Rainfall Variability, Occupational Choice, and Welfare in Rural Bangladesh

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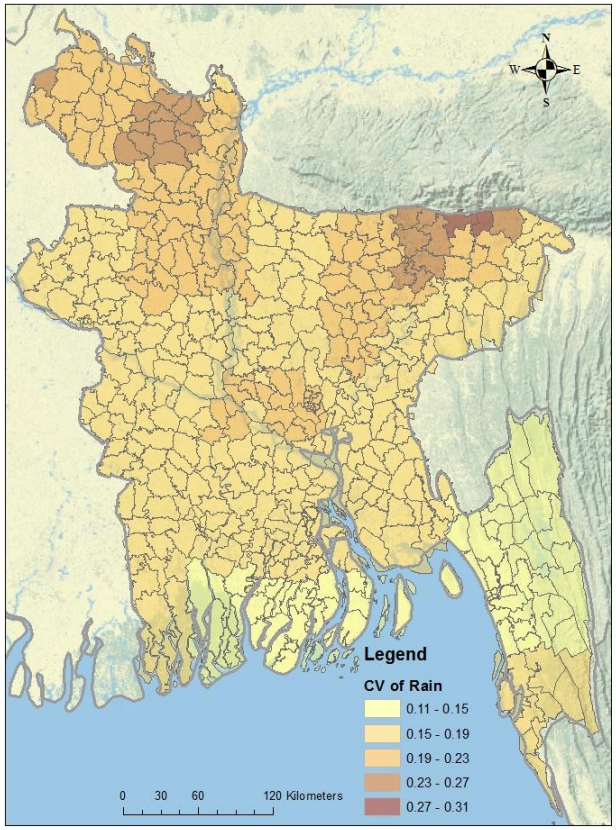
Rainfall Variability

- Coefficient of variation of **total rainfall for June–September** for the 30 year period 1980–2009 for each Upazila.
- Source: 0.5^{o}x0.5^{o} Grid data, Climate Research Unit (CRU) of the University of East Anglia.
  - In non-flood-prone Upazilas: farmers are more vulnerable to local rainfall variability.
  - In flood prone Upazilas: Flood water substitutes for rainfall and protects farmers from local rainfall variability.

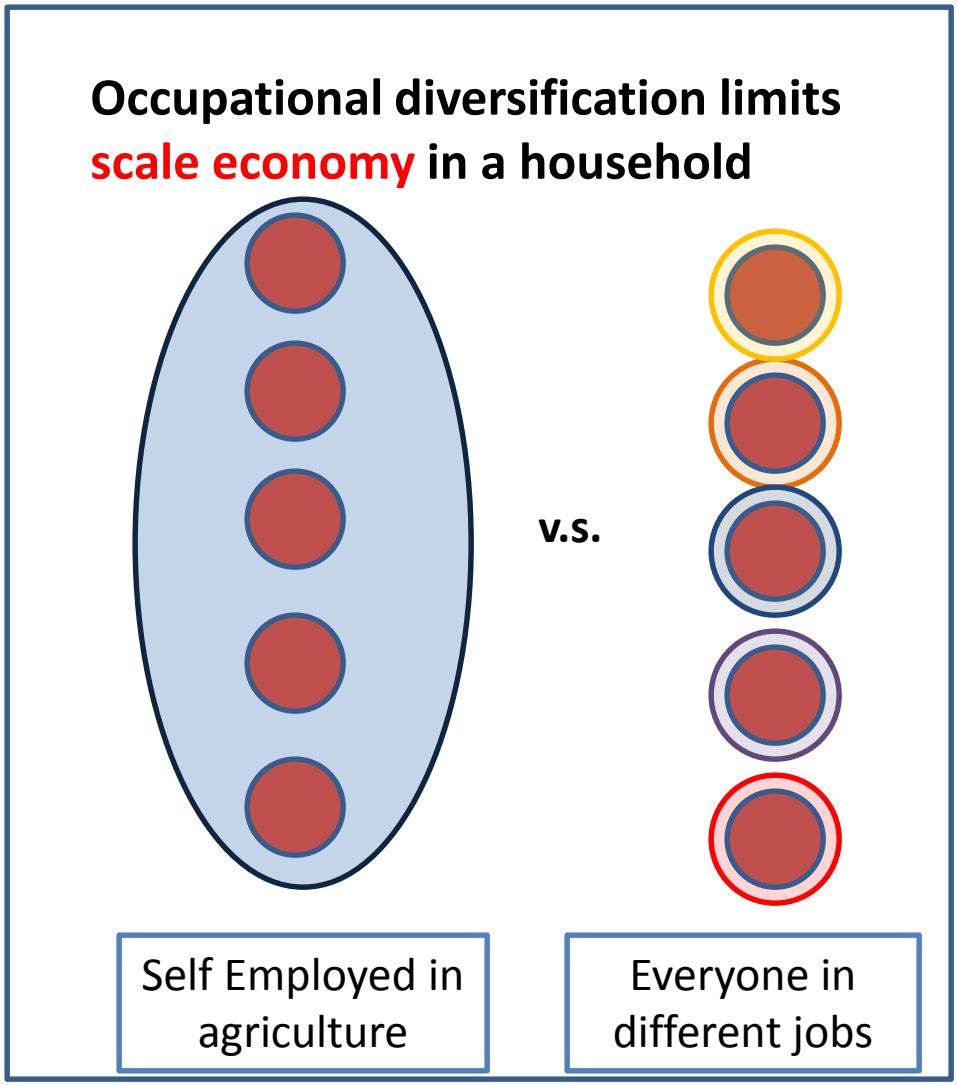
Local rainfall variability by Upazila



Occupational Focus and Welfare

- **Both self-employed in agriculture** takes the value 1 if both the member and the head of the household report to be self-employed in agriculture and 0 otherwise
- Monthly per capita consumption expenditure
- Other household characteristics
- Source: Household Income-Expenditure Survey (HIES) 2010

Household Adaptation and Implications for Productivity



Proactive Household Adaptation to Rainfall Variability

- Rainfall Variability affects household welfare through ex-ante anticipatory actions/effects

- Anticipatory household actions may affect welfare negatively.
  - Households diversifying their employment and occupational choices as adaptation to rainfall variability.

Policy Actions

- Rainfall insurance is not available

Other alternatives

- Household access to credit
- Household access to social safety nets
- Access to markets: an index based on population size of the markets in the vicinity of an Upazila, inversely weighted by the travel time between the Upazila and markets (Blankespoor and Yoshida, 2010).

The effects of rainfall variability on household occupational focus

$$\ln\left(\frac{P_{iju}}{1-P_{iju}}\right) = b + b_1 X_{1\,iju} + b_2 X_{2\,ju} + b_3 X_{3\,u} + b_4 RV_u + b_5 PA_{ju\,/\,u}$$

$$+ b_6 (RV_u \times PA_{ju\,/\,u}) + e_{iju}$$

- where P_{iju} is the probability that non-head member *i* in household *j* in Upazila *u* is self employed in agriculture same as the household head.
- $X_{1\,iju}$, $X_{2\,ju}$, and $X_{3\,u}$ are exogenous variables specific to member *i*, household *j* and Upazila *u* respectively.
- RV_u is the *ex ante* climate risk measure, such as coefficient of variation.
- $PA_{ju\,/u}$ is one of the three policy action variables for the household I in Upazila u: Access to credit, safety-net or market

Result 1: Local Rainfall Variability and Household Adaptation

- Local rainfall variability is a dominant push factor for diversification, in non-flood prone Upazilas.
  - Household members diversify from self employment in agriculture to cope with local rainfall variability.
- This type of diversification diminishes with better access to markets, credit, and safety nets.
  - Access to credit and safety nets, and market tend to weaken the role of pro-active diversification within households to local rainfall variability.

Estimates of interactions between policy actions and rainfall variability on occupational focus

	(1)	(2)	(3)
Dependent variable	Both self employed in agriculture		
Policy interaction term:	Credit	Safety Net	Market
CV Rain (b_4)	**-1.080*** **	**-1.095*** **	**-0.992** **
	(-2.821)	(-2.814)	(-2.475)
Policy X CV Rain (b_6)	0.068	0.164	1.108
	(0.053)	(0.393)	(0.450)
Observations	0.0202	0.0120	0.863

Coefficients represent average marginal effects (AME). AME for interaction terms taking into account the nonlinearity of the model are estimated based on the "inteff" command by Norton et al. (2004).

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Effects of flood and rainfall variability on household welfare

$$\ln C_{ju} = \gamma + \gamma_2 X_{2\,ju} + \gamma_3 X_{3\,u} + \gamma_4 FLOOD_u + \gamma_5 RV_u + e_{ju}$$

- where C_{ju} is the per capita consumption expenditure of the household j in Upazila u.

Results 2: Implications for Household Welfare

- Consumption is not different in households in historically flood prone Upazilas.
  - Ex ante flood risks have no effects on consumption (normal flood may have a positive effect on consumption).
- Higher local rainfall variability accounts for significantly lower consumption.
  - proactive household adaptation is associated with lower consumption (higher precautionary saving , lower investment, and thus lower growth)

Estimates of the effects of rainfall variability on welfare

Sample:	(1) Overall	(2) Non-flood	(3) Flood
Flooded Upazilas 1998	0.00690		
	(0.372)		
CV Rain (β_4)	**-1.149*** **	**-1.715*** **	-0.286
	(-3.107)	(-4.036)	(-0.443)
Observations	7,697	3886	3811

Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Note: Dependent variable is log of per capita monthly consumption expenditure measure of welfare.

Take-Home Message

- IPCC AR5 report says that climate change in Asia will increase the risk of crop failure and lower production (medium confidence)
  - Autonomous adaptation of farmers is on-going in many parts of Asia
- Autonomous *ex ante* adaptation to rainfall variability has a welfare costs to the agricultural households in rural Bangladesh
- In the absence of crop insurance, access to market is likely to ameliorate some of the costs of *ex ante* climate risks

Thank You

- Paper http://link.springer.com/article/10.1007/s11150-013-9203-z

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