Labor Responses to Rainfall Variability in Rural Ethiopia:
A Model of Migration, Off-farm Activities and Remittance

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INTRODUCTION

- Previous studies on labor responses to rainfall variability
  - generate more disagreement than consensus
  - focus on only one aspect of labor responses
  - generally ignore the role of rainfall variance
- More theoretical and empirical work is needed

THEORETICAL MODEL

- A world of three agents: a government, a rural household, and a sender of transfers from informal social safety nets (ISSN)
- The government offers a public transfer program, and the household must apply for it to get the benefit (& welfare stigma)
- The household sends a share of its adult members to urban area, allocates its remaining labor between on-farm and off-farm activities, and decides whether to participate the public transfer program
- The sender can either give its available resource to the household, or keep it with its own
- Rainfall is an input in the agriculture production, and rainfall shocks affect the mean and variance of agricultural income, and the available resource of the sender

DATA

- Household data from the Ethiopian Rural Household Survey
  - >1,500 households (HHs) from 15 villages across 3 waves (1999, 2004 & 2009)
  - detailed information on migration, off-farm activities, transfers, and HH demographics
- Climatic data from the African Flood and Drought Monitor
  - 30 years of daily rainfall data
  - only available at the village level
  - rainfall measures in main (Kiremt) season
- Independent variables
  - share of migrated-out HH members due to labor market reasons
  - number of days worked off-farm per capita
  - per capita value of transfers
  - binary indicator for public transfer

EMPIRICAL MODELS

- Household i in village j at year t
- For household participation in public transfer $y_{ijt}$: panel logit/probit models:
  $$ \logit(0|1) = \alpha_i + \beta_1 \bar{R}_{ijt} + \beta_2 \sigma_{ijt} + \mu_i + \nu_{ijt} $$
  $$ y_{ijt} = \max(0, y_{ijt}^*), i=1,...,N; j=1,...,15; t=1,2,3 $$
- For other four dependent variables with censoring issues, fixed effects (FE) Tobit models & correlated random effects (CRE) Tobit models

RESULTS

(1) Share of Out-migration

<table>
<thead>
<tr>
<th>(1) Share of Out-migration</th>
<th>(2) Off-farm Labour Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH size</td>
<td>0.006***</td>
</tr>
<tr>
<td>Ratio of rainfall in the past 5 years</td>
<td>0.346***</td>
</tr>
<tr>
<td>Standard deviation of rainfall in the past 5 years</td>
<td>0.314***</td>
</tr>
<tr>
<td>Mean ratio of rainfall</td>
<td>0.241</td>
</tr>
<tr>
<td>Mean standard deviation of rainfall</td>
<td>0.116***</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.322</td>
</tr>
</tbody>
</table>

(3) Remittance from Former HH Members

<table>
<thead>
<tr>
<th>(3) Remittance from Former HH Members</th>
<th>(4) Transfers from Other ISSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of rainfall in the past 5 years</td>
<td>0.005***</td>
</tr>
<tr>
<td>Standard deviation of rainfall in the past 5 years</td>
<td>0.134***</td>
</tr>
<tr>
<td>Mean ratio of rainfall</td>
<td>0.101</td>
</tr>
<tr>
<td>Mean standard deviation of rainfall</td>
<td>0.050</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.548</td>
</tr>
</tbody>
</table>

HYPOTHESES

- From the theoretical model
  - An increase in mean rainfall leads to decreases in the share of out-migration, off-farm labor supply, and the probability of participating in public transfer programs
  - An increase in the variance of rainfall leads to increases in the share of out-migration, off-farm labor supply, and the probability of participating in public transfer programs
  - Mean and variance of rainfall have no definite effect on transfers from ISSN

CONCLUSIONS

- Share of out-migrated HH members decreases with mean rainfall level and increases with the standard deviation of rainfall
- Per capita off-farm labor supply and participation in public transfer programs decreases with mean rainfall level and increases with the standard deviation of rainfall
- Level and standard deviation of rainfall may have no effect on the amount of transfers that households receive from former HH members and other ISSN

<table>
<thead>
<tr>
<th>(5) Participation in Public Transfers</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ratio of rainfall in the past 5 years</td>
<td>-0.347***</td>
</tr>
<tr>
<td>Standard deviation of rainfall in the past 5 years</td>
<td>0.234***</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.429***</td>
</tr>
</tbody>
</table>

Department of Agricultural & Applied Economics