sector through growth of linkages and is
  2. key to poverty reduction

- However, agricultural productivity stagnating and poverty is rampant.

- Major impediment is the lack or low use of productivity-enhancing inputs due to:
  1. Unavailability of liquid capital to finance such expenditures
  2. Risk averse nature of small scale farmers
Introduction & Motivation

- Most affected are food crops that lack the institutional support available for cash crops

- Off-farm earnings are considered relevant in this case because:
  - Could be used to relax the cash constraint of households
  - Could be used to spread the risk of using these inputs.

BUT: OFW could be competing with the farm for resources especially labour

- We approach the problem from two perspectives:
  - Possible competition for resources e.g. labour
  - Potential re-investment of off-farm earnings
Objectives/Research Questions

- Main objective of this paper is to explore whether and how participation in off-farm work impacts on farm outcomes

- The study explores the relationship between off-farm work and farm input use and intensification for smallholder farmers

- Specific Questions
  - What is the distribution and shares of off-farm work across regions and time?
  - Holding other factors constant, does OFW compete for resources with the farm?
  - Do off-farm earnings contribute to the financing of productivity-enhancing investments in agriculture?
Objectives/Research Questions

Hypothesis

- Competition for resources may result in a negative relationship between OFW and farm outcomes

- OFW earnings may be used to compensate for the missing and imperfect credit markets by providing ready cash for farm input purchases

Analysis done by

- Type of Off-farm Work
- Across Crops
Objectives/Research Questions

- **Type of work**
  - Overall Off-farm work
  - Nonfarm work
    - Informal business
    - Salaried/wage employment
    - Agricultural labor/Farm Kibarua: piecework on other farms

- **Crops**
  - Main staple (maize)
  - Emerging cash crop (vegetables)
  - Traditional cash crop (tea)
Objectives/Research Questions

- Nature of rural OFW in Kenya varies
  - high end salaried wage labor (teachers and doctors)
  - Profitable business activities (public transport, hotels)
  - Low wage labor (watchman, cook, etc)
  - Petty business & labor activities (shoe shining, farm kibarua, etc)
Agricultural labor
Low return business-charcoal burning
Local Market
Informal business activities-low return
Informal business activities-high return
Hotel Business

[Image of a beachside Starbucks sign]
Rural town/local shopping center
Data and Sample

- Tegemeo Rural Household Panel
  - 1999/00, 2003/04, 2006/07, 2009/10
- Balanced panel: **1243**
- Data on economic, demographic and locational characteristics of households
Conceptual Approach/Methods

- Analytical framework based on the theory of Agric Household Model (AHM) following Singh et al. (1986) and Huffman (1991).

- Input demand functions estimated to determine the factors that affect the farmers’ decision to use inputs.
  - Dependent variable structure: Fertilizer Kgs per ha, N nutrient kgs per ha

- To identify coefficients of interest we control for:
  - Economic incentives facing the household
  - Investment in public infrastructure
  - Household resource endowments,
  - Credit availability
  - Other income sources
  - Locational characteristics of household
Methods

Specification Issues

- Zero-expenditure /non-use of fertilizer
  - Maize: Censored (CRE)
  - Vegetables: Continuous (FE2SLS)
  - Tea: Continuous (FE2SLS)

- Envision potential endogeneity of OFW variables
  - Instrumental variables
    - Share of Non-farm earnings - Aggregate
    - Distance to electricity
Findings
## Distribution of Households with OFW across Agro-regional Zones

<table>
<thead>
<tr>
<th>Agro-regional zones</th>
<th>% with off-farm work</th>
<th>Off-farm share</th>
<th>Crop share</th>
<th>Livestock share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal Lowlands</td>
<td>0.98</td>
<td>0.67</td>
<td>0.28</td>
<td>.05</td>
</tr>
<tr>
<td>Eastern Lowlands</td>
<td>0.97</td>
<td>{0.49}</td>
<td>0.37</td>
<td>.14</td>
</tr>
<tr>
<td>Western Lowlands</td>
<td>0.90</td>
<td>0.45</td>
<td>0.40</td>
<td>.14</td>
</tr>
<tr>
<td>Western Transitional</td>
<td>0.87</td>
<td>0.32</td>
<td>0.52</td>
<td>.16</td>
</tr>
<tr>
<td>High Potential Maize Zone</td>
<td>0.83</td>
<td>0.36</td>
<td>.38</td>
<td>.26</td>
</tr>
<tr>
<td>Western Highlands</td>
<td>0.83</td>
<td>0.34</td>
<td>.47</td>
<td>.19</td>
</tr>
<tr>
<td>Central Highlands</td>
<td>0.86</td>
<td>0.31</td>
<td>.49</td>
<td>.19</td>
</tr>
<tr>
<td>Overall</td>
<td>0.88</td>
<td>.40</td>
<td>.42</td>
<td>.18</td>
</tr>
</tbody>
</table>
## Characteristics of Households with Off-farm Work by Quintiles of Total Income

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Total Income (Ksh)</th>
<th>Crop share in total income</th>
<th>Off-farm share in total income</th>
<th>% with salaried wage income</th>
<th>% with Business/informal income</th>
<th>% with Farm Kibarua income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 low</td>
<td>39,245</td>
<td>0.49</td>
<td>0.37</td>
<td>0.60</td>
<td>0.49</td>
<td>0.28</td>
</tr>
<tr>
<td>2</td>
<td>86,817</td>
<td>0.42</td>
<td>0.37</td>
<td>0.63</td>
<td>0.58</td>
<td>0.20</td>
</tr>
<tr>
<td>3</td>
<td>142,092</td>
<td>0.41</td>
<td>0.38</td>
<td>0.66</td>
<td>0.62</td>
<td>0.17</td>
</tr>
<tr>
<td>4</td>
<td>226,138</td>
<td>0.40</td>
<td>0.41</td>
<td>0.74</td>
<td>0.63</td>
<td>0.09</td>
</tr>
<tr>
<td>5 high</td>
<td>564,763</td>
<td>0.39</td>
<td>0.44</td>
<td>0.77</td>
<td>0.69</td>
<td>0.04</td>
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<tr>
<td>Total</td>
<td>216,945</td>
<td>0.42</td>
<td>0.40</td>
<td>0.68</td>
<td>0.60</td>
<td>0.15</td>
</tr>
</tbody>
</table>
# Income Shares by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Share of Total income</th>
<th>Share of Off-farm income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crop</td>
<td>Livestock</td>
</tr>
<tr>
<td>2000</td>
<td>.44</td>
<td>.18</td>
</tr>
<tr>
<td>2004</td>
<td>.41</td>
<td>.18</td>
</tr>
<tr>
<td>2007</td>
<td>.42</td>
<td>.18</td>
</tr>
<tr>
<td>2010</td>
<td>.41</td>
<td>.19</td>
</tr>
<tr>
<td>Total</td>
<td>.42</td>
<td>.18</td>
</tr>
</tbody>
</table>
## Characteristics of Households with and without Off-farm Work

<table>
<thead>
<tr>
<th>Type of off-farm work</th>
<th>Status</th>
<th>Total income</th>
<th>Crop income</th>
<th>Crop share</th>
<th>Educ. of head</th>
<th>% of Female head</th>
<th>Km to road</th>
<th>Km to Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Off-Farm</strong></td>
<td>Non-participants</td>
<td>138,831</td>
<td>91,752</td>
<td>0.7</td>
<td>5.0</td>
<td>23</td>
<td>7.7</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
<td>222,420</td>
<td>87,191</td>
<td>0.4</td>
<td>6.3</td>
<td>20</td>
<td>7.5</td>
<td>3.7</td>
</tr>
<tr>
<td><strong>Salary</strong></td>
<td>Non-participants</td>
<td>175,071</td>
<td>90,368</td>
<td>0.5</td>
<td>5.7</td>
<td>19</td>
<td>7.9</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
<td>232,148</td>
<td>86,262</td>
<td>0.4</td>
<td>6.3</td>
<td>22</td>
<td>7.2</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Business/Inform</strong></td>
<td>Non-participants</td>
<td>174,832</td>
<td>82,454</td>
<td>0.5</td>
<td>5.5</td>
<td>25</td>
<td>7.2</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
<td>239,848</td>
<td>92,772</td>
<td>0.4</td>
<td>6.6</td>
<td>17</td>
<td>7.6</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Farm Kibarua</strong></td>
<td>Non-recipients</td>
<td>223,429</td>
<td>93,832</td>
<td>0.5</td>
<td>6.2</td>
<td>20</td>
<td>7.3</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
<td>117,531</td>
<td>49,695</td>
<td>0.4</td>
<td>5.0</td>
<td>23</td>
<td>8.6</td>
<td>4.0</td>
</tr>
</tbody>
</table>
### Off-farm work Shares by Crop

<table>
<thead>
<tr>
<th></th>
<th>Nonfarm</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bus-Inf</td>
<td>Salaries/remit</td>
<td>Farm Kibarua</td>
<td>All Off-Farm</td>
<td>All On-Farm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(1+2+3)</td>
<td>(4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>0.142</td>
<td>0.175</td>
<td>0.027</td>
<td>0.344</td>
<td>0.656</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>0.137</td>
<td>0.164</td>
<td>0.021</td>
<td>0.322</td>
<td>0.678</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tea</td>
<td>0.085</td>
<td>0.133</td>
<td>0.012</td>
<td>0.230</td>
<td>0.770</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Fertilizer use by Off-farm Work Type

<table>
<thead>
<tr>
<th>Off-farm Work</th>
<th>Maize</th>
<th>Vegetables</th>
<th>Tea</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of HH Using</td>
<td>Intensity (kgs/ha)</td>
<td>% of HH Using</td>
</tr>
<tr>
<td>Non-Participants</td>
<td>75</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Participants</td>
<td>66</td>
<td>69</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>68</td>
<td>100</td>
</tr>
</tbody>
</table>
## Effect of Non-farm Work by Crop (N kgs/ha)

<table>
<thead>
<tr>
<th>Crop</th>
<th>All Nonfarm</th>
<th>Salary</th>
<th>Business</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>-***</td>
<td>-***</td>
<td>-***</td>
</tr>
<tr>
<td>Vegetables</td>
<td>-**</td>
<td>-**</td>
<td>-**</td>
</tr>
<tr>
<td>Tea</td>
<td>+</td>
<td>+</td>
<td>+*</td>
</tr>
</tbody>
</table>
## Effect of OFW on Fertilizer Demand on Maize

<table>
<thead>
<tr>
<th>Type of OFW</th>
<th>Adoption</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Off-farm earnings (s-1)</td>
<td>+***</td>
<td>+***</td>
</tr>
<tr>
<td>Salaried/Wage employment (s-1)</td>
<td>+***</td>
<td>+***</td>
</tr>
<tr>
<td>Business /Informal (s-1)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Summary/Conclusions

- Generally high off-farm work shares in total hh income across all types of households – 31 to 67%
  - OFW has been increasing over time
  - Increasing across income groups – highest in high income hhs
  - Relatively high in low ag potential areas ref high potential areas

- Households engaged in OFW have significantly higher total hh incomes and lower crop shares

- OFW shares high for maize producing households followed by vegetables and lastly tea
  - Consistent with relative levels and stability of income from these crops
Summary/Conclusions

- Households engaged in OFW have relatively low use of fertilizer on the 3 crops
  - Lower % of hh using and lower intensities

- Effect of Non-farm work on fertilizer use differs by crop and OFW type but broadly:
  - Maize: Negative (-)
  - Vegetables: Negative (-)
  - Tea: Positive (+)

- Accounting for timing of OFW, the effects on fertilizer use on maize are positive and complementary
  - --- possible reinvestment of off-farm earnings in fertilizer use.
Contribution/Policy Implications

- High OFW shares in low ag potential areas implies possible entry point in reaching these disadvantaged hhs

- Increasing OFW shares with income and over time
  - possible signs of structural transformation in these rural economies?

- The positive results on the relationship on fertilizer application in tea
  - consistent with the stability of tea production and incomes allowing for decision making on labor and capital allocations

- The interactions between the farm and off-farm sectors,
  - Imply need for investments in growth of rural economies
  - implications for agricultural growth and transformation of small holder agriculture.
More important is the role played by OFW in

- risky production environments and
- during periods of external shocks to the farming environment

- The importance of OFW in rural household incomes and farm production decisions imply
  - Important to factor OFW in the overall strategies of transforming smallholder agriculture and reducing rural poverty
  - Comprehensive package that takes account of rural economies in totality
Contribution/Policy Implications

- Broadly the question of whether and how off-farm work affects agriculture has implications on farm productivity enhancement programs and institutional failures.

- Such information can guide policy as to the choice of emphasis on investments such as:
  - agricultural research, extensions, input subsidies versus education and public assets that spur growth in the rural economies thus encouraging growth in the off-farm labor market.

- The results imply investments in infrastructure and electricity are key to growth of the off-farm sector.
Thank You