Understanding the factors that drive scaling of agricultural interventions: Evidence from rural Ghana

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Introduction
The concept of scaling has in recent times gained traction as donors are increasingly becoming concerned about the ability of pilot projects to ultimately extend their reach beyond their initial targets.

Objective
Estimate the factors that determine ordered selection and intensity of scaling of new agricultural information

Study area

Method

\[ Y* = X\beta + Z\delta + \epsilon \]  \hspace{1cm} (1)

where \( Y^* \) is a latent variable that measures the probability of extending knowledge to other farmers. The variable is observed as basic \( (Y = 1) \); intermediate \( (Y = 2) \); and widespread \( (Y = 3) \) if \( Y^* \leq 4; 4 < Y^* \leq c_1 \); and \( c_1 < Y^* \). Unknown parameters to be estimated are \( c, \beta, \) and \( \delta \).

Whereas \( X \) represents a vector of factors that influence the decision to scale as well as the intensity of scaling, \( Z \) is an instrument(s) that only affects the decision to scale. \( \epsilon \) is an unexplained or error term. The second-stage equation is given as:

\[ Q_1 = X\beta_1 - \frac{\sigma_{1}\phi_{1} - \rho_{1}Z\delta}{\phi_{1}' - \rho_{1}Z\delta} + e_1 \]  \hspace{1cm} (2)

\[ Q_2 = X\beta_2 - \frac{\sigma_{2}\phi_{2} - \rho_{2}Z\delta}{\phi_{2}' - \rho_{2}Z\delta} + e_2 \]  \hspace{1cm} (3)

\[ Q_3 = X\beta_3 - \frac{\sigma_{3}\phi_{3} - \rho_{3}Z\delta}{\phi_{3}' - \rho_{3}Z\delta} + e_3 \]  \hspace{1cm} (4)

The convoluted expression on the RHS of equations 2-4 represents the IMR that corrects for ordinal selection bias. The number of farmers reached through basic, intermediate, and widespread scaling is represented by \( Q_1, Q_2, \) and \( Q_3 \), respectively. The associated error terms are \( e_1, e_2, \) and \( e_3 \).

Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Basic Estimate</th>
<th>Basic Std. Err</th>
<th>Intermediate Estimate</th>
<th>Intermediate Std. Err</th>
<th>Widespread Estimate</th>
<th>Widespread Std. Err</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance to market</td>
<td>-0.016</td>
<td>0.058</td>
<td>-0.243</td>
<td>0.349</td>
<td>0.111</td>
<td>0.452</td>
</tr>
<tr>
<td>Household size</td>
<td>0.022</td>
<td>0.026</td>
<td>0.291**</td>
<td>0.159</td>
<td>0.678</td>
<td>0.552</td>
</tr>
<tr>
<td>Frequency of OFSP consumption</td>
<td>0.081**</td>
<td>0.018</td>
<td>0.090</td>
<td>0.256</td>
<td>0.382</td>
<td>0.488</td>
</tr>
<tr>
<td>OFSP Income</td>
<td>-0.0003</td>
<td>0.0002</td>
<td>-0.002</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>Education</td>
<td>-0.042</td>
<td>0.064</td>
<td>0.054</td>
<td>0.529</td>
<td>-0.604</td>
<td>0.571</td>
</tr>
<tr>
<td>Upper East Region</td>
<td>0.442</td>
<td>0.495</td>
<td>4.208</td>
<td>3.846</td>
<td>11.894**</td>
<td>6.542</td>
</tr>
<tr>
<td>IMR</td>
<td>-1.630***</td>
<td>0.318</td>
<td>23.168</td>
<td>15.790</td>
<td>7.842</td>
<td>6.649</td>
</tr>
</tbody>
</table>

Notes: ** and *** denote statistical significance at 5% and 1%, respectively. Instrument considered is distance to training center

Conclusion
Our results also show that agricultural projects need to take specific factors into consideration when designing extension projects depending on the intensity of scaling envisaged. Projects that are aimed at low, intermediate, and widespread scaling should emphasise the importance of the technology or innovation being promoted, target farmers or communities with larger households, and work in densely populated areas that require the technology or innovation being promoted.