Land asset and food insecurity in gender-segregated rural households in Bangladesh

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Abstract We explore the contributory role of land assets in explaining the dynamics of gender-segregated rural households' food expenditure in Bangladesh. We apply both panel random and fixed effect OLS and quantile regression models on segregated households' data for the periods 1991 and 1998. Results offer useful insights on the dynamics and determinants of food security and conclude with policy recommendations for land reform that would recognise the vulnerable members of both genders headed households in rural areas

Acknowledegment:

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Keywords: Land Ownership and Tenure; Land Reform; food security

JEL Codes: Q15, Q18, C43

1. Introduction

The literature accounts in several ways for the differential gap in the dynamics and the contributory factors of food poverty between male and female headed households (Lipton 1983; Quisumbing et al., 2001). A major plausible conclusion is that difference in the land access and ownership between the two households could be responsible for the gap (Rao 2006). Access to land assets could be responsible for moving households in and out of poverty (Valente 2009), and it is often the case that the poor land tenure system in several developing countries are biased in favour of male-headed households (Agarwal 1994, Deere and León 2003, Kaarhus et al. 2005)[1].

However, our knowledge of the differential gap in food poverty and the contributory role of land asset ownership between male and female headed households in developing countries are still weak and mostly based on anecdotal evidence (Lipton 1983; Quisumbing et al., 2001). In many studies, Male Headed Households (MHH) tend to be over-represented in household food security surveys which could introduce a bias in the Female-Headed Households' (FHH) estimates. In addition, analysis tends to be done within a static time frame (short spells) whereas; the effect of household food insecurity tends to be exhibited more in a dynamic timeframe. Accounting for one short survey may be insufficient in

[1] Women constitute less than one-quarter of the landowners, and men are more likely than women to be successful buyers (Toulmin 2009).

capturing the extent and spells of food deprivation. Understanding these dynamics and the contributory factors are necessary for the design of welfare programs with long-term sustainable impacts on the general well-being of resource-constrained households in developing countries.

We contribute to the existing literature that focuses on the differential gap in food poverty between male and female headed households in two ways. First, we utilise a rich panel data set from rural households in Bangladesh to compare and explain how heterogeneity in food expenditure per capita over time is explained by ownership of land in a segregated male and female headed households. Second, we rebased and normalised food expenditure per capita to a common unit so that it could be indexed and aggregated (Global food security index, 2015). This is of particular importance as it allows for utilising the fixed effect quantile regression to account for the heterogeneous effects of the conditional explanatory role of land asset ownership on the dependent variable at various quantiles.

We test our hypothesis using data from the Bangladesh household survey for the period 1991 and 1998 on segregated Female-Headed Households' (FHH) and Male Headed Households (MHH). Our results show that holding all other variables constant; a 1% of land value translates into 2.9% decrease in household food expenditure per capita for the FHH (at the mean value of household food expenditure per capita other things being equal). For the MHH, an increase in land value assets by 1% would lead to 0.6% increase in food expenditure per capita (at the mean value of household food expenditure per capita other things being equal).

Further results from the quantile regression indicate that for the MHH at the 25^{th} and 75^{th} conditional quantile, there is a significant improvement in food expenditure whereas, for the FHH, there is no obvious significant improvement. Land assets only contributed to the food expenditure at the 25^{th} conditional quantile to MHH, and no significant contribution is experienced for FHH across all conditional quartiles. However, there is a caveat to our analysis that suggests caution in the interpretation of the estimates. It is plausible that the simultaneity bias between the value of land assets and household food expenditure could be driving the results. For instance, it could be that poor households with less food expenditure are unable to acquire land than rich households. We, however, conclude by suggesting the need for greater empowerment for both gender-based households and supporting the call for reform in the land policy allocation that would consider the vulnerable FHH in rural areas.

Findings from this study are related in parts with Bane and Ellwood (1986) which examined the dynamics of poverty by using longitudinal data on income and poverty data to carry out a comprehensive analysis of the durations, beginnings, and endings of spells of poverty. It is also related to Mallick and Rafi (2010), Agarwal and Herring (2013) and Ribar and Hamrick (2003). Ribar and Hamrick (2003) show that female-headed households experience a higher chance of being food insecure in the USA and Appleton (1996) empirically examined women-headed households and welfare in Uganda. The empirical strategy is related to the instrumental quantile fixed-effects panel estimation methodology used in You et al. (2016) to show that rising income tends to reduce inequality in macronutrient intake in both urban and rural areas in 2004-2009. The current study thus builds and extends previous findings to compare and understand the dynamics of gender-segregated rural households' food expenditure across countries in developing countries.

Following this introduction, the methodology is presented in section II, and in section III, we present and discuss the results and conclude in section IV.

II. Methodology

Data Source

We utilise data on rural household surveys in Bangladesh which was collected in two waves, 1991 and 1998. The data is very detailed, collected in three villages by the Bangladesh Household Survey 1991/92–1998/99 and conducted jointly by the Bangladesh Institute of Development Studies and the World Bank. The information was collected at the individual, household, and community levels and accounts for the household food expenditure separately for each gender. The data is readily available from http://siteresources.worldbank.org/INTRES/Resources/469232-1107449512766/ImpactEvaluation_Data_files.zip .

We exploit these advantages to make a comparison between the two gender headed households and to explore the effect of interesting variables on the mean and at different quartiles of the log of household expenditure distribution. There are 826 (5% female, 95% male) and 1129 (9% female, 91% male) observations in the 1991 and 1998 waves respectively. Overall, male and female headed households comprise of 1533 and 119 observations respectively in the final data used.

Estimation Strategy

Because of the poor representation of the FHH, we ran a separate regression for the two genders. We accounted for measurement errors, sampling weights and household size by adjusting the reported food expenditure for each household which we used for the panel OLS regression. To account for the effect of land value and time on the log of food expenditure (Yit), we estimate Eqn. (1) using unbalanced panel data with household fixed and random effects for the gender-segregated data with robust standard errors.

$$logY_{i,t} = \alpha + \beta_1 logLD_{it} + \beta_2 logAsset_{it} + \beta_3 \sum(X_{it}) + \delta(Year_t) + \phi(Location_i) + \mu_{it} \quad (1)$$

Where $logY_{i,t}$ stands for the log log of food expenditure in hosuehold *i* time *t*. $logLD_{it}$ is the log of the value of land asset of household *i* in time *t*. The variable $logAsset_{it}$ is the log of value of other household assets and $\sum(X_{it})$ is the bunch of other households' time-varying covariates that could basically influence the household food expenditure. The estimates ϕ and δ are the location and time fixed effect respectively to control for non-varying time and location effects. We conduct both random and fixed effect OLS and as a robustness check, we would conduct the Bresch-Pagan test to decide the choice between pooled OLS and random effect and the Hausman test to decide the choice between Fixed and Random Model.

Furthermore, to lend for easy comparison of food expenditure between households and across time, we normalised and rebased the food expenditure indicator data to a common unit. Following the Global Food Security Index (2015), we defined an Index of household food expenditure per capita at time t as the adjusted food expenditure (W):

$$W_{it} = \frac{((X_{it}) - \text{Min}\,(X_{it}))}{(\text{Max}(X_{it}) - \text{Min}(X_{it})} \quad (2)$$

Where W_{it} is the log of adjusted food expenditure for each housholds in time t and the Min (x) and Max (x) are the lowest and highest values of the log of the adjusted Food expenditure per capita in each time t.

To account for the quantile panel regression, we used W_{it} in eqn (2) and after re-estimating the panel regression in (1) to obtain a standard within estimator $\acute{u}$ which is used to get rid of the fixed effect and generate another variable (Q) which we used for the quantile regression

in (4). Finally, following You et al. (2016), we estimated equation (3) to allow for the quantile regression

$$Qln_{kit} = Wit - \acute{u}i \quad (3)$$

Subsequently, we model

$$Qln_{kit}(\pi)_{i,t} = \alpha(\pi) + \beta_1 logLD_{it}(\pi) + \beta_2 logAsset_{it}(\pi) + \beta_3 \sum(X_{it})(\pi) + \delta(Year_t) + \phi(Location_i)(\pi) + \mu_{it} \quad (4)$$

π repesents the quantiles of household food index at the various conditional quantiles of 25%, 50% and 75% respectively and we used bootstrap standard errors.

III. Results and discussion

Table I shows that OLS estimate of the log of the value of the land asset on the log of food expenditure per capita. The first three columns are the estimates of the Fixed Effect (FE), Random Effects (RE) and Pooled OLS for the Female-headed households (FHH), and the last three columns present the estimates for the Male headed households (MHH). The result shows that for the FHH, having access to more valuable land lead to a reduction in food expenditure whereas for the MHH, having possession of land with higher value translate into improvement in the log of food expenditure per capita.

The model's robustness check indicates that for the panel OLS regression models, the Random effect model was accepted for the female-headed households while the fixed effect model was used in the male-headed households. Findings reveal that holding all other variables constant and estimated at it sample mean, a 1% in land value translates into 2.9% decrease in household food expenditure per capita for the FHH (at the mean value of household food expenditure per capita other things being equal). Whereas for the male-headed households, the fixed effect model is preferred and an increase in log value of land value assets by an increase in land value assets by 1% would lead to 0.6% increase in food expenditure per capita (at the mean value of household food expenditure per capita other things being equal). Total assets value and year were found to be positively significant in both households and across the models (Table 1).

Table 1: OLS Estimates of the determinant of Log of food expenditure per capita

	Female-Headed HH (n=113)			**Male-Headed HH (n=1533)**		
	FE	RE	Pooled OLS	FE	RE	Pooled OLS
Adjusted log Food expenditure per capita	Coef	Coef	Coef	Coef	Coef (Std err)	Coef (Robust Std err)
Age HH head (years)	19.36*	20.3*	20.27*	13.3***	13.3***	13.3***
	(11.3)	(11.2)	(11.32)	(2.5)	(2.5)	(3)
Education HH head (years)	88.4	85.7	85.67	96.9***	97.9***	97.9***
	(58.9)	(56.1)	(53.7)	(9)	(9)	(10)
Farm size	-157.9***	-146.4***	-146.4**	-149.3***	-145.0***	-145***
	(63)	(61)	(58.7)	(14.4)	(14)	(17.6)
logValue HH land	-2.8**	-2.9**	-2.87*	0.6***	0.6***	0.6**
	(1.3)	(1.3)	(1.7)	(0.2)	(0.2)	(0.3)
lnValue Total HH asset	0.04***	0.05***	0.05***	0.003***	0.003***	0.003*
	(0.01)	(0.01)	(0.02)	(0.0010	(0.001)	(0.002)
Proportion of village land irrigated	-498.7	-398.8	-398.83	-177*	-154.1	-154.1*
	(406)	(389)	(404)	(94.6)	(94.6)	(89.8)
Hausman Test: Ho: difference in coefficients not systematic				Hausman Test: Ho: difference in coefficients not systematic		
chi2(15) = (b-B)'[(V_b-V_B)^(-1)](b-B)=0.84				chi2(15) = (b-B)'[(V_b-V_B)^(-1)](b-B)=20.59		
Prob>chi2 = 0.997				Prob>chi2 = 0.004		

Notes to Table I. Standard errors are robust and in parentheses. Data are from the Bangladesh Household Survey 1991/92–1998/99, conducted jointly by the Bangladesh Institute of Development Studies and the World Bank in two waves between 1991 and 1998. Each regression also includes yearly dummies and a dummy for village accessibility. *, ** and *** represent significance level of estimates at p-values of <0.1, 0.05 and 0.01 respectively.

These results offer valuable insights for policymakers interested in improving the food security status of rural households. First, it is essential to empower both households in assets accumulation as this would assist in improving food security. However, the negative relationship of land assets value of female-headed households with food expenditure calls for more in-depth reflection. Perhaps, the local institutions and traditions constrain female-headed households from allowing land assets to make a significant contribution to their general welfare. Also, it could be that being in possession of land may come with a certain cost (relocation, transportation, and displacement cost), reduction of labour use for food production and other income generating activities because of labour spent on guarding land property. The local tradition and costs associated with land ownership could be less pronounced for male-headed households.

More generally, we suggest that the strength of the estimates should be interpreted with caution because of the causality loop that exists between the log of food expenditure and the log of the value of land assets. It could be the case that rich households who could afford more food expenditure per capita could also afford to purchase or access land with higher values. Nevertheless, our OLS finding corroborates previous findings. Valente (2009) for instance observed that beneficiaries of the land redistribution program in South Africa report land grant recipients are more food insecure than comparable non-participants.

Table II shows the result of the determinant of the log of household food expenditure per capita across the quantiles for MHH and FHH. The quantile regression models reveal that while land assets were significant only for the MHH, it contributed weakly ($p<10\%$) to the female-headed households at the conditional 50^{th} quartile. Also, the total value of assets plays a significant role in explaining the conditional food expenditure per capita index for the FHH at the conditional 50 and 75^{th} quantiles and no significant contribution to MHH at all quartiles (Table II).

Table II: Estimates of the determinant of Log of food expenditure per capita across the quartile distribution of Male and Female-headed Households

	Female-Headed Household (n=119)			Male-Headed Households (n=1533)		
	Q1 (Pseudo R2=0.15)	Q2 (Pseudo R2=0.12)	Q3 (Pseudo R2=0.20)	Q1 (Pseudo R2=0.07)	Q2 (Pseudo R2=0.12)	Q3 (Pseudo R2=0.16)
Age HH head	0.001*	0.0008	0.0005	0.0006***	0.001***	0.001***
	0.001	0.001	0.002	0.0002	0.0002	0.002
Educ HH head	0.005	0.006	0.007	0.004***	0.01***	0.01***
	0.005	0.01	0.01	0.001	0.001	0.001
HH size	-0.007*	-0.007	-0.02*	-0.01***	-0.009***	-0.01***
	0.004	0.004	0.01	0.001	0.001	0.001
lnHH land	-0.06	-0.2*	-0.2	0.5**	0.48	0.005
	0.1	0.1	0.1	0.002	0.03	0.004
lnHH asset	1.72	3.77**	4.9***	1.2	5.9	0.07
Per irrigation	0.007	-0.0002	-0.04	-0.01	-0.01**	-0.014*
	0.03	0.03	0.04	0.01	0.01	0.01

Notes to Table II. Standard errors are bootstrapped and in parentheses. Data are from the Bangladesh Household Survey 1991/92–1998/99, conducted jointly by the Bangladesh Institute of Development Studies and the World Bank in two waves between 1991 and 1998. Each regression also includes yearly dummies and a dummy for village accessibility. *, ** and *** represent significance level of estimates at p-values of <0.1, 0.05 and 0.01 respectively.

The result of the quantile regression offers critical insights into the contribution to the male-female household dichotomy in food security dynamics. It could be that male-headed households in the mid to upper quartile tend to get out of poverty more quickly than their female counterparts and males at the lower quartile. It could also be that the FHH requires significant effort to make them come out of poverty. Additionally, the negative significance of land assets to food security in female-headed households follows similar explanation for the panel regression and could be a confirmation of the additional cost associated with land for vulnerable FHH members which could be detrimental to food security or the endogeneity bias associated with the bidirectional causality between log of household food expenditure and ownership of land assets.

IV. Conclusion

We examine the contribution of log of value of land assets on log of food expenditure per capita on a gender-segregated rural households' data in rural Bangladesh. We utilised data on rural households that cover the years 1991 and 1998. The result from the panel regression using OLS estimation show that land value is negatively related to household food expenditure per capita for the FFH, while it contributed positively to MHH. Total assets value was positive, and both households' heads saw an overall improvement in food status relative to the lag year. Based on quartile distribution, we found that male-headed households at the conditional 25^{th} percentile and the female-headed households across all quartiles recorded no significant improvement in their foods security status. Furthermore, land asset appears to negatively influence food security of female-headed households, though the effect is weak and only at the conditional 50^{th} percentile. The results suggest that empowering both gender-based households and call for designing land policy reforms that would recognise the vulnerable members and female-headed households in rural areas.

Due to the endogeneity bias that could have been introduced in the study, we suggest that more informative findings could be found by correcting for the bias, either by the use of instrumental variables estimates or any other statistical analysis that correct for the causality loop. In addition, it would be useful for policy recommendation to compare results on how land assets and the tenure practices drive the gender gap in rural household food poverty across selected countries in Sub-Sahara Africa, Latin America and South-East Asia.

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