Crop Diversification for Dietary Quality: Evidence from Bangladeshi Farm Households

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BIDS RESEARCH ALMANAC | 2017

Introduction and Background

- Bangladesh has progressed a lot since its independence.
- However, still we are mostly dependent on staple food like other developing countries. 70% or more calories come from rice.
- Agriculture might be used to diversify diet or to decrease dependence on staple food.
- Dietary diversity index (with range 1 to 7) has increased from 4.82 to 4.95 between 2000 and 2010.
- Necessity for dietary diversity.
- WHO recommends to eat at least 400g (5 portions) of fruits and vegetables a day.

Introduction and Background Cont.

- Positive and significant association between farm diversity and dietary diversity:
  - Sibhatu, Krishna and Qaim, 2015.
  - Esha Sraboni et al.,2014.
  - Mahbub Hossain et. al, 2016.
  - Lorenzo Pellegrini & Luca Tasciotti, 2014.
  - (Eight developing countries).
  - Signorellia S. et. al, 2016 (Ghana)
- No significant impact of crop diversification on dietary diversity:
  - R. Srinivasulu et. al. 2014 (Tanzania)
- Crop diversification augments income and employment opportunities in the rural settings:
  - (Monirul and Hossain, 2014)

Conceptual Framework

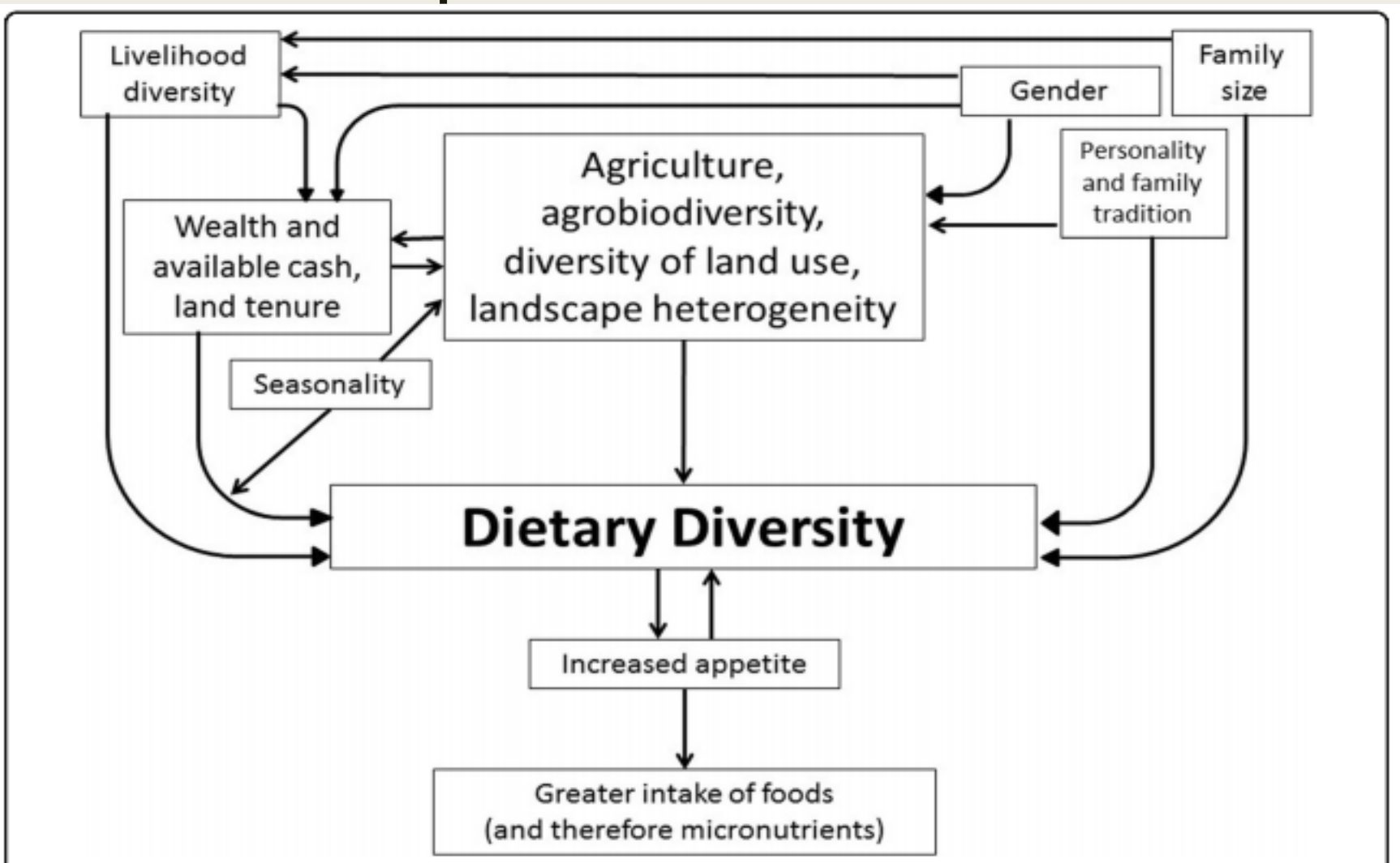


Fig. 1 Diagram of the most salient relationships between determinants and outcomes of dietary diversity, showing an interpretation of how they interact within the social-ecological system (*arrows* indicate associations that can be either positive or negative, they are not meant to indicate causation)

Objectives

- Two objectives:

i. Find the main factors contributing to better dietary quality

ii. Does production diversity result in consumption diversity or dietary diversity?

Methods and Data

- Measurement of Crop Diversification
- Rice Share Index (RI):

$$RI = \sum_{i=1}^{n} \frac{r_i}{A}$$

ri= production of a particular rice variety and A = amount of all crop products. So, higher value of RI means lower crop diversification and vice versa.

- Simpson Index (SI):

$$SI = 1 - \sum_{i=1}^{n} p_i^2$$ where, $$p = \sum_{i=1}^{n} \frac{a_i}{A}$$

ai= area devoted to a single crop in a given year, A= total area devoted to cultivated crops in a given year. So, higher value of SI means higher crop diversification and vice versa

Methods and Data Cont.

- Measurement of Dietary Diversity:
- Household Dietary Diversity Score (HDDS): The number of different food groups consumed would be calculated. There are 13 food groups: Cereals, Roots and tubers, Vegetables, Leafy Vegetables, Fruits, Meat and poultry, Eggs Fish and seafood, Pulses/nuts, Milk and milk products, Oil/fats, Sugar and honey, Miscellaneous.

  Limitation: Doesn't consider quantity of consumption

- To overcome the limitation of HDDS, Dietary Diversity Index DDI has been introduced
- Dietary Diversity Index (DDI): $\mathrm{DDI} = 1 - \sum_{\mathrm{i}=1}^{\mathrm{n}} C_i^2$

Where, $C_i = \frac{a_i}{A}$, ai= amount of food consumption from a particular food group and A= total amount of consumption

Methods and Data cont.

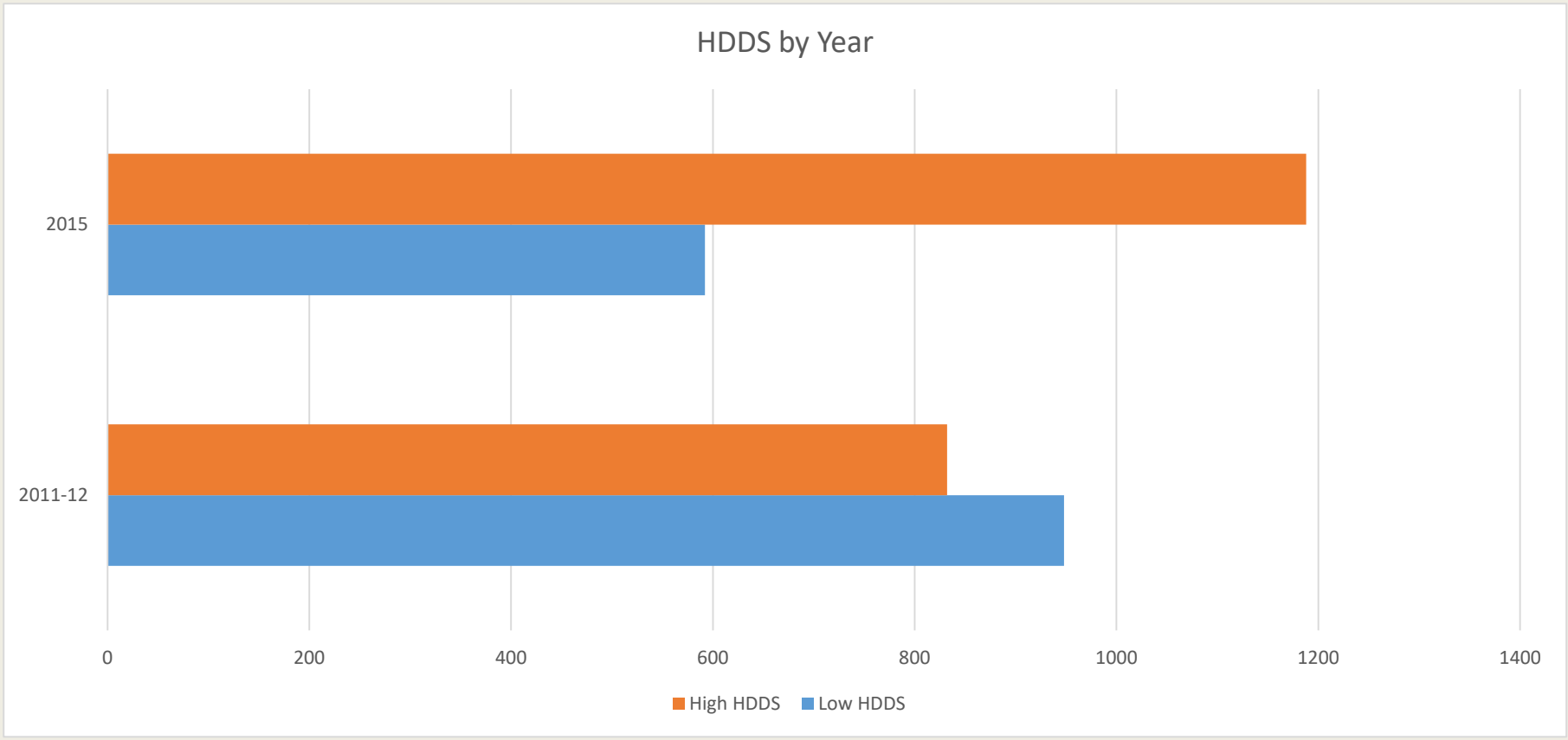
- Two rounds of the Bangladesh Integrated Household Survey (BIHS) 2011-12 and 2015: Panel Data
- The total BIHS sample survey of 6500 households in 325 primary sampling units (i.e. villages).
- 5503 households are “Nationally Representative (representative of Rural Bangladesh)”
- Since we are dealing with farm households we have smaller sample size than the original BIHS data- 1780 households (3560 for 2 rounds)

Methods and Data cont.

- Model:
- Fixed-Effects Model (FE): When using FE we assume that something within the individual may impact or bias the predictor or outcome variables and we need to control for this. This is the rationale behind the assumption of the correlation between entity's error term and predictor variables. FE removes the effect of those time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable.
- Random-Effects Model: The rationale behind the random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. RE allows to generalize the inferences beyond the sample used in the model.
- 'Hausman Test' for selecting one of these two.

Descriptive Statistics: Household Dietary Diversity Score (HDDS)

High HDDS if HDDS>=11, Low HDDS if HDDS<11

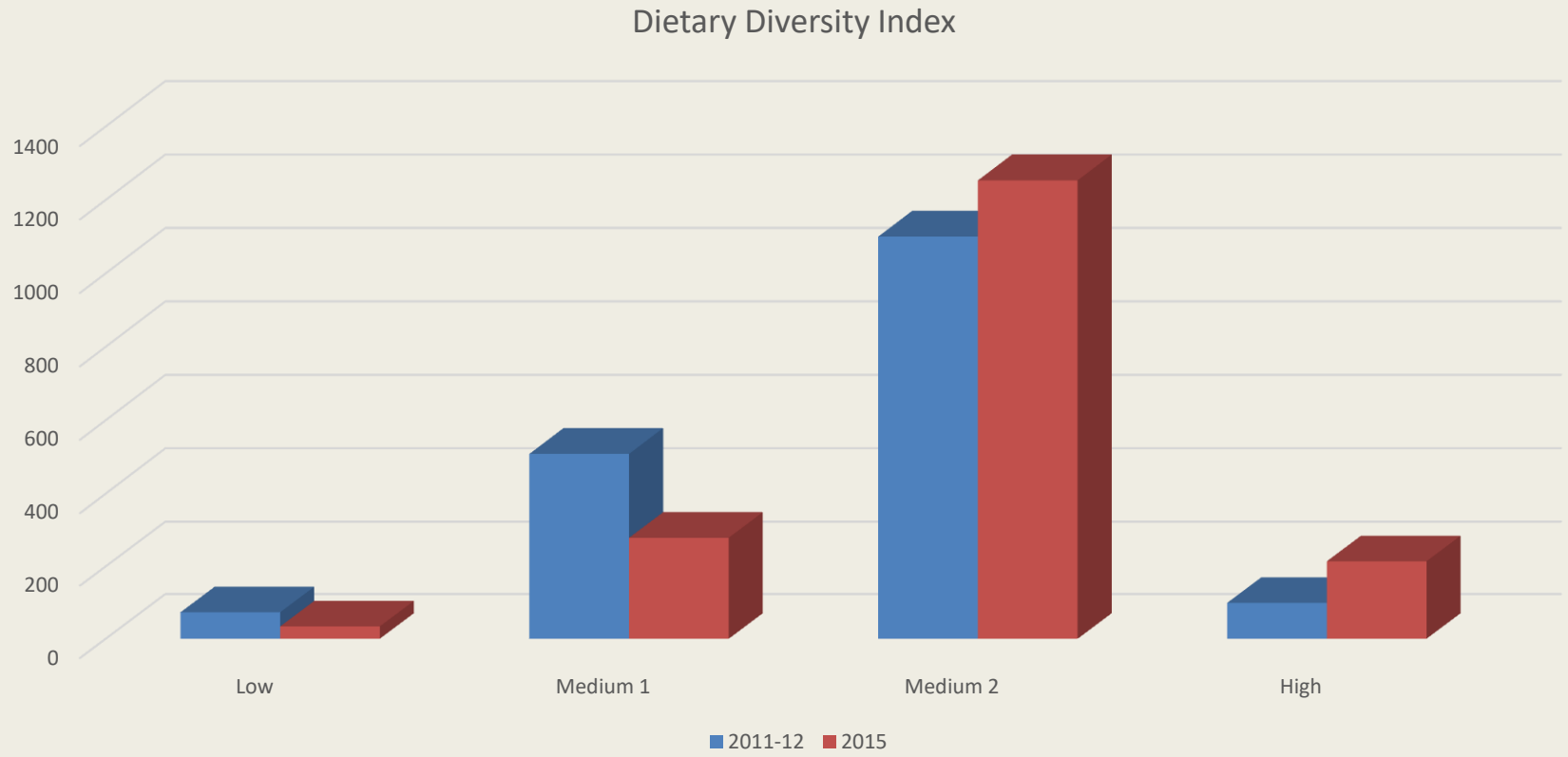


Household Dietary Diversity Score

	Year		
HDDS	**2011-2012**	**2015**	**Total**
5	**3**	**4**	**7**
6	**31**	**8**	**39**
7	**105**	**25**	**130**
8	**203**	**92**	**295**
9	**284**	**186**	**470**
10	**322**	**277**	**599**
11	**367**	**383**	**750**
12	**305**	**500**	**805**
13	**160**	**305**	**465**
Total	**1,780**	**1,780**	**3,560**

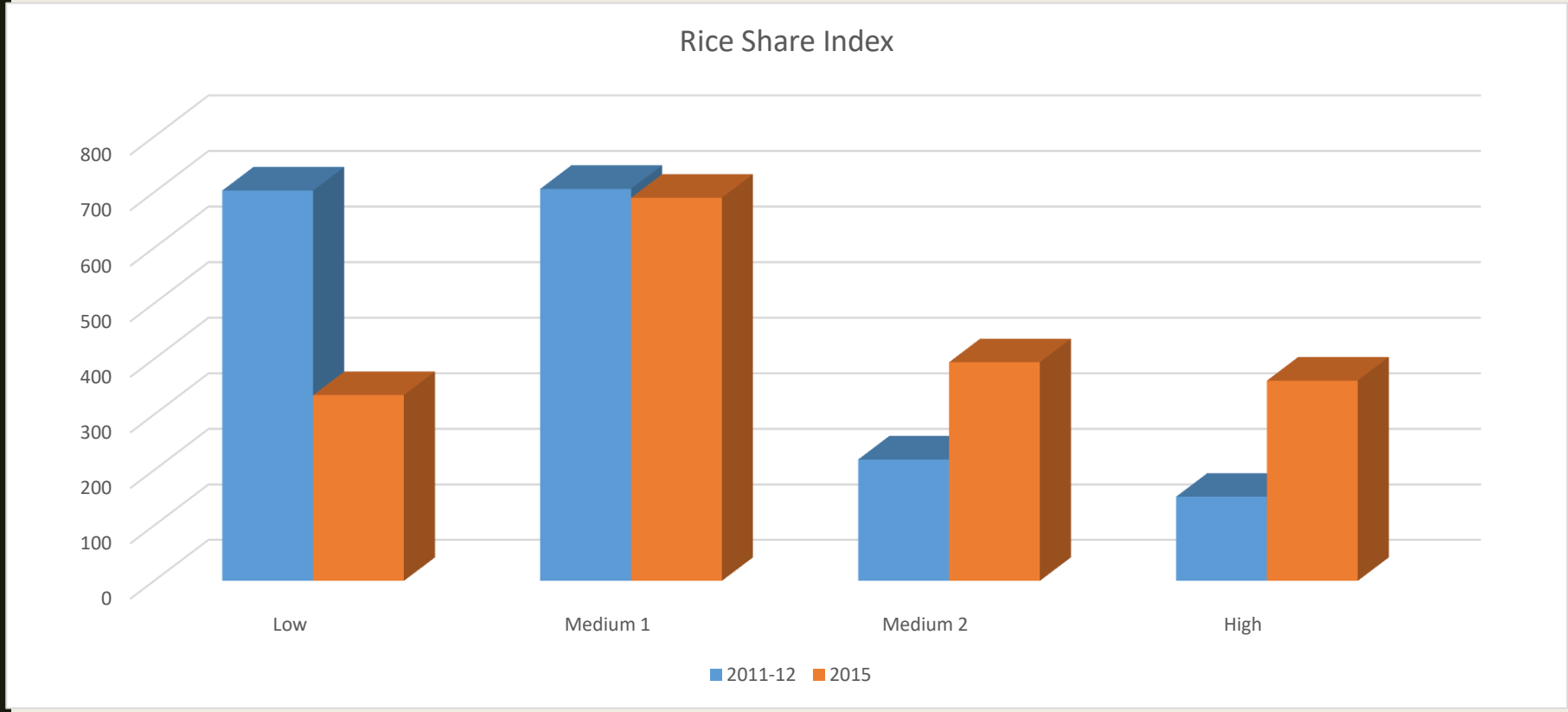
Descriptive Statistics: DDI

High if DDI>0.90, Medium2 if 0.90>=DDI>0.75, Medium1 if 0.75>=DDI>0.60, low if DDI<=0.60



Rice Share Index (RI):

High if RI<=0.10, Medium2 if 0.35>=RI>0.10, Medium1 if 0.50>=RI>0.35, low if RI>0.50



VARIABLES	(1) HDD	(2) HDD	(3) DDI	(4) DDI
RI	-0.354**	-0.273***	-0.0140*	-0.0170***
	(0.157)	(0.0944)	(0.00819)	(0.00499)
Family Size	0.0167	-0.0764***	-0.00665***	-0.0114***
	(0.0442)	(0.0160)	(0.00230)	(0.000848)
Age of the Head	-0.00716	-0.00276	0.000315	0.000138
	(0.00647)	(0.00205)	(0.000337)	(0.000109)
Education	0.0217	0.0422***	0.00186	0.00268***
	(0.0252)	(0.00677)	(0.00131)	(0.000360)
Asset	0.0777***	0.0737***	0.00360***	0.00323***
	(0.00815)	(0.00646)	(0.000425)	(0.000338)
Gender	-0.0251	-0.0493	0.00678	0.00952*
	(0.201)	(0.0986)	(0.0105)	(0.00523)
Crop	-0.0445	0.0356	1.55e-05	-0.00229*
	(0.0478)	(0.0243)	(0.00249)	(0.00129)
Fish	-0.0401	0.0168	-0.000116	9.90e-05
	(0.0557)	(0.0143)	(0.00290)	(0.000763)
Savings	0.0173	0.0211***	0.000796	0.000619**
	(0.0107)	(0.00534)	(0.000556)	(0.000283)
Int. Migrants	0.223*	0.225**	0.00853	0.0138***
	(0.126)	(0.0937)	(0.00658)	(0.00494)
Domestic Migrants	0.0847	-0.0315	0.0136***	0.00651**
	(0.0734)	(0.0565)	(0.00382)	(0.00297)
Income	1.111***	1.371***	0.0475***	0.0693***
	(0.0862)	(0.0525)	(0.00449)	(0.00278)
Constant	-0.328	-3.300***	0.311***	0.159***
	(0.903)	(0.441)	(0.0470)	(0.0234)
Observations	3,546	3,546	3,546	3,546
R-squared	0.250		0.181	
Number of hhid	1,780	1,780	1,780	1,780

Results

Variable	HDDS	DDI
Rice Share Index (RI)	-0.354**	-0.0140***
Age of the hh head	-0.0007	0.0003
hh Size	0.0167	-0.0066***
hh Asset	0.08***	0.004***
hh income	1.1***	0.048***

Results

- One unit increase in crop diversification (one unit decrease in RI) will lead to 0.35 unit increase in Household Dietary Diversity Score (HDDS).
- One unit increase in crop diversification leads to 0.01 unit increase in Dietary Diversity Index (DDI)
- One percent increase in asset leads to 8% increase in HDDS and 0.3% increase in DDI
- One percent increase in household income leads to 101% increase in HDDS and 5% increase in DDI

Conclusion and Policy Implications

- Both crop diversification and dietary diversity have increased among farm household of Bangladesh.
- Income and asset impact on dietary diversity is obvious- positive association between them.
- Similarly, impact of crop diversification on dietary diversity is also positive
- Household head's gender, age and education does not have any significant effect on increasing dietary diversity
- Govt. support on different varieties of seed rather than that of staple food can encourage farmers to produce diversified food.
- Providing training for producing high value crops or diversified crops also can help to produce diversified foods

Thank You!