Building Market Linkages for Smallholder Farmers in Uganda

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Poor Integration in African Markets:

- Lack of market integration is a major issue.
  - Leads to highly variable prices across time, so farmers tend to sell low (harvest) and buy high (hungry season) (Burke 2013).
  - Leads to high search costs (Allen 2013) and poor co-integration across space (Minten, Stifel, and Tamru 2012).
  - Improving intermediation allows for the possibility of large returns in the gains from trade (Antras & Costinot, 2011).
- Downward-sloping demand curves dampen incentives to invest in productivity enhancement, may also have major long-run effects on agricultural productivity in shallow markets.
Poor Integration in African Markets:

- Some very expensive ways to solve this problem:
  - Infrastructure investment:
    - roads (Minten 2011, Casaburi et al. 2013)
    - storage capacity (Deaton & Laroque 1996)
  - Information Technology appears to be a cost-effective alternative, but:
    - Simply providing price information to farmers isn’t sufficient in most contexts (Fafchamps & Minten 2012, Mitra et al. 2013), despite Jensen (2007) and Aker & Fafchamps (2010).
    - Necessary to fundamentally shift intermediary power/actors in order to change prices (Goyal 2011, Aker 2010, Svensson & Yanagizawa 2009).
Poor Integration in African Markets:

- Hypotheses: what is required to change intermediary market power, improve farm-gate prices:
  1. Farmers must be informed at the time they make sales decisions.
  2. Farmers must have multiple, competing buyers.
  3. Buyers must overcome search cost, obstacles related to price and quality uncertainty in order to be willing to trade deep in rural areas.
  4. Long output sales chains need to be shortened. Need to cut out multiple intermediaries all of whom can extract information rents.
Our solution:

- **Multipronged intervention providing:**
  - Creation of new private-sector intermediaries with direct links to large buyers, including forward contracts for specific cash crops.
  - Implementation of Kudu, new digital trading platform for agricultural crops, allows farmers or agents to post lots, reservation prices.
  - Use of quality/bulking certification by agents and randomized transport cost guarantees to promote digital platform.
  - Creation of large-scale SMS-based Market Survey in 260 markets, collecting price data every two weeks.
  - Creation of ‘SMS Blast’ system that broadcasts price data from Kudu + Market Survey out to traders and farmers in treatment markets.
  - Large-scale RCT covering 12% of Uganda.
Our Team:

- Policy Design & Evaluation Lab at UCSD.
- AgriNet: largest private-sector ag intermediary.
- Kudu: new software platform from Makerere
- IPA Uganda
Building Blocks of the Project:

- **AgriNet**
  - Largest private-sector agricultural intermediary in Uganda.
  - Recruit and train ‘Commission Agents’, who:
    - bulk and sell output using AN and own capital,
    - receive ‘trader alerts’ about district & national prices and post on community whiteboard.
    - engage in forward contracting, provision of inputs for specific crops (sorghum) for specific buyers (Uganda Breweries).
Building Blocks of the Project:

- Kudu.
  - Designed by the College of Computing and Informatics Technology at Makerere University.
  - Registered sellers post lots for sale, state reservation prices, system knows seller location.
  - Buyers post bids and a ceiling price, matching algorithm finds distance/price pareto frontier and displays 3 best lots to each seller.
  - Price-setting mechanism gives buyer lowest price possible.
  - Kudu advertises by radio in sales markets.
Building Blocks of the Project:

- **Kudu registration rising rapidly:**

![Graph showing user registration over months of 2013]

<table>
<thead>
<tr>
<th>Produce type</th>
<th>Total ask quantity</th>
<th>Produce type</th>
<th>Total bid quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peanuts</td>
<td>512,375 Kg</td>
<td>Maize</td>
<td>917,300 Kg</td>
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<tr>
<td>Maize</td>
<td>1,711,935 Kg</td>
<td>Sesame</td>
<td>110,000 Kg</td>
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<tr>
<td>Beans mixed</td>
<td>114,900 Kg</td>
<td>Beans mixed</td>
<td>179,050 Kg</td>
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<tr>
<td>Coffee (Robusta)</td>
<td>36,800 Kg</td>
<td>Soya</td>
<td>40,000 Kg</td>
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<tr>
<td>Sweet Potatoes</td>
<td>2,221 Sacks</td>
<td>Peanuts</td>
<td>35,050 Kg</td>
</tr>
</tbody>
</table>
Building Blocks of the Project:

- **AgriNet-enhanced Kudu.**
  - CAs will ‘certify’ the quality and bulking of lots posted on Kudu.
  - Creation of an enhanced Kudu interface that allows for posting of quality, AN certifications, guarantees.
  - Project will provide transport cost guarantees to randomly selected lots to understand how contractual risk may prevent this market from working.
Building Blocks of the Project:

- **SMS Market Survey System.**
  - Recruit traders to serve as enumerators; every two weeks they are pushed out a survey and they respond by SMS.
  - Open-source software being designed at UCSD.
  - Training, spot-checking to be conducted by IPA.
  - New way of providing high-granularity market data, system designed to be scaled rapidly within SSA if successful.
  - Provides data capture for study as well as price inputs for interventions in treatment markets.
Market Linkages:

Basic Schematic: Farmers sell to traders in local market trading centers.

Local traders sell on to regional middlemen who transport to large national, international markets.
Market Linkages:

Kudu: Provides direct linkage between farmers and national buyers.

Our project trains & licences AgriNet CAs to certify the quality of lots posted in Kudu.

AN to provide liquidity for bulking.

Randomized guarantees of transport costs for buyers.
Market Linkages:

Market survey captures prices in T & C markets biweekly.

Price data from Market Survey, Kudu fed into Blast SMS system.

Farmers and Traders sign up to receive Blast SMS, system free for first year of project.
Market Linkages:

AgriNet’s Trader Alerts system sends out tenders from large buyers, prices in all regional markets.

Permits CAs to sign forward contracts for specific cash crops.
Research Design & Statistical Power:

- Randomization conducted at sub-county level.
- Pick 2-3 largest trading centers in each subcounty; become PSUs.
- Statistical power is an issue despite very large geographic coverage.

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>Control</th>
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<tbody>
<tr>
<td>Subcounties</td>
<td>55</td>
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<tr>
<td>Trading Centers:</td>
<td></td>
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<tr>
<td>Hub Markets</td>
<td>15</td>
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<tr>
<td>Spoke Markets</td>
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<tr>
<td>Traders:</td>
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<tr>
<td>All</td>
<td>550</td>
<td>550</td>
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<tr>
<td>AgriNet Cas</td>
<td>220</td>
<td></td>
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<tr>
<td>Farming Households</td>
<td>1500</td>
<td>1500</td>
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</tbody>
</table>
Study districts:

are:

• maize surplus
• relatively remote
• deemed by Agrinet to be attractive commercial candidates for expansion.
### Project Timeline:

- Market identification study currently underway.
- Trader and Household Baselines Jan-Mar 2015.
- Interventions begin with harvests in June 2015.

<table>
<thead>
<tr>
<th>Years</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<tbody>
<tr>
<td>Months</td>
<td>Oct</td>
<td>Nov</td>
<td>Dec</td>
<td>Jan</td>
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<tr>
<td>Visualization maps sub-counties</td>
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<td>Compiling list of sub-counties</td>
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<td>Randomization</td>
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<td>Design Survey Instruments</td>
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<td>Recruitment Interns</td>
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<td>Market Identification</td>
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<td>Market Selection</td>
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<td>Pre-test Survey Instruments</td>
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<td>Programming surveys on tablets + testing</td>
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<td>Recruitment of Enumerators</td>
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<tr>
<td>Preparation training &amp; field work</td>
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<tr>
<td>Training baseline survey</td>
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<td>Household Survey team + recruitment farmers for KUDU</td>
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<tr>
<td>Trader Survey team + recruitment traders for KUDU</td>
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<tr>
<td>Trader recruitment for SMS market survey + training team</td>
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<tr>
<td>CA Recruitment</td>
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<tr>
<td>CA/Kudu Training</td>
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<tr>
<td>Pilot SMS survey</td>
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<tr>
<td>Intervention</td>
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<td>Farmer data collection</td>
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<tr>
<td>Market data collection</td>
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<tr>
<td>Impact Evaluation Workshop for East African PIs</td>
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<td>Clean and analyse data</td>
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<td>Roadshow (outreach) to USAID missions</td>
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<td>Draft report and academic papers</td>
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Primary outcomes:

- **Market level:**
  - price levels, price dispersion, buying/selling margins.
  - intertemporal price variation.
  - responsiveness of prices to weather-driven output shocks.

- **Trader level:**
  - profits & degree of market competition.
  - trading volumes, trading locations, crops.
  - what info held, where acquired.

- **Farmer level:**
  - farmgate prices.
  - marketed surplus, crop choice, inputs, who sold to.
  - what info held, where acquired.
Analysis of market outcomes:

- Dyadic analysis, ignoring ‘hub and spoke’:
  \[ \rho_{ij} = \beta_0 + \beta_11_{ij} + \beta_22_{ij} + \delta_0 d_{ij} + \delta_1 (d_{ij} * 1_{ij}) + \delta_2 (d_{ij} * 2_{ij}) + \varepsilon_{ij}. \]
  - This will recover the following parameters:
    - \( \beta_1 \): Impact of having one dyad treated but not both, at zero distance.
    - \( \beta_2 \): Impact of having both in dyad treated, zero distance.
    - \( \delta_0 \): Effect of distance on price dispersion in control, +underlying spatial correlation.
    - \( \delta_1 \): Partially a TE from one pair being treated, also contains a spillover coming from traders being able to forecast prices better even in control markets.
    - \( \delta_2 \): impact of improved information between dyads
Analysis of market outcomes:

Using ‘hub and spoke’ to parameterize spillovers:

\[
\rho_{ih} = \beta_0 + \beta_1 T_{ih} + \beta_2 T_h + \beta_3 (T_h * T_{ih})
+ \delta_0 d_{ih} + \gamma_0 d_h + \delta_1 (T_{ih} * d_{ih}) + \delta_2 (T_h * d_h) + \delta_3 (T_h * T_{ih} * d_{ih}) + \varepsilon_{ih}
\]

This will recover the following parameters:

- \(\beta_1, \delta_1\) give the impact of having a spoke market treated.
- \(\beta_2, \delta_2\) give the spillover effect of having a hub treated conditional on the spoke not being treated.
- \(\beta_3, \delta_3\) give the additional treatment + spillover effect of treating a spoke if the hub is also treated.
Handling Spillovers:

- Would like to have ‘pure control’ districts, don’t have the power for this.
- Might also like to use ‘randomized saturation’ design (Crepon et al. 2013, Baird et al. 2014) to look at spillovers directly, don’t have power.
- How to balance desire for balance across districts (blocking) with the need to measure spillovers?
  - ‘Hub and spoke’ designation as a way of pre-committing to spillover structure: for each spoke market we identify the 1 or 2 major hubs and consider the treatment status of the hub as well as of the spoke.
  - Block by hub & spoke, stratify by baseline prices, but don’t block by district so as to create accidental variation in treatment at district, spatial level.
  - Identify 20 markets that are outside of the study area to serve as pure controls (non-experimental) and track them through the whole study using the Market Survey.
  - Other ideas?
Wrap-up:

- **Multipronged intervention that seeks to:**
  - improve knowledge of prices and potential buyers for farmers.
  - deepen resources available for commercial intermediaries in local markets.
  - develop new high-tech platforms for agricultural trade.

- **Additional issues we hope to explore:**
  - experiment with guarantees & use of liquidity in the AgriNet bulking process; is *capital* a barrier to arbitrage?
  - provide randomized fuel subsidies for truckers moving over specific routes to T & C markets: how do *information* and *transport costs* intersect to create Law of One Price?
  - secure support from USAID mission to help AN take over management of *storage* facilities in selected markets
Thank you!