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Private Sector Rice Stocks in Bangladesh

Estimated levels and determinants

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ACRONYMS AND ABBREVIATIONS

BIDS	Bangladesh Institute of Development Studies
BIHS	Bangladesh Integrated Household Survey
CSD	Central Storage Depot
FPMU	Food Planning and Monitoring Unit
HIES	Household Income and Expenditure Survey
IFPRI	International Food Policy Research Institute
IFPRP	Integrated Food Policy Research Program
IMR	Inverse Mills Ratio
JV	IFPRI-BIDS-UIUC Joint Venture
LSD	Local Supply Depot
PFDS	Public Food Distribution System
UIUC	University of Illinois at Urbana Champaign

1. INTRODUCTION

In order to promote price stability of foodgrains, the Government of Bangladesh maintains public food stocks and intervenes in domestic markets. To boost producer incomes, as well as acquire supplies for the Public Foodgrain Distribution System (PFDS), the government procures paddy, milled rice and wheat from farmers and traders. Similarly, to enhance food security of consumers, the government distributes foodgrains through various channels and sells foodgrain in the open market. Public stocks, located in Silos, Central Storage Depots (CSDs) and Local Supply Depots (LSDs) throughout the country, play a central role in the PFDS, serving a dual role as working stocks for planned distribution as well as security stocks for emergency relief and price stabilization in the event of major production shortfalls.

The effects of these PFDS interventions on market prices depend on the volume of procurement and distribution. They also depend on overall supply in the market, farmers' response to prices, consumer demand and trader behavior. All of these groups make decisions on sales or purchases; they also hold stocks for future sales or to minimize future purchases.[1]

This paper focuses on the role of private stocks in the Bangladesh foodgrain economy, and presents estimates of the quantities of private stocks in Bangladesh based on data on household-level monthly stocks of paddy and rice from the Bangladesh Integrated Household Survey (BIHS), 2010-11 and 2013-14 and other sources. Section 2 presents basic descriptive information from the two survey rounds, highlighting figures for household stocks of paddy and rice. Section 3 presents econometric estimates of the determinants of household stocks in terms of household size, level of production, expenditures (or assets) and other variables. Section 4 presents estimates of total stocks in the Bangladesh economy by month and utilizes production, trade and PFDS data along with estimates of household stocks to construct estimates of private trader / miller stocks as a residual. Section 5 summarizes and outlines possible extensions to the analysis.

2. HOUSEHOLD STOCK IN BANGLADESH: RECENT SURVEY ESTIMATES

Nationally representative data on household stocks are available from two sources: the Bangladesh Integrated Household Survey (BIHS) (rural households only) and the Bangladesh Household Income and Expenditure Survey (HIES).

The BIHS provides data on monthly stocks of paddy and rice held by households, both farmers and rural non-farmers. Round one of this panel dataset covers the December 2010 to November 2011 harvest year; round two covers the December 2013 to November 14 harvest year. Just less than half of the respondents in the first year of the survey reported producing rice in one of the year's three rice seasons, and just more than half reported rice production in the 2014 survey.[2] The 2010 HIES survey provides information about rice stocks held by both rural and urban households. For each paddy crop, the uses of the paddy are specified in terms of

[1] Moreover, in general, if households are not constrained by credit, and if labor and product markets function well, then household consumption and production decisions can be considered as separable decisions in which production is a function of technology, and the prices of inputs and outputs, and consumption is a function of household income (independent of source) and prices of consumer goods.

[2] Note that in the 2011-12 survey, there are no households with paddy or rice stocks coded as "missing". However, in the 2013-14 data, about 45% of the household stocks data is coded as "missing", almost exclusively among non-rice farming households. In the analysis presented here, the 2013-14 "missing" values have been treated as zeroes.

own consumption, feed, seed, losses and stocks. For households that do not produce paddy, there is no information on stocks.

Table 1 presents estimates of household rice stocks from both the BIHS and HIES surveys.[3] For the BIHS survey data, the figures for average aus, aman and boro stocks are the stocks belonging to the BIHS farmers who produced paddy in each of these respective seasons. For purposes of comparison with the HIES data, we present BIHS data for October for end stocks from aus and boro crops; for end stocks from the aman crop, the table shows March stocks data. Estimated stocks for rural households are generally higher in the BIHS data (both for 2011 and 2014) than in the HIES 2010 data, though both surveys show stocks considerably higher from the boro season (1.35 to 2.30 million tons) than in the aman (0.82 to 2.01 million tons) or aus (0.11 to 0.31 million tons). The HIES data indicate that few urban residents are rice farmers. The 2010 data indicate that urban rice production was 1.7 million tons out of 27.6 million tons produced nationally; urban farmer stocks are about one-tenth of those of rural farmers.

Table 4 and Figure 1 through Figure 4 show the decomposition in use of household rice production across consumption, sales, stocks, payments and other categories, by season. Overall quantities and shares are consistent across the surveys. The boro season harvest accounts for 57 to 61 percent of production across years, followed by the aman harvest with a share ranging between 32 to 40 percent, and the categories of consumption and sales account for the largest uses of production, at an average share of 37 percent each across surveys and rounds.[4]

According to the BIHS 2011 survey data, almost all (92 percent) of rural households hold stocks.[5] On average, stock-owning households have greater per capita expenditures (2,718 as compared to 2,393 Taka/person/month) and have a higher value of rice consumption (1,887 and 1,718 Taka/person/month). Stock-owning households' produce much more of their own rice for consumption and spend less on rice purchases than their non-stock owning counterparts (Table 2).

Households who produce rice also consume greater values of rice and produce more of their own rice for consumption compared to non-rice farmers, and this trend grows while the value of purchased rice shrinks by increasing quintiles of rice producers. Likewise, the volume of rice sold and stocked is greater among rice-harvesting households, increasing by rice production quintile (Table 3). Among non-rice farmers, rice stocks averaged 35 kg/HH per month throughout the year in 2010-2011. Stocks average around 300 kg/HH among rice farmers in both survey years, by comparison, representing between 3.6 and 3.9 million tons per month across all rural households (see Table 1).

Non-parametric analysis using the BIHS 2014 data shows that average monthly stock holdings tend to rise as rice production increases (Figure 5). Average stock holdings reach a plateau of around 0.5 tons/household once rice production reaches about 6.3 tons per household – farmers producing over 6.3 tons per household also tend to hold only 0.5 tons of stock. Similar patterns are seen for peak stock levels, for which the plateau is around 2.0 tons/household (Figure 6). Average monthly stocks for aman and boro rice reach plateaus at

[3] Estimates of rice stocks from the BIHS 2011-2012 (2010-11) survey by division and month have previously been reported by Ahmed et al. (2013).

[4] Note, however, that the share of production held in stocks in these figures is accounted for differently across surveys. In the BIHS, farmers' current stocks of last year's boro, aus or aman harvest at the date of interview are used. The HIES 2010 survey question, on the other hand, figures this share by asking "How much [boro, aus or aman rice production] did your household stock in the last 12 months?" It is likely that answers to this question relate to end-of-season totals and are not directly comparable to responses to the BIHS questions: "What are your current stocks," asked of farmers in decomposing uses of production, or "What were your month-end stocks of paddy or rice over the course of the last year" discussed later in this paper.

[5] Ninety-nine percent of rice farmers hold stocks, and 86% of non-rice farmers hold stocks.

around 0.6 and 1.5 tons/household, respectively (Figure 7). Peak monthly stocks for aman, boro and aus are about 1.1, 2.5 and 0.4 tons /household, respectively (Figure 8).

3. DETERMINANTS OF HOUSEHOLD STOCK

In analyzing household stocks, this section presents two sets of regressions. The first set examines the determinants of annual average household stocks. The second set of regressions focuses on seasonality of household stocks, with separate regressions for stock levels in each month.

3.1 Annual Average Household Stocks

As discussed in the previous section, nearly all rural households store some paddy or rice. For farm households, household stocks are closely tied to the household's own production. For non-farm households, stocks may be kept to smooth seasonal food consumption (purchasing foodgrain when market prices are low, to help ensure adequate consumption in periods of high prices) or as a hedge against sharp increases in market prices. Thus, we model household foodgrain storage as a function of household characteristics influencing consumption decisions, and farm characteristics that influence production of rural farm households. Moreover, given the rapid rural transformation taking place in Bangladesh, we also include product diversification and non-farm employment opportunities as possible determinants of private stock. We also include dummy variables for location (see a complete list of variable names, descriptions, means and standard errors of these variables in Annex Table A.1).

We estimate the following equation:

$$Y_{it} = \beta_1 + \sum_{j=2}^{k} \beta_j X_{jit} + \alpha_i + \delta_t + \varepsilon_{it} \qquad (1)$$

where the dependent variable, Y_{it}, is foodgrain stock (in kilograms) of household i in period t, defined as the annual average of combined paddy, rice, and wheat stocks kept by a rural household at the end of each month. The X_j represents observed explanatory variables, where α (referred to as individual-specific unobserved effect) represents unobserved covariates, δ is the time trend coefficient, ε is the error term, i refers to an observation (household h in period t) and y (observation) index, and t is time index.

Explanatory variables (X_{jit}) include household characteristics such as family size (*fmsz*), sex of household head (*sxdm*), and farm and production characteristics such as value of owned farm implements (in Taka) (*frimpv*), size of agricultural and pond land (in hectares) (*lndsz*), total quantity of paddy, rice and wheat produced (in kilograms) (*crpdn*), and total grain storage capacity (in kilograms) (*grstcp*).

The rural transformation process taking place in Bangladesh is expected to increase the engagement of household family members in non-farm employment activities, diversify agricultural production and, hence, income from high-value products such as fruits and vegetables and livestock products. Therefore, non-traditional variables considered in the model include number of non-farm employment activities in which household family members are engaged (*empno*), level of savings (in Taka) (*svgs*), value of fruit and vegetable crops produced (in Taka) (*frvgpdn*), value of livestock products marketed (in Taka) (*lvstkv*), and access to transport services (in kilometers) (*dst*). Susceptibility to flood is included, as well, since flood losses in

traditional storage facilities made of wood and soil may discourage households from holding stocks[6]. Similarly, households in coastal areas, prone to cyclone disasters, may be expected to store more foodgrain. A flood dummy variable (*fldm*) is used for households located in flood prone areas and a coastal dummy variable (*cstdm*) for households located in coastal areas. We estimate equation 1 using both fixed effects and random effects models.[7]

As shown in Table 5, each explanatory variable regressed against total household stocks of both rice and wheat combined has the expected sign and each variable (except household expenditure on food consumption items) has statistically significant coefficients (p = 0.01). The results show positive association of household grain stock with quantity of cereal production, grain storage capacity, and household expenditure on non-food items. On the other hand, household grain stock is negatively associated with level of producer price, quantity of fruit and vegetable production, household expenditure on food items, and proneness to flood areas. These results are consistent with the theoretical expectation that the more a farm household engages in market-oriented production activities, the limited the role of grain storage as a household food security strategy becomes. Households located in flood prone areas are also less likely to be engaged in foodgrain storage, as expected.

3.2 Monthly Household Stocks

Using the BIHS 2013-14 data, we also econometrically estimate the determinants of per capita household stocks for each month, $Stocks_t$, as a function of a household's per capita expenditure Exp_{pc}, per capita harvests of aman, boro and aus over the last year ($Aman_{pc}$, $Boro_{pc}$, and Aus_{pc}), household size (*HHsize*) and dummy variables for administrative divisions. Because many households do not hold stocks, we include the Inverse Mills ratio (*IMR*) from a probit regression (see a complete list of variable names, descriptions, means and standard errors of these variables in Annex Table A.2).[8] Thus, the estimated equation is:

$$Stocks_t = \beta_0 + \beta_1 Exp_{pc} + \beta_2 Aman_{pc} + \beta_3 Boro_{pc} + \beta_4 Aus_{pc} + \beta_5 HHsize + \beta_6 IMR + \varepsilon \quad (2)$$

To correct for endogeneity, we use a two-stage least squares procedure and instrument expenditures per capita as a function of household size, education of the household head, gender of the household head, land size (in hectares), number of tropical livestock units and distance of upazila from a major city and region. For the regressions in which the data for aman, boro or aus production corresponds to a period after the month of the regression equation, we use lagged values of production corresponding to the season in 2010-11. For

[6] Mia and Haq (1994) reported a storage loss of about 2.47% for Kazipur and Raigonj flood prone areas located in the Sirajgonj district of Bangladesh. Alam et al. (2007) reported an average 8% stored grain damage in Aguria, Khidrachapri, Mulkandi and Adachaki areas of Sirajgonj district by the flood in 2007.

[7] A random effects model specification of unobserved effects assumes zero covariance between the individual-specific unobserved variables explanatory variables (X_j) and the observable explanatory variable (a), (i.e., cov(a, $X_{j,i,t}$) = 0). In a fixed effects model, it is assumed that the covariance between the individual-specific unobserved variable and the observable explanatory variables is zero. We use a Hausman test (Hausman, 1978) to test which of these two models better explains the data.

[8] IMR is calculated from a probit regression of household stock holding where 0 = no household stocks and 1 = positive household stocks, with the following explanatory variables: household size, education of the household head, gender of the household head, land size (in hectares), distance of Upazila from a major city, and region.

example, for the regression for January 2014 stocks, we use data for aus production in 2013, along with data for boro and aus in 2011.[9]

Regression results are reported in Table 6. Per capita production has a positive and highly significant effect on stock-holdings, as expected, and per capita expenditure is likewise positive and significant in regressions for half of the months (May, June, August, September, October and November), but it is insignificant in the other six months. Household size has a negative and significant effect on monthly per capita stocks in all months except the months of May and November.

Note that the seasonal effects of each harvest's crop vary on the month by month stock holdings depending on the time of year. In January, for example, the coefficient for the per capita aman harvest is positive and significant, while the coefficient for the per capita boro harvest is negative and significant. In August, this relationship is the reverse: the per capita aman harvest is negative and significant, while the coefficients for the per capita aus and boro harvests are positive and significant. For each month, the harvest effects corresponding to each season are calculated as the regression coefficients for that season multiplied by the total harvest for that season (from the survey data). (Only coefficients that are statistically different from zero at a 0.01 confidence level are included.)

The effect of seasonal production on monthly stocks is shown in Figure 9. As shown, the boro harvest has significant positive effects on household stocks for all months between April and November; with the size of the effect diminishing from May to November. The size of the forthcoming (expected) boro harvest has a negative effect on farmer stocks in January through March, however, indicating that the larger the expected future boro crop, the more farm households draw down stocks in the months prior to the boro harvest. Using the estimated coefficients from the regression and quantities of the aman, boro and aus harvests from the BIHS survey, it is possible to calculate the total effect of these harvests on monthly stocks (Table 7).[10] These calculations suggest that if the expected boro harvest increases by one million tons (i.e. equivalent to 6.5 percent of the 15.4 million ton 2014 boro harvest, then household stocks at the end of March would have bene 12 thousand tons (0.8 percent) lower, and household stocks at the end of May would be 167 thousand tons (2.1 percent) higher.[11]

4. ESTIMATES OF TOTAL PRIVATE STOCK

Total monthly private stocks in the economy are estimated using production by season,[12] monthly private sector imports, private consumption and public net distribution (distribution less domestic procurement). Household demand is modeled using an own-price elasticity of demand of -0.3. Given the relatively small changes in the real price of rice over the year (the ratio of the peak price to the lowest price was 1.33 in 2010-11, but only 1.08 in 2013-14), household demand changes relatively little over the year. Carryover stocks prior to the aman season harvest in both 2010 and 2013 are assumed to be equal to 1.5 months of estimated annual consumption (i.e. about 3.5 million tons). As shown in Table 8 and Table 9 and Figure 10, estimated private

[9] We also use the values for the 2013-14 harvests of aman, boro and aus, for regressions of monthly stocks in months prior to these harvests (see Annex Table A.3 & Table A.4). These regressions can be interpreted as representing perfect foresight regarding future harvests for each household.

[10] Only coefficients that are statistically significant (i.e. different from zero) are used in these calculations.

[11] Elasticities of end-period stocks with respect to a change in the boro harvest are thus -0.82/6.49 = -0.13 for end-March stocks and 2.13/6.49 = 0.33 for end-May stocks.

[12] Each year, half of the aman harvest is assumed to be harvested in November and half in December. Similarly, each year, half of the boro harvest is assumed to be harvested in April and half in May. The entire aus harvest is assumed to be harvested in August.

stocks are at their peak in May, after the boro harvest (17.85 million tons in May 2011 and 16.27 million tons in May 2014). Stocks also increase substantially at the time of the aman harvest reaching 12.44 and 12.30 million tons in December 2010 and 2013, respectively. By contrast, stocks are at their lowest levels (7.15 million tons in 2011 and 5.37 million tons in 2014) in March just before the April/May boro harvest and in October (7.44 and 6.02 million tons in 2011 and 2014, respectively) just before the November/December aman harvest.

Data on rural farm household-level monthly stocks of paddy and rice from the Bangladesh Integrated Household Survey (BIHS), 2010-11 and 2013-14, suggest similar levels and patterns for farmer stocks over time (Table 10, Table 11 and Table 12, and Figure 11 and Figure 12). Estimated average farm household stocks are 3.6 million tons in 2010-11 and 3.9 million tons in 2013-14. Both surveys also show that farm household stocks vary significantly during the year, however, with peak stocks in May, at the time of the boro harvest (7.58 million tons in May 2011 and 7.84 million tons in May 2014). Farm household stocks are at their lowest levels in March (1.55 and 1.46 million tons in 2011 and 2014, respectively). Stock levels just before the aman harvest were not as low (2.29 and 2.40 million tons in October 2011 and 2014, respectively), perhaps because of a large carryover from the boro harvest took place only five months earlier (and from the aus harvest for some farmers). In contrast, the boro harvest in April-May takes place seven months after the aman harvest.[13] Rural non-farm household stocks averaged only 35 kgs/household/month in 2010-11, considerably lower than rural farm household stocks. Urban household stocks per capita are assumed to be the same levels as for rural non-rice farmer households, i.e. 35 kgs/household/month.[14]

Given the estimates of total private stocks (Table 8 and Table 9), trader / rice miller stocks are estimated as a residual of total private stocks less household stocks. The data on seasonal production and household stocks imply that stocks of millers and traders account for more than half of total stocks in the country throughout the year (an average of 54.0% in 2013-14). Public stocks are relatively small, averaging only 862 thousand tons from December 2013 through November 2014, equivalent to 8.7 percent of total (public plus private) stocks in this period.

5. SUMMARY AND CONCLUSIONS

Private and public foodgrain stocks play an important role in the food economy of Bangladesh. This foodgrain serves as working stocks for various actors, helping to reduce transactions costs and guarantee supplies for future consumption or sales. Stocks, especially public stocks, help to stabilize market prices, as well.

Recent rural household survey data (BIHS 2010-11 and 2013-14) indicate that for rice farmers, stocks average around 300 kilograms per household, totaling about 3.6 and 3.9 million tons per month across all rural households. Among non-rice farmers, rice stocks are only about one-tenth as large, averaging only 35 kilograms per household in 2010-2011. Farm household stocks vary significantly during the year, however, with peak stocks in May, at the time of the boro harvest (a total of 7.58 million tons in May 2011 and 7.84 million tons in May 2014). As might be expected, the size of farmer stocks increases with the level of production. Non-parametric statistical analysis of the household survey data, however, shows that farmer

[13] The estimates of aman stocks at harvest time are somewhat hard to interpret since the surveys do not include data for November and December for the same calendar year.

[14] As discussed in the previous section, the HIES data on stocks do not permit a calculation of average monthly urban or rural stocks.

stocks tend to increase along with the quantity of rice production only up to about a stock level of 1.5 tons per household for boro rice farmers and 0.5 tons per household for aman rice farmers.

Econometric analysis of the determinants of rural household stocks shows that total quantity of cereal production, grain storage capacity, financial savings and having a male household head are all associated with greater household foodgrain storage. Households located in flood prone areas and coastal areas are less likely to hold stocks. Econometric analysis also provides evidence that farmer stocks are responsive to expected future harvests, as well as recent past harvests. The regression results imply that a one million-ton (6.5 percent) increase in the expected boro harvest leads to a 12 thousand ton (0.8 percent) reduction of farmer stocks at the end of March and a 167 thousand tons (2.1 percent) increase in farmer stocks at the end of May.

In general, however, farmer stocks account for less than half of all stocks in the country. Instead, private trader / rice miller stocks accounted for an average of 54 percent of private sector stocks (5.44 million out of 10.13 million tons) in 2013-14. Public rice stocks were much smaller – averaging only 0.86 million tons, 8.7 percent of the 10.99 million tons of total national stocks.

Further data and analysis is needed in several areas. Given the predominance of trader / miller stocks, a high priority is a wholesale traders and millers survey to better understand timing of farmer sales, ownership of stocks (e.g. traders and millers), information flows about stocks and the feasibility of direct estimates of trader and miller stocks. Survey data could also enable analysis of determinants of trader and miller stocks, formation of price expectations and price responsiveness of stocks. This information could help increase the reliability of price forecasts and analysis of alternative government policies on market prices and household welfare. Better understanding of private sector stock behavior thus has the potential to increase the effectiveness of the Public Foodgrain Distribution System and thereby help enhance food security in Bangladesh.

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TABLES

Table 1. Bangladesh Household Rice Stocks, 2010, 2011 and 2014

HIES 2010	Surveyed HHs	Annual Total Harvest (mn MT)	Aus Stocks (mn MT)	Aman Stocks (mn MT)	Boro Stocks (mn MT)	Average Monthly HH stocks (mn MT)
Urban	1,522	1.7	0.01	0.06	0.22	-
Non-rice farmers[a]	986	-	-	-	-	-
Rice farmers	536	1.7	0.01	0.06	0.22	-
Rural	4,652	27.6	0.11	0.82	2.30	-
Non-rice farmers[a]	1,059	-	-	-	-	-
Rice farmers	3,593	27.6	0.11	0.82	2.30	-
BIHS 2011						
Non-rice farmers	2,928	-	-	-	-	0.5
Rice farmers	2,575	23.9	0.31[b]	2.01[c]	1.35[b]	3.6
BIHS 2014						
Non-rice farmers[d]	2,420	-	-	-	-	-
Rice farmers	2,678	27.8	0.29[b]	1.36[c]	2.09[b]	3.9

Source: Authors' estimates from BIHS and HIES survey data.

[a] In the HIES questionnaire, stocks information was only collected from households that produced paddy.

[b] End-season (October) stocks.

[c] End-season (March) stocks. [d] Stocks held by non-rice farmers seem largely unreported in this round of the BIHS.

Table 2. Characteristics of Rice Stock-Owners: Household size, Per-capita Expenditures, and Rice Consumption

		Average HH Size	Per Capita Expenditures		Value of total rice consume per HH per month		Value of total own production rice consumed per HH per month		Value of total purchased rice consumed per HH per month		Value of total other source rice consumed per HH per month	
BIHS 2011	**N**		**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
HHs with Rice or Paddy Stocks, at least one month of the year	5,067	4.1	2,718	2,317	1,887	1,721	790	-	1,064	999	32	-
HHs with 0 Stocks	436	4.1	2,393	1,976	1,718	1,643	105	-	1,583	1,564	31	-
BIHS 2014												
HHs with Rice or Paddy Stocks, at least one month of the year	2,600	4.3	2,798	2,393	2,003	1,847	1,225	1,251	754	104	23	-
HHs with Missing Stocks	2,303	3.9	2,586	2,188	1,680	1,553	181	-	1,454	1,408	45	-
HHs with 0 Stocks	195	4.0	2,776	2,284	1,833	1,597	521	-	1,282	1,369	30	-

Source: Authors' estimates from BIHS survey data.

Table 3. Characteristics of Rice Producers: Household size, Per-capita Expenditures, and Rice Consumption

	N	Average HH Size	Per Capita Expenditures		Value of total rice consumed per HH per month		Value of total own production rice consumed per HH per month		Value of total purchased rice consumed per HH per month		Value of total other source rice consumed per HH per month	
BIHS 2011			**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Non-rice farmers	2,928	3.9	2,661	2,188	1,675	1,521	137	-	1,494	1,423	44	-
Rice farmers	2,575	4.4	2,726	2,396	2,085	1,934	1,376	1,405	689	43	20	-
Rice farmer quintile 1	541	4.1	2,402	2,076	1,857	1,738	699	-	1,128	1,086	30	-
Rice farmer quintile 2	467	4.3	2,512	2,226	2,006	1,860	1,163	1,238	826	87	17	-
Rice farmer quintile 3	526	4.3	2,638	2,316	2,021	1,879	1,311	1,380	688	-	22	-
Rice farmer quintile 4	534	4.5	2,771	2,507	2,196	2,034	1,670	1,673	502	-	25	-
Rice farmer quintile 5	507	4.7	3,317	2,904	2,358	2,123	2,075	1,955	278	-	4	-
BIHS 2014												
Non-rice farmers	2,420	3.9	2,358	1,801	1,693	1,556	198	-	1,451	1,408	44	-
Rice farmers	2,678	4.2	2,803	2,396	1,994	1,847	1,207	1,243	764	104	23	-
Rice farmer quintile 1	561	3.9	2,714	2,174	1,705	1,582	555	-	1,116	1,112	33	-
Rice farmer quintile 2	514	4.2	2,643	2,208	1,939	1,799	952	435	960	521	27	-
Rice farmer quintile 3	545	4.3	2,671	2,348	1,976	1,834	1,217	1,304	742	65	17	-
Rice farmer quintile 4	537	4.4	2,773	2,460	2,081	1,947	1,468	1,525	593	-	20	-
Rice farmer quintile 5	521	4.5	3,217	2,809	2,280	2,081	1,865	1,825	396	-	19	-

Source: Authors' estimates from BIHS survey data.

Table 4. Bangladesh: Rice Production, Sales, Consumption and Stocks (mn tons): 2010, 2011 and 2014[a]

	Season	N	Consumption	Stocks[b]	Sales	Given as payments	Used for seed, feed, waste, other	Total Production
HIES 2010 Rural	Aman	2,368	3.80	0.82	3.16	0.91	0.21	8.90
			(0.43)	(0.09)	(0.35)	(0.10)	(0.02)	(1.00)
	Boro	2,834	5.43	2.30	7.15	1.74	0.33	16.96
			(0.32)	(0.14)	(0.42)	(0.10)	(0.02)	(1.00)
	Aus	704	0.85	0.11	0.51	0.17	0.06	1.71
			(0.50)	(0.07)	(0.30)	(0.10)	(0.04)	(1.00)
HIES 2010 Urban	Aman	348	0.17	0.06	0.15	0.04	0.01	0.43
			(0.40)	(0.13)	(0.35)	(0.10)	(0.02)	(1.00)
	Boro	438	0.36	0.22	0.47	0.10	0.02	1.17
			(0.31)	(0.19)	(0.40)	(0.09)	(0.02)	(1.00)
	Aus	84	0.03	0.01	0.03	0.01	0.00	0.08
			(0.40)	(0.08)	(0.34)	(0.17)	(0.02)	(1.00)
BIHS 2011	Aman	1,842	1.87	3.92	1.99	1.48	0.07	8.25
			(0.23)	(0.47)	(0.24)	(0.18)	(0.01)	(1.00)
	Boro	1,963	5.62	1.14	6.84	2.91	0.05	14.66
			(0.38)	(0.08)	(0.47)	(0.20)	(0.00)	(1.00)
	Aus	378	0.42	0.11	0.35	0.21	0.01	1.02
			(0.41)	(0.11)	(0.35)	(0.21)	(0.01)	(1.00)
BIHS 2014	Aman	1,942	3.46	1.54	4.23	1.68	0.12	11.04
			(0.31)	(0.14)	(0.38)	(0.15)	(0.01)	(1.00)
	Boro	1,943	5.69	0.32	7.19	2.72	0.04	15.97
			(0.36)	(0.02)	(0.45)	(0.17)	(0.00)	(1.00)
	Aus	1,944	0.33	0.03	0.31	0.13	0.01	0.81
			(0.40)	(0.04)	(0.38)	(0.16)	(0.02)	(1.00)

Notes: [a] Shares of production are given in parentheses.
[b] For the HIES data, the stocks figure is the difference of net production less consumption, sales, payments and other non-stock uses. For BIHS data, the stock figures are directly reported in the survey.

Source: Authors' calculations from HIES and BIHS survey data.

Table 5. Fixed effects IV regression estimates of household grain stock

Variable	Coefficient	Std. Err.	z	P > |z|	95% conf. interval
Constant	-277.435	170.774	-1.620	0.104	-612.145, 57.275
Quantity of cereal production (*crpdn*), kg	0.090	0.671	7.480	0.000	0.495, 0.847
Family size (*fmsz*)	75.085	19.930	3.770	0.000	36.023, 114.148
Household grain storage capacity (*grstrcp*), kg	0.027	0.004	7.43 4	0.000	0.020, 035
Producer price of grain (*grpr*), Taka/kg	-16.557	7.710	-2.150	0.032	-31.668, -1.446
Quantity of fruit and vegetable production (*frvgpdn*), kg	-0.289	0.042	-6.860	0.000	-0.370, -0.206
Household expenditure on food consumption items (*fdex*), Taka	-0.084	0.063	-1.330	0.183	-0.209, 0.040
Household expenditure on non-food consumption items (*nfdex*), Taka	0.027	0.011	2.400	0.017	0.005, 0.050
Dummy variable on proneness to flood area (*flddm*), Yes = 1	-415.267	98.862	-4.200	0.000	-609.033, -221.501

Source: Authors' estimates from BIHS survey data.

Table 6. Paddy Farmer Month-specific per capita rice stocks regression results, 2013-14*

	Expenditure Per capita	Aman harvest Per capita	Boro harvest Per capita	Aus harvest Per capita	HH size	Inverse Mills Ratio	Constant	R-squared
December 2013	0.0201***	**0.0633*** **	**-0.00420**	**-0.0206**	0.699	-49.70***	62.24***	0.169
	(3.083)	**(7.792)**	**(-0.926)**	**(-1.018)**	(0.335)	(-18.63)	(4.326)	
January 2014	0.0231***	0.0997***	**-0.0144*** **	**-0.0271**	4.236**	-32.79***	20.64	0.171
	(3.947)	(16.42)	**(-3.573)**	**(-1.495)**	(2.297)	(-13.36)	(1.635)	
February 2014	0.0100**	0.0911***	**-0.0127*** **	**-0.0314*** **	1.156	-23.14***	27.34***	0.267
	(2.570)	(22.44)	**(-4.713)**	**(-2.594)**	(0.937)	(-14.11)	(3.239)	
March 2014	0.00752**	0.0784***	**-0.0123*** **	**-0.0195***	0.635	-18.33***	25.42***	0.233
	(2.077)	(20.85)	**(-4.920)**	**(-1.737)**	(0.556)	(-12.06)	(3.250)	
April 2014	0.121***	-0.0935***	**-0.0284** **	**0.0261**	23.17***	-116.9***	-47.34	-
	(6.726)	(-5.025)	**(-2.298)**	**(0.470)**	(4.098)	(-15.55)	(-1.224)	
May 2014	0.122***	0.0108	**0.167*** **	**-0.0602**	23.01***	-114.8***	-72.49*	0.109
	(6.560)	(0.556)	**(13.00)**	**(-1.042)**	(3.906)	(-14.65)	(-1.798)	
June 2014	0.0903***	-0.0658***	0.203***	**-0.0126**	18.12***	-75.82***	-49.88	0.154
	(6.107)	(-4.326)	(22.08)	**(-0.278)**	(3.856)	(-12.75)	(-1.535)	
July 2014	0.0505***	-0.0632***	0.163***	**0.0445**	7.251*	-65.99***	13.62	0.196
	(4.030)	(-4.903)	(20.95)	**(1.156)**	(1.822)	(-13.10)	(0.495)	
August 2014	0.0252***	-0.0429***	0.112***	**0.145*** **	1.540	-54.22***	45.10**	0.231
	(2.793)	(-4.618)	(19.91)	**(5.231)**	(0.537)	(-14.94)	(2.276)	
September 2014	0.0202***	-0.0272***	0.0951***	0.197***	3.597**	-32.83***	11.81	0.333
	(3.689)	(-4.814)	(27.91)	(11.86)	(2.065)	(-14.96)	(0.980)	
October 2014	0.00866	-0.0102*	0.0849***	0.187***	-0.157	-25.60***	26.36**	0.293
	(1.585)	(-1.821)	(24.98)	(11.31)	(-0.0901)	(-11.70)	(2.194)	
November 2014	0.0637***	0.212***	0.118***	0.293***	15.62***	-26.42***	-96.22***	0.279
	(5.541)	(17.86)	(16.47)	(8.391)	(4.270)	(-5.734)	(-3.801)	

Notes: T-statistics in parentheses, and significance levels: *, **, and *** represent 10%, 5%, and 1% significance, respectively. Expenditure_pc is instrumented with variables amanharv_pc ausharv_pc boroharv_pc hhsize IMR div2 div3 div4 div5 div6 div7 areaplanted hhmale hheduc tlu tt250k_2010_minute. Coefficients for harvest variables correspond to harvests in the current year, except for the coefficients in bold font, which are drawn from the 2011 year. Administrative division dummy variables were also included as controls in these regressions, but the coefficients are not reported in this table. The total number of observations in all regressions is 5,098.

Source: Authors' estimates from BIHS survey data.
*Using lagged harvest variables from 2011.

Table 7. Seasonal Harvest Effects and Seasonal Total Harvest Amounts, partially lagged regression model, 2013-2014

Month	Aman Harvest Coefficient	Aman Harvest Effect	Boro Harvest Coefficient	Boro Harvest Effect	Aus Harvest Coefficient	Aus Harvest Effect
December 2013	***0.06***	0.72	**0.00**	-0.07	**-0.02**	-0.02
January 2014	*0.10*	1.14	***-0.01***	-0.24	**-0.03**	-0.02
February 2014	*0.09*	1.04	***-0.01***	-0.22	***-0.03***	-0.03
March 2014	*0.08*	0.89	***-0.01***	-0.21	***-0.02***	-0.02
April 2014	*-0.09*	-1.06	***-0.03***	-0.48	***0.03***	0.02
May 2014	0.01	0.12	***0.17***	2.84	**-0.06**	-0.05
June 2014	*-0.07*	-0.75	*0.20*	3.45	**-0.01**	-0.01
July 2014	*-0.06*	-0.72	*0.16*	2.77	**0.04**	0.04
August 2014	*-0.04*	-0.49	*0.11*	1.90	***0.15***	0.12
September 2014	*-0.03*	-0.31	*0.10*	1.62	*0.20*	0.16
October 2014	*-0.01*	-0.12	*0.08*	1.44	*0.19*	0.15
November 2014	*0.21*	2.41	*0.12*	2.01	*0.29*	0.24

Notes: Coefficients significant at the .01 level or higher are in italic and colored font. Coefficients for harvest variables correspond to harvests in the current year, except for the coefficients in bold font, which are drawn from the 2011 year.

Source: Authors' estimates from BIHS survey data.

Table 8. Bangladesh: Estimated Private Sector Stocks, 2010-11

	Net Production	Private Imports	PFDS Net Distribution	Total Change in Supply	Household Consumption	Change in Private Stocks	Total Private Stocks
	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)
November 2010	5.27	---	---	---	---	---	7.05
December 2010	5.27	0.00	0.02	5.29	2.30	2.99	10.05
January 2011	0.00	0.32	0.10	0.41	2.26	(1.84)	8.21
February 2011	0.00	0.36	0.12	0.47	2.24	(1.77)	6.44
March 2011	0.00	0.27	0.32	0.58	2.27	(1.68)	4.75
April 2011	7.53	0.00	0.33	7.87	2.30	5.56	10.32
May 2011	7.53	0.00	0.03	7.56	2.42	5.14	15.46
June 2011	0.00	0.00	-0.11	(0.11)	2.47	(2.58)	12.87
July 2011	0.00	0.00	-0.11	(0.11)	2.45	(2.55)	10.32
August 2011	1.89	0.00	-0.01	1.87	2.47	(0.60)	9.72
September 2011	0.00	0.00	0.03	0.03	2.49	(2.45)	7.27
October 2011	0.00	0.17	0.14	0.31	2.53	(2.22)	5.05
November 2011	5.18	0.07	0.12	5.38	2.59	2.79	7.85
Total	27.41	1.19	0.98	29.57	28.78	0.79	---

Notes: Farmer stocks calculated from Bangladesh Integrated Household Survey (BIHS) data.
Initial stock for end of November 2010 is assumed to equal 0.5 months of annual household consumption plus 50% of the aman harvest.
Assumes 25 percent of aman is harvested in December 2011.

Source: Authors' estimates from BIHS survey data and FPMU data.

Table 9. Bangladesh: Estimated Private Sector Stocks, 2013-14

	Net Production	Private Imports	PFDS Net Distribution	Total Change in Supply	Household Consumption	Change in Private Stocks	Total Private Stocks
	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)
November 2013	5.27	---	---	---	---	---	7.04
December 2013	5.27	0.00	-0.02	5.25	2.34	2.91	9.95
January 2014	0.00	0.03	-0.05	(0.02)	2.34	(2.36)	7.59
February 2014	0.00	0.06	-0.03	0.03	2.34	(2.31)	5.28
March 2014	0.00	0.08	0.00	0.08	2.34	(2.27)	3.01
April 2014	7.70	0.00	0.15	7.85	2.33	5.52	8.53
May 2014	7.70	0.00	0.03	7.73	2.35	5.38	13.91
June 2014	0.00	0.00	-0.19	(0.19)	2.36	(2.54)	11.37
July 2014	0.00	0.00	-0.23	(0.23)	2.36	(2.60)	8.77
August 2014	1.89	0.00	-0.13	1.77	2.37	(0.61)	8.17
September 2014	0.00	0.00	-0.02	(0.02)	2.38	(2.40)	5.77
October 2014	0.00	0.27	0.00	0.26	2.38	(2.11)	3.66
November 2014	5.88	0.03	0.05	5.96	2.42	3.53	7.19
Total Dec 2013 – Nov 2014	28.43	0.48	-0.44	28.47	28.32	0.16	---

Notes: Farmer stocks calculated from Bangladesh Integrated Household Survey (BIHS) data.
Initial stock for end of November 2013 is assumed to equal 0.5 months of annual household consumption plus 50% of the aman harvest.
Assumes 25 percent of aman is harvested in December 2014.

Source: Authors' estimates from BIHS survey data and FPMU data.

Table 10. Bangladesh Household, Trader and Private Rice Stocks by Month, 2010-11

	Rice Farm Households	Non-Rice Farm Households	All Households	Traders / Millers	Total Private Stocks	Public Stocks	Total Stocks
	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)
December 2010	3.51	0.87	4.38	5.67	10.05	0.57	10.62
January 2011	2.64	0.87	3.51	4.69	8.21	0.51	8.71
February 2011	1.95	0.87	2.83	3.61	6.44	0.52	6.96
March 2011	1.55	0.87	2.42	2.34	4.75	0.45	5.20
April 2011	2.97	0.87	3.84	6.48	10.32	0.28	10.60
May 2011	7.58	0.87	8.45	7.01	15.46	0.34	15.80
June 2011	5.76	0.87	6.64	6.24	12.87	0.57	13.44
July 2011	4.60	0.87	5.47	4.85	10.32	0.91	11.23
August 2011	3.67	0.87	4.54	5.18	9.72	1.05	10.77
September 2011	2.95	0.87	3.82	3.45	7.27	1.21	8.47
October 2011	2.29	0.87	3.16	1.89	5.05	1.24	6.30
November 2011	3.94	0.87	4.81	3.03	7.85	1.15	9.00
Average	3.62	0.87	4.49	4.54	9.03	0.73	9.76

Notes: Farmer stocks calculated from Bangladesh Integrated Household Survey (BIHS) data.
Assumes that 25 percent of the November – December aman crop was harvested in December.

Source: Authors' estimates from BIHS survey data and FPMU data.

Table 11. Bangladesh Household, Trader and Private Rice Stocks by Month, 2013-14

	Rice Farm Households	Non-Rice Farm Households	All Households	Traders / Millers	Total Private Stocks	Public Stocks	Total Stocks
	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)
December 2013	3.04	0.80	3.85	6.10	9.95	0.66	10.61
January 2014	2.56	0.80	3.37	4.22	7.59	0.72	8.30
February 2014	1.88	0.80	2.69	2.59	5.28	0.79	6.07
March 2014	1.46	0.80	2.27	0.75	3.01	0.81	3.82
April 2014	4.17	0.80	4.98	3.56	8.53	0.66	9.19
May 2014	7.84	0.80	8.64	5.27	13.91	0.62	14.54
June 2014	6.05	0.80	6.85	4.52	11.37	0.73	12.11
July 2014	4.81	0.80	5.61	3.17	8.77	0.97	9.74
August 2014	3.77	0.80	4.57	3.59	8.17	1.09	9.26
September 2014	2.94	0.80	3.74	2.03	5.77	1.12	6.89
October 2014	2.40	0.80	3.21	0.45	3.66	1.12	4.78
November 2014	5.68	0.80	6.49	0.71	7.19	1.07	8.26
Average	3.89	0.80	4.69	3.08	7.77	0.86	8.63

Notes: Farmer stocks calculated from Bangladesh Integrated Household Survey (BIHS) data.
Assumes that 25 percent of the November – December aman crop was harvested in December.

Source: Authors' estimates from BIHS survey data and FPMU data.

Table 12. Bangladesh Household, Trader and Private Rice Stocks, 2010-11 and 2013-14

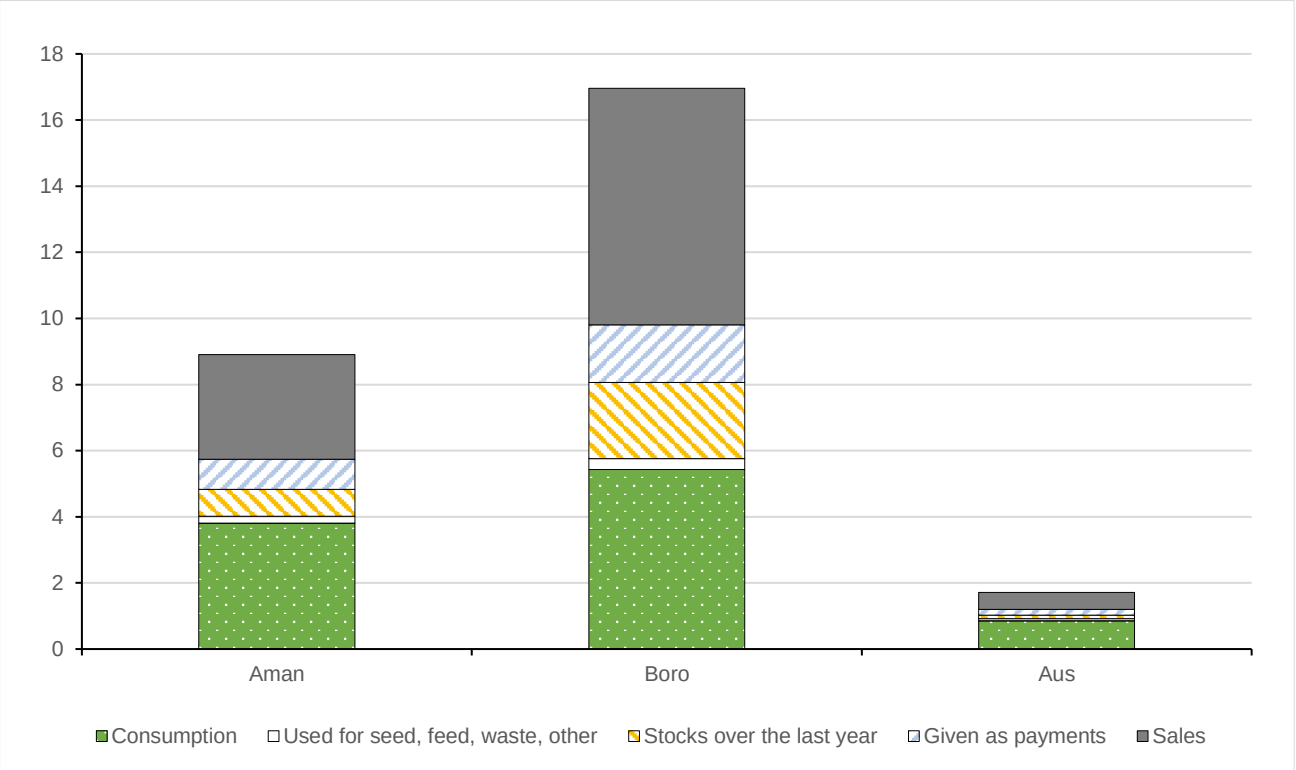
	Rice Farm Households	Non-Rice Farm Households	All Households	Traders / Millers	Total Private Stocks	Public Stocks	Total Stocks
	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)	(mn tons)
2010-11							
Average Stocks	3.62	0.87	4.49	4.54	9.03	0.73	9.76
	(0.37)	(0.09)	(0.46)	(0.46)	(0.92)	(0.08)	(1.00)
Lowest Stocks (March)	1.55	0.87	2.42	2.34	4.75	0.45	5.20
	(0.30)	(0.17)	(0.46)	(0.45)	(0.91)	(0.09)	(1.00)
Peak Stocks (May)	7.58	0.87	8.45	7.01	15.46	0.34	15.80
	(0.48)	(0.06)	(0.53)	(0.44)	(0.98)	(0.02)	(1.00)
Share (Average Stocks) (%)	37.1%	8.9%	46.0%	46.5%	92.5%	7.5%	100.0%
2013-14							
Average Stocks	3.89	0.80	4.69	3.08	7.77	0.86	8.63
	(0.45)	(0.09)	(0.54)	(0.36)	(0.90)	(0.10)	(1.00)
Lowest Stocks (March)	1.46	0.80	2.27	0.75	3.01	0.81	3.82
	(0.38)	(0.21)	(0.59)	(0.20)	(0.79)	(0.21)	(1.00)
Peak Stocks (May)	7.84	0.80	8.64	5.27	13.91	0.62	14.54
	(0.54)	(0.06)	(0.59)	(0.36)	(0.96)	(0.04)	(1.00)
Share (Average Stocks) (%)	45.0%	9.3%	54.3%	35.7%	90.0%	10.0%	100.0%

Notes: Farmer stocks calculated from Bangladesh Integrated Household Survey (BIHS) data. Shares in parentheses.

Source: Authors' estimates from BIHS survey data and FPMU data.

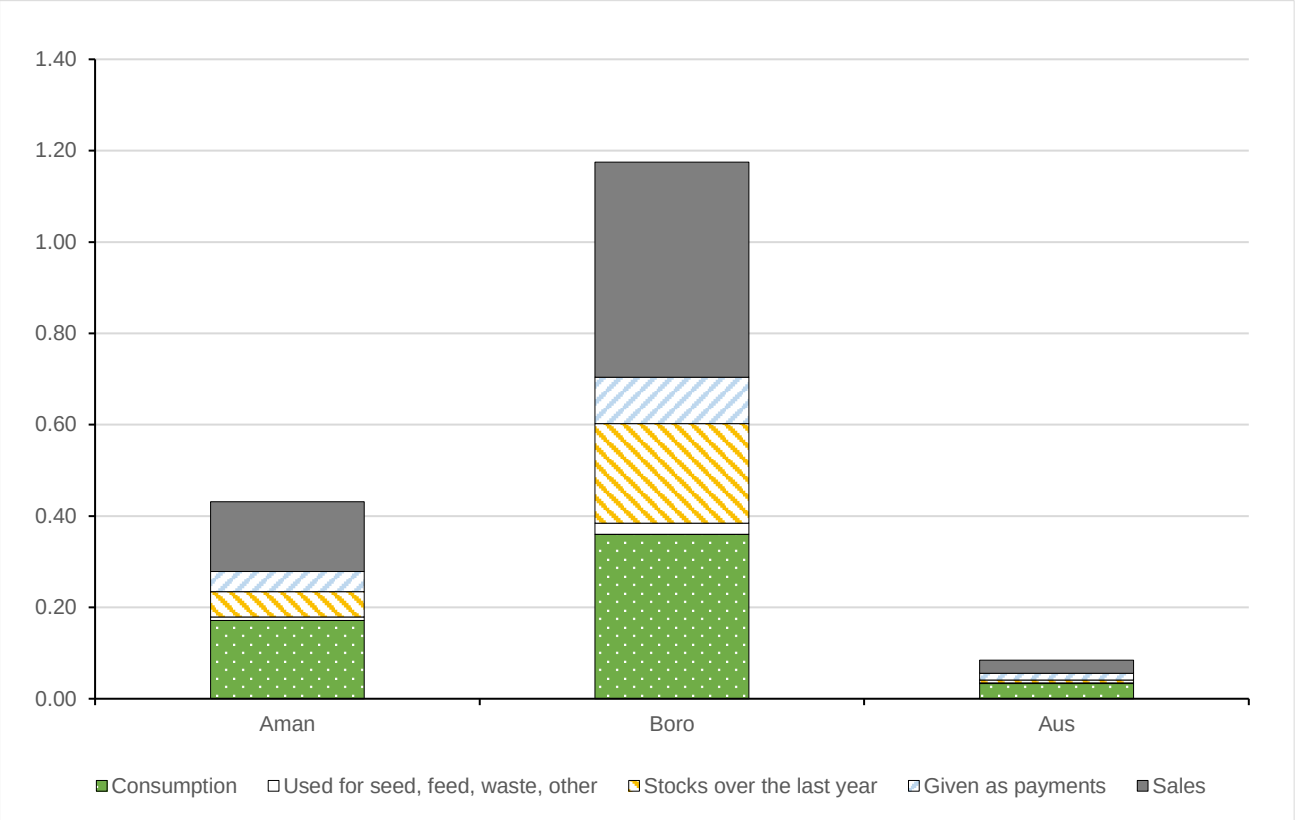
FIGURES

Figure 1. Bangladesh: Production, Sales, Consumption and Stocks, HIES 2010 Survey Estimates among Rural Households



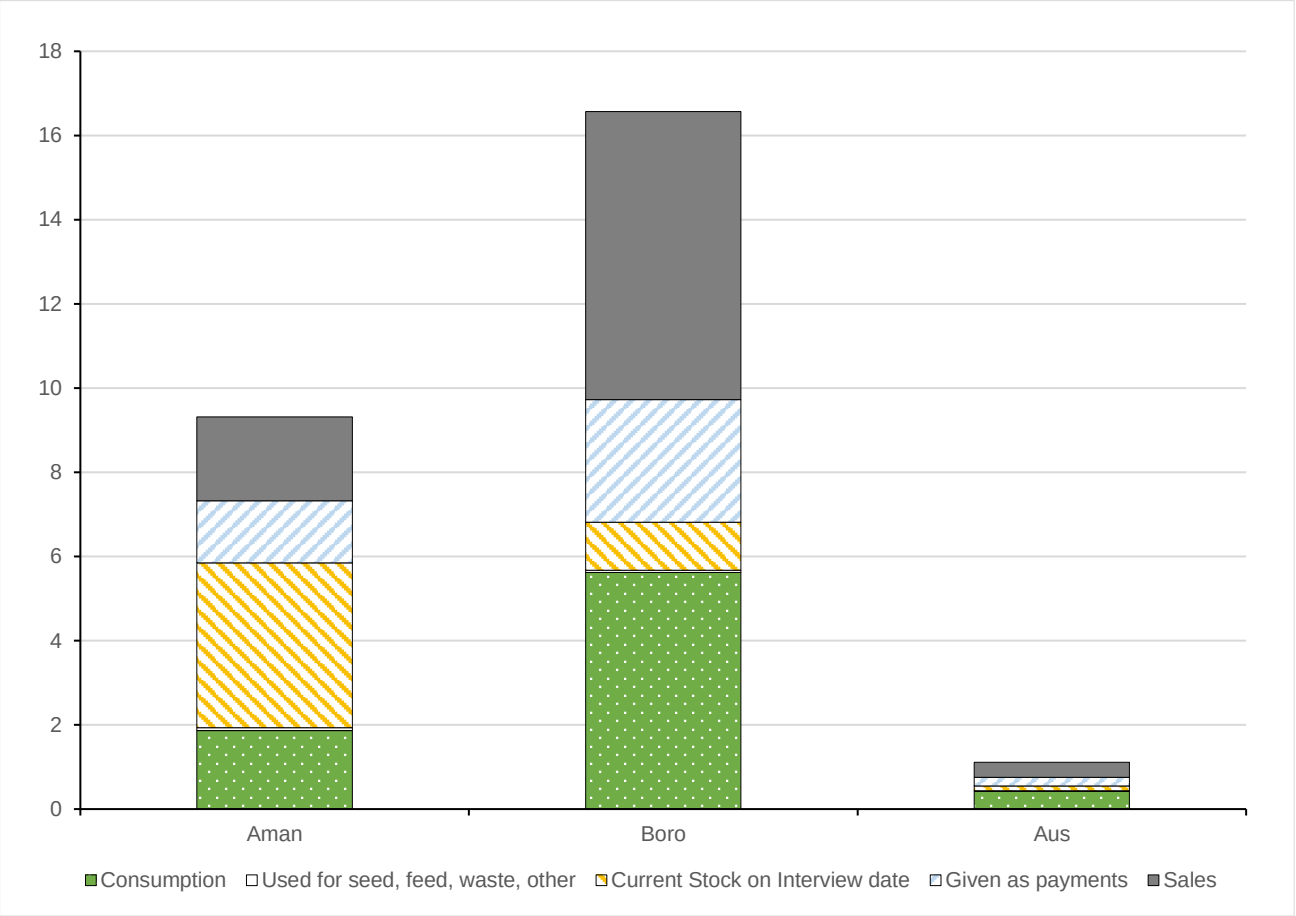
Source: Authors' estimates from HIES survey data. Column height is the total seasonal production.

Figure 2. Bangladesh: Production, Sales, Consumption and Stocks, HIES 2010 Survey Estimates among Urban Households



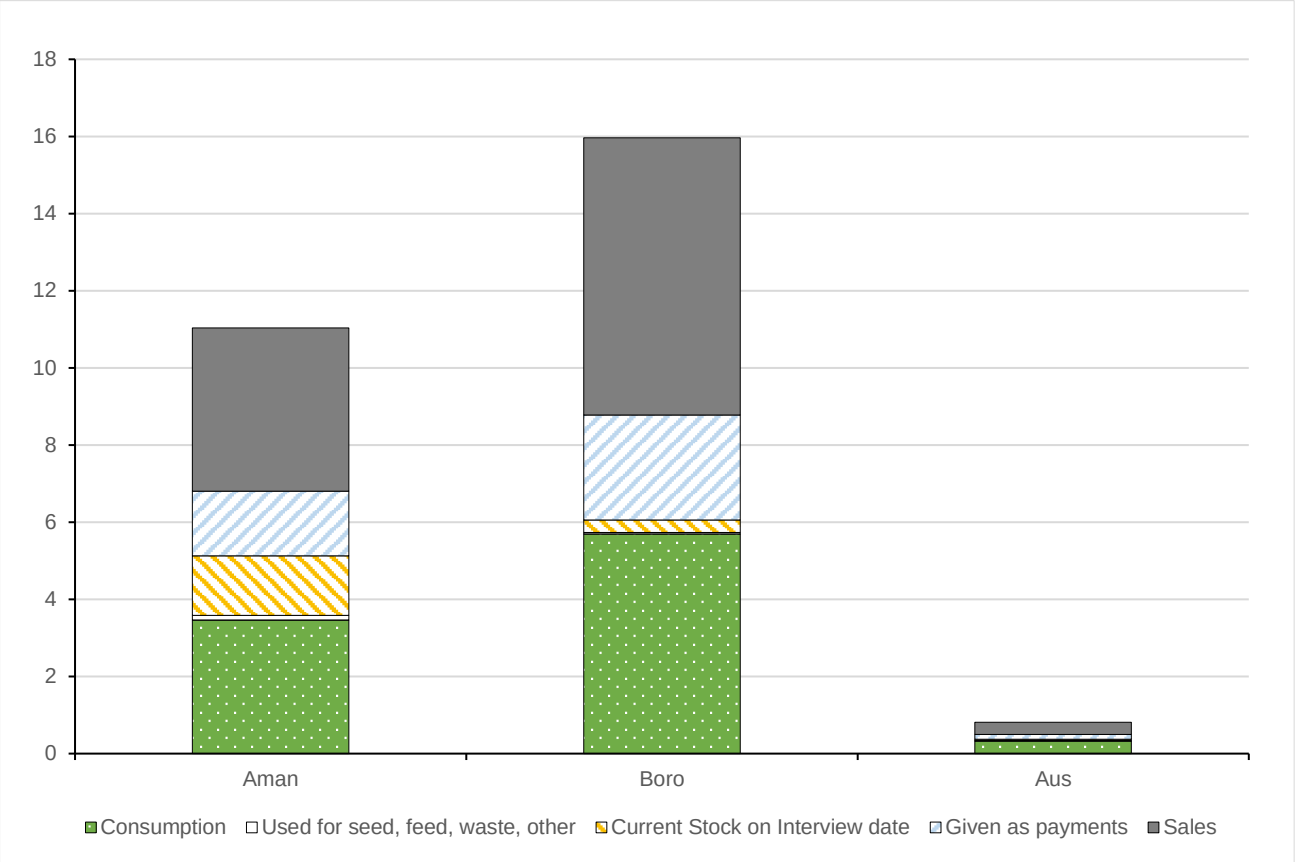
Source: Authors' estimates from HIES survey data. Column height is the total seasonal production.

Figure 3. Bangladesh: Production, Sales, Consumption and Stocks, BIHS 2011 Survey Estimates



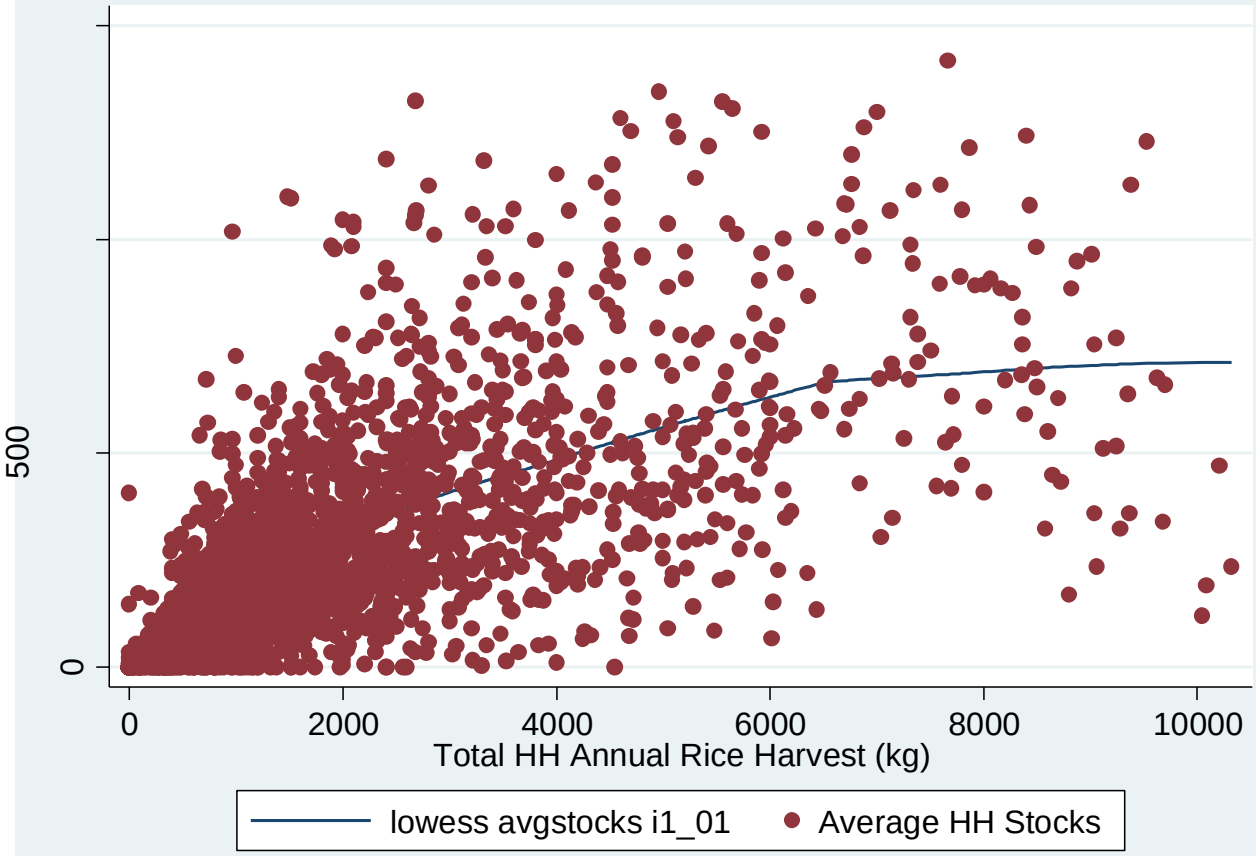
Source: Authors' estimates from BIHS survey data. Column height is the total seasonal production.

Figure 4. Bangladesh: Production, Sales, Consumption and Stocks, BIHS 2014 Survey Estimates



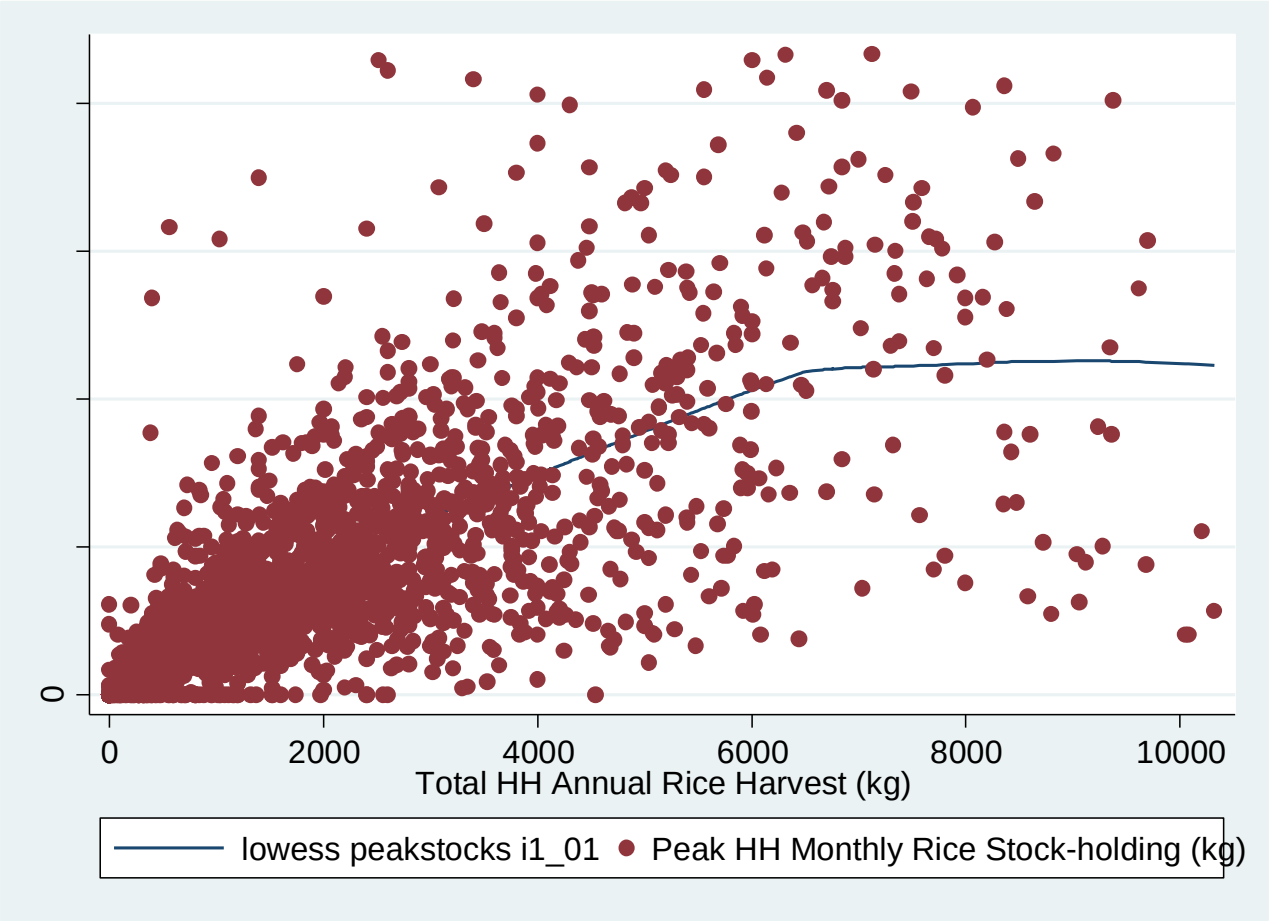
Source: Authors' estimates from BIHS survey data. Column height is the total seasonal production.

Figure 5. Bangladesh: Average Paddy Farmer Total Paddy and Rice Stocks, 2013-14



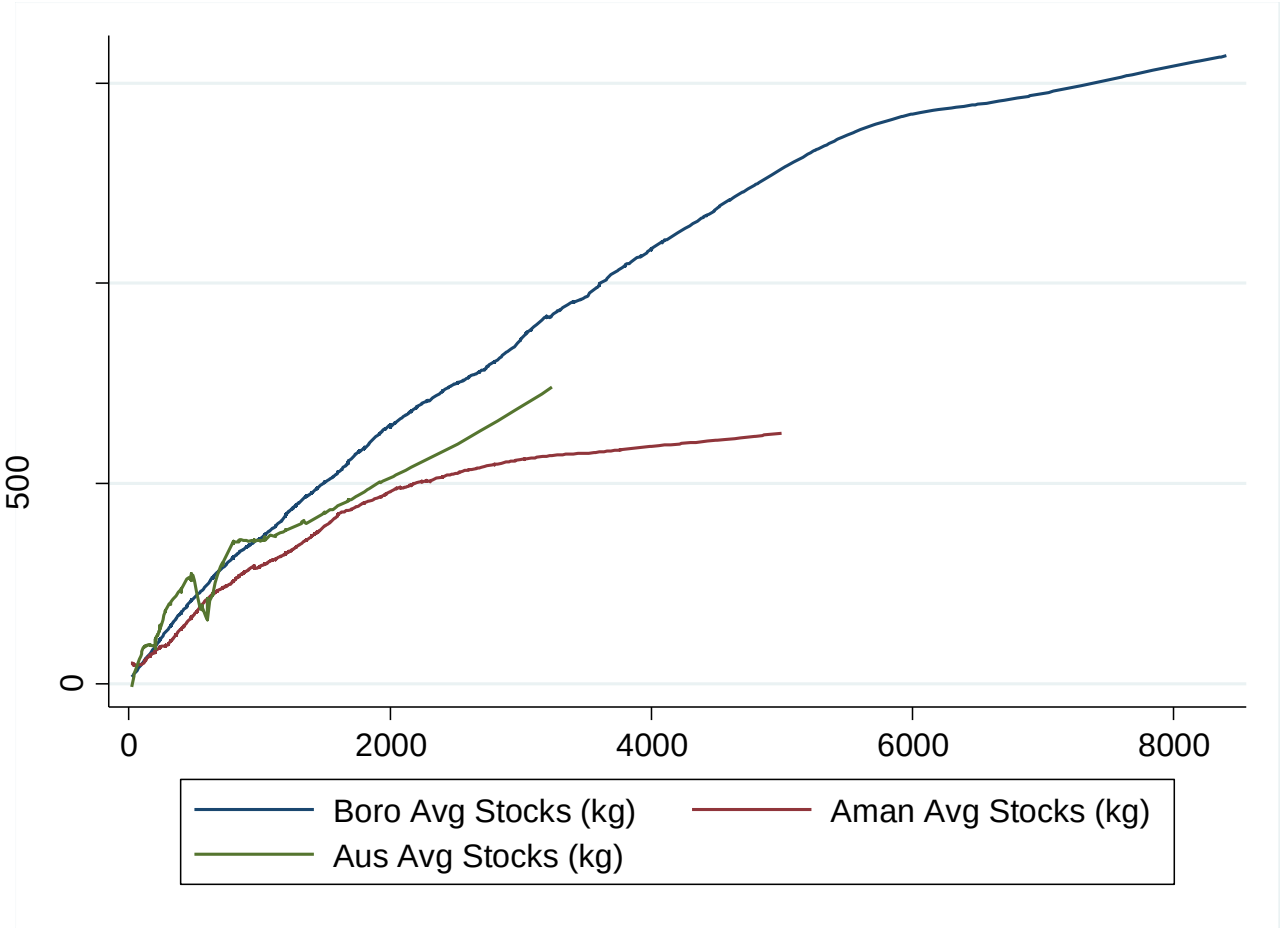
Source: Authors' estimates from BIHS survey data and FPMU data.

Figure 6. Bangladesh: Peak Paddy Farmer Total Paddy and Rice Stocks, 2013-14



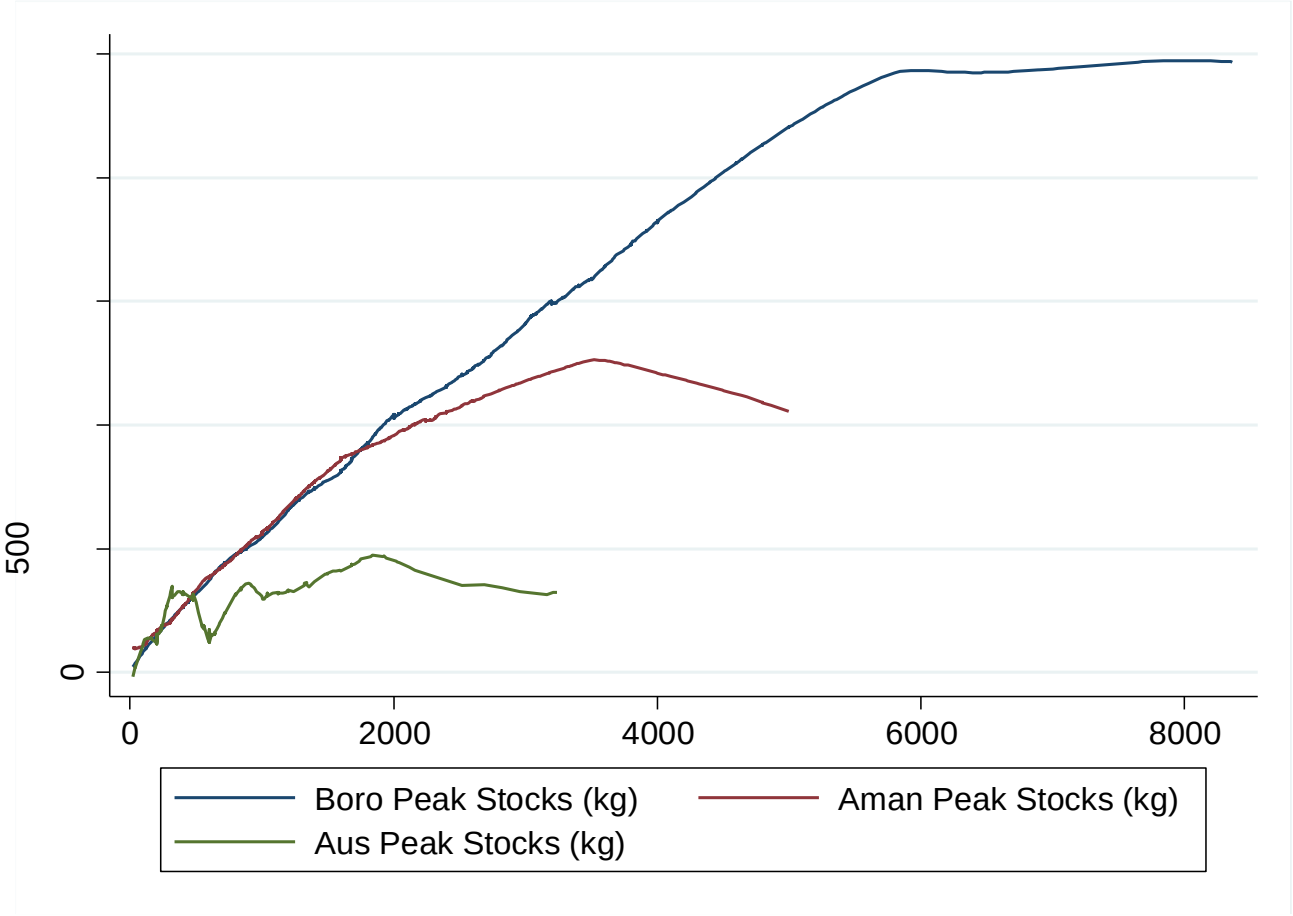
Source: Authors' estimates from BIHS survey data and FPMU data.

Figure 7. Bangladesh: Average Paddy Farmer Total Paddy and Rice Stocks by Season, 2013-14



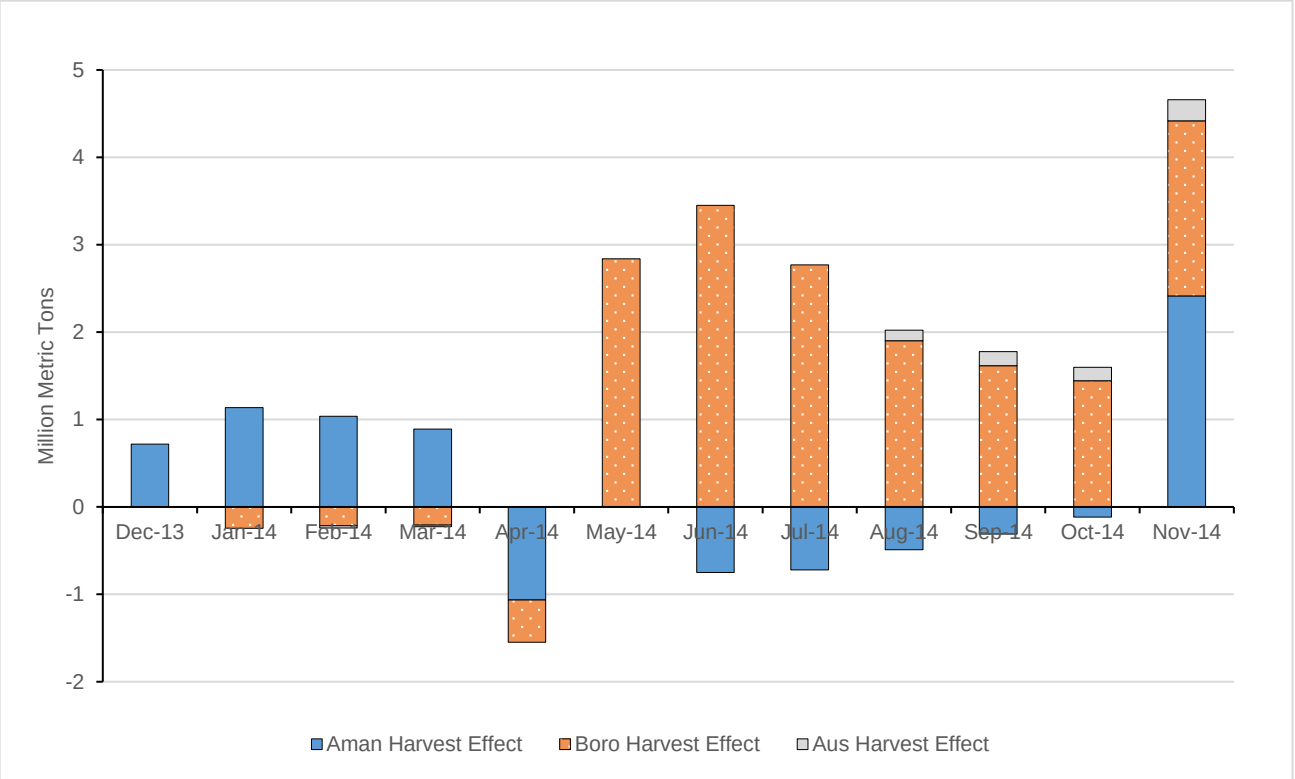
Source: Authors' estimates from BIHS survey data and FPMU data.

Figure 8. Bangladesh: Peak Paddy Farmer Total Paddy and Rice Stocks by Season, 2013-14



Source: Authors' estimates from BIHS survey data and FPMU data.

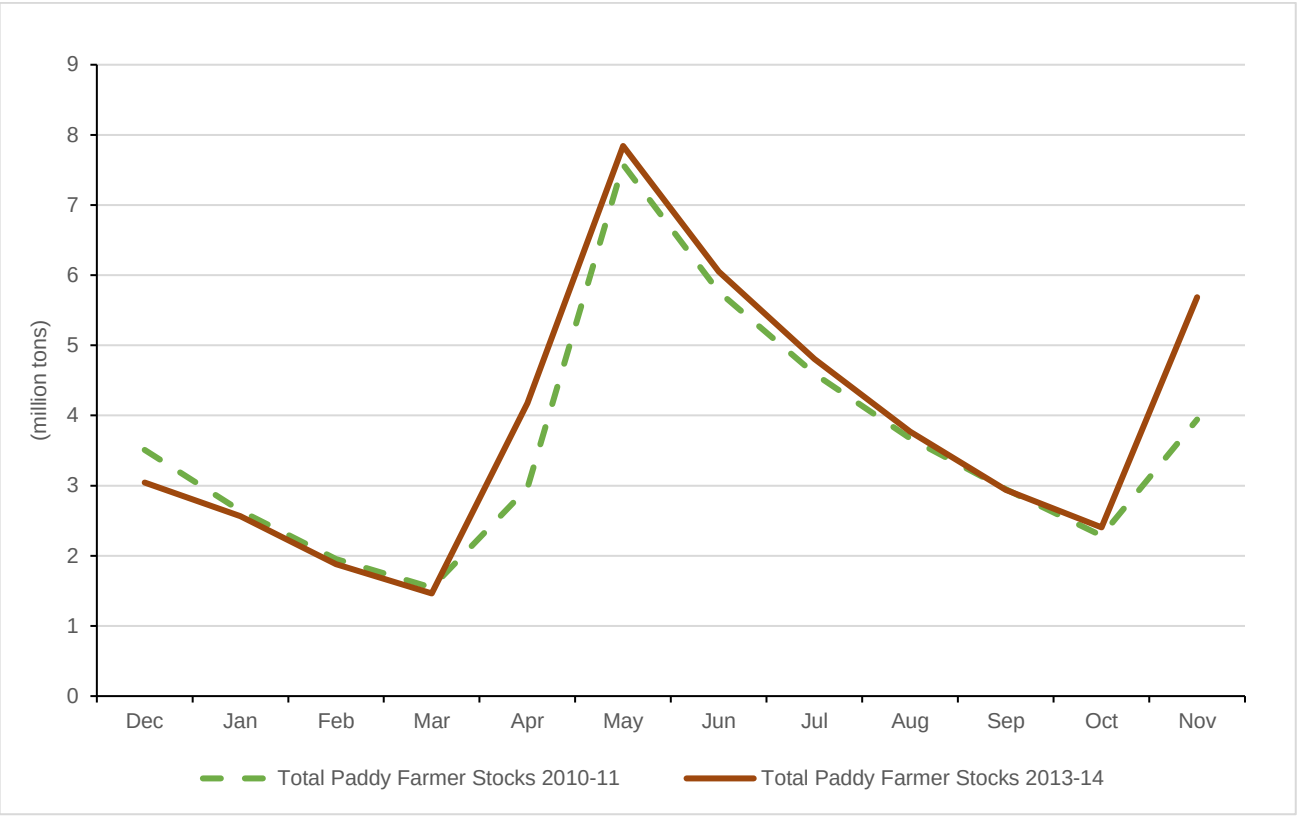
Figure 9. Monthly Per Capita Stocks by Seasonal Harvest effect, partially lagged regression model, scaled to average harvest size (mn MTs), 2013-14



Notes: For each month, the harvest effects corresponding to each season are calculated as the regression coefficients for that season multiplied by the total harvest for that season (as calculated from the survey) in the case that the coefficient is significant at the .01 level or higher.

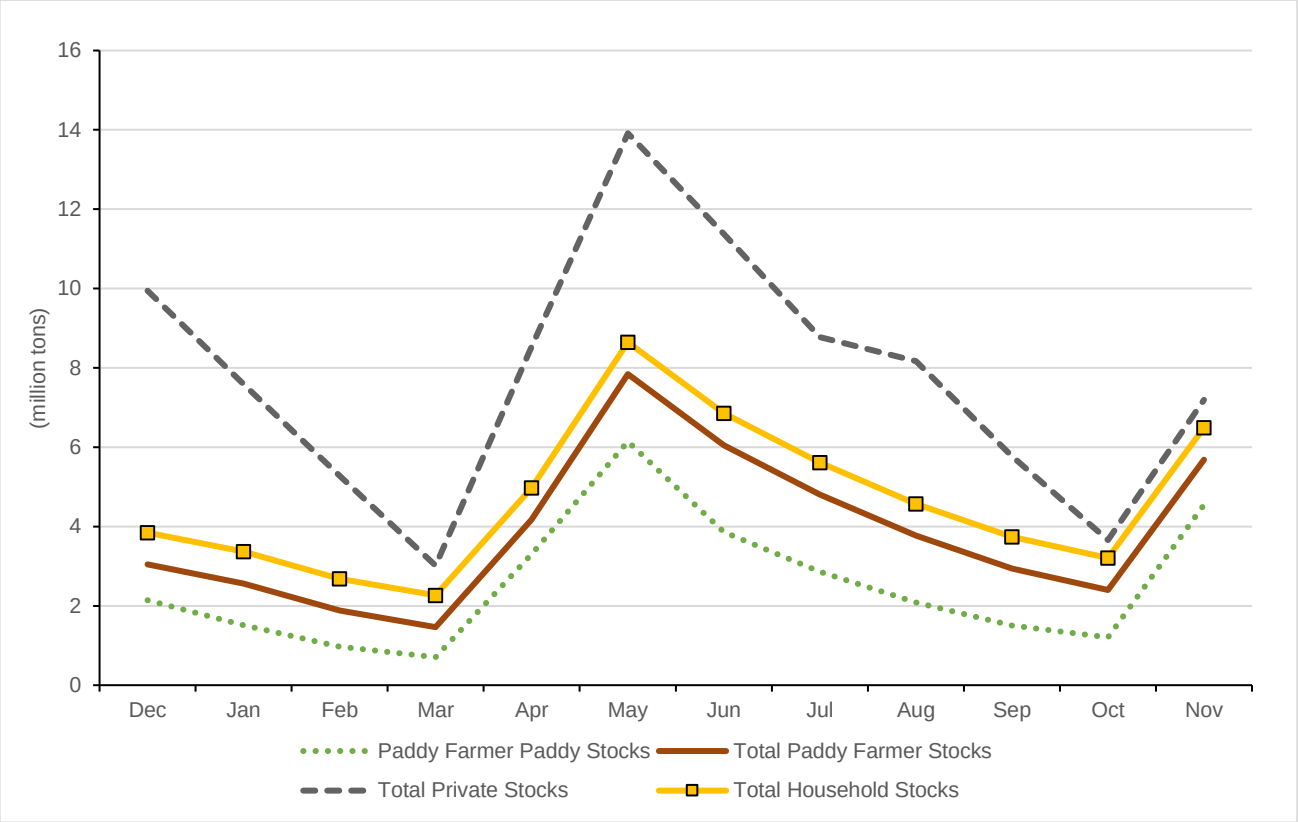
Source: Authors' estimates from BIHS survey data.

Figure 10. Bangladesh: Paddy Farmer Total Paddy and Rice Stocks, 2010-11 and 2013-14



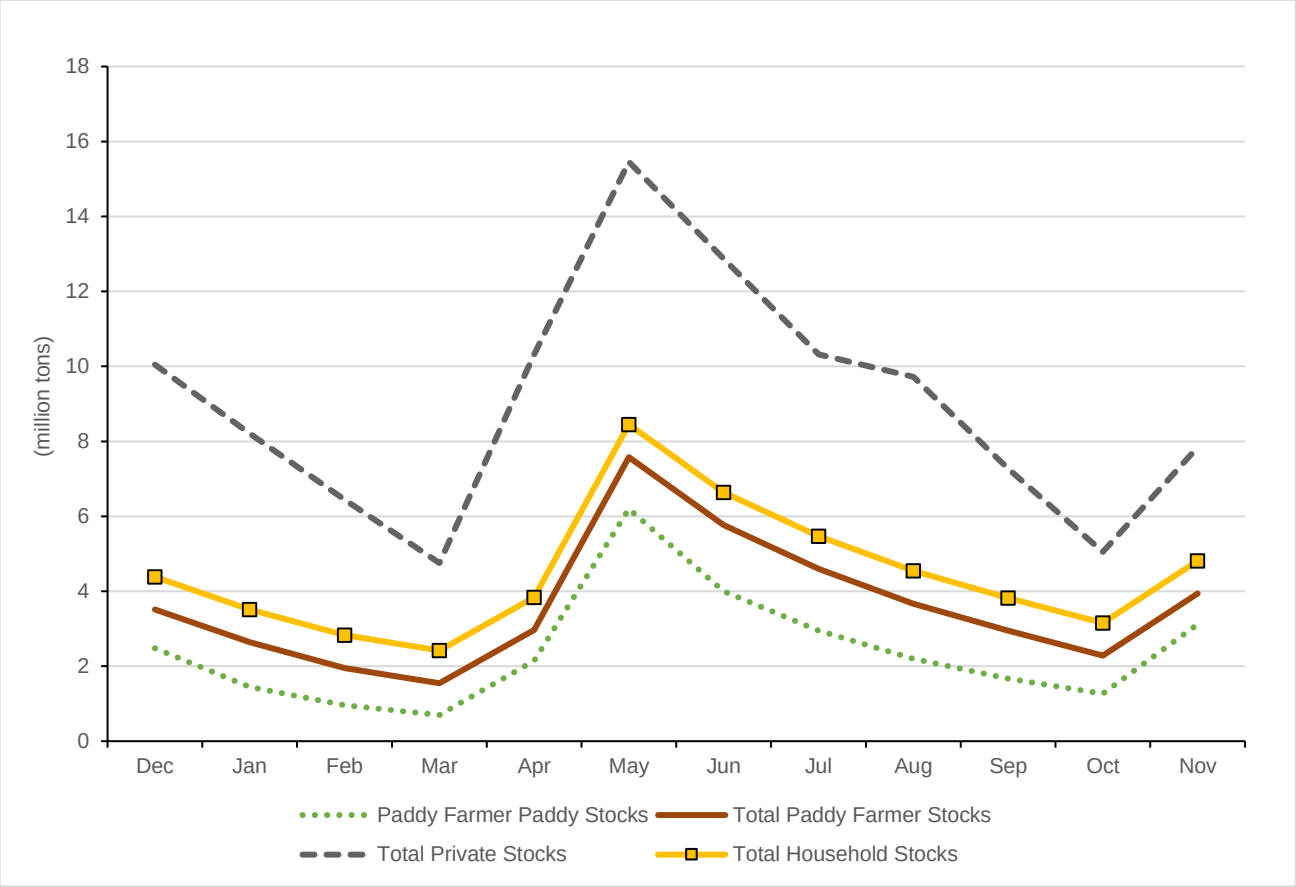
Source: Authors' estimates from BIHS survey data.

Figure 11. Bangladesh Household, Trader and Private Rice Stocks, 2010-11



Source: Authors' estimates from BIHS survey data and FPMU data.

Figure 12. Bangladesh Household, Trader and Private Rice Stocks, 2013-14



Source: Authors' estimates from BIHS survey data and FPMU data.

ANNEX - A. SUPPLEMENTARY TABLES AND FIGURES

Table A.1 Variable Names, Descriptions, Means and Standard Errors, Total Grain Stocks Regressions

2014

Variable Name	Description	Mean	SE
grstr	Average rice and wheat stocks over the past year	159.50	325.50
crpdn	Total household crop production	1,169.16	2,413.93
grstrcp	Grain storage capacity	1,936.13	3,183.49
frvgpdn	Fruit and vegetable production	1,163.01	3,376.17
svgs	Savings	22,752.47	74,812.33
loan	Loans	54,805.40	203,173.1
fdex	Food expenditure	368.13	346.61
flddm	Dummy variable: flood prone area (=1)	0.71	0.46
sxdm	Dummy variable: male household head (= 1)	0.83	0.37

2011

Variable Name	Description	Mean	SE
grstr	Average rice and wheat stocks over the past year	162.00	302.79
crpdn	Total household crop production	2,328.84	4,271.74
grstrcp	Grain storage capacity	1,439.90	3,512.15
frvgpdn	Fruit and vegetable production	1,793.74	4,099.42
svgs	Savings	14,875.36	56,447.63
loan	Loans	33,726.94	97,643.88
fdex	Food expenditure	1,137.82	776.63
flddm	Dummy variable: flood prone area (=1)	0.71	0.45
sxdm	Dummy variable: male household head (= 1)	0.81	0.39

Source: Authors' calculations from BIHS survey data.

Table A.2 Variable Names, Descriptions, Means and Standard Errors, Rice Stocks Regressions

Variable Name	Description	Mean	SE
	Dependent Variables		
stocksdummy	Dummy variable if household holds rice stocks at any point in the past year (=1)	0.52	0.01
	Monthly rice stocks per capita over the previous year, with paddy stocks accounted for in rice equivalents		
dec13stocks_pc	December 2013 household rice stocks per capita	32.43	1.16
jan14stocks_pc	January 2014 household rice stocks per capita	27.08	1.06
feb14stocks_pc	February 2014 household rice stocks per capita	19.99	0.73
mar14stocks_pc	March 2014 household rice stocks per capita	15.68	0.65
apr14stocks_pc	April 2014 household rice stocks per capita	42.71	2.34
may14stocks_pc	May 2014 household rice stocks per capita	83.48	2.98
jun14stocks_pc	June 2014 household rice stocks per capita	64.32	2.37
jul14stocks_pc	July 2014 household rice stocks per capita	50.88	1.99
aug14stocks_pc	August 2014 household rice stocks per capita	39.62	1.43
sep14stocks_pc	September 2014 household rice stocks per capita	30.54	1.03
oct14stocks_pc	October 2014 household rice stocks per capita	25.60	0.99
nov14stocks_pc	November 2014 household rice stocks per capita	62.00	2.22
	Independent Variables		
pcexpenhat	Total household per capita monthly expenditure (Tk), estimated from instrumented variables regression	820.19	6.82
amanharv_pc	Per Capita Harvest in the previous year's aman season (kg)	103.89	2.92
boroharv_pc	Per Capita Harvest in the previous year's boro season (kg)	155.58	4.61
ausharv_pc	Per Capita Harvest in the previous year's aus season (kg)	7.68	0.73
amanharv_pc11	Per Capita Harvest in the 2010-11 year's aman season (kg)	80.24	2.44
boroharv_pc11	Per Capita Harvest in the 2010-11 year's boro season (kg)	150.27	4.31
ausharv_pc11	Per Capita Harvest in the 2010-11 year's aus season (kg)	9.97	0.75
hhsize	Number of Persons in the household	4.09	0.02
IMR	Inverse Mills Ratio from a probit on whether or not the household holds stocks.	0.83	0.01
hhmale	Dummy variable if household head is male (=1)	0.81	0.01
hheduc	Household head education level, from 0=no formal education, to 19=advanced degree of a number of varieties"	4.30	0.06
areaplanted	Maximum area planted (hundredths of acres) with any crop in any season over the past year	52.21	1.34
tt250k_2010_minute	District Average travel time in minutes to nearest city of 250k+,	151.78	1.72
tlu	Livestock units calculated as bullock/cow = 0.65, buffalo = 0.7, pig = 0.25, goat/sheep = .0.1, & chicken/duck/other bird = 0.01	0.66	0.02
	Division dummies, one for Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet. Default = Barisal		
div2	Dummy variable if adminstrative division is Chittagong (=1)	0.17	0.01
div3	Dummy variable if adminstrative division is Dhaka (=1)	0.29	0.01
div4	Dummy variable if adminstrative division is Khulna (=1)	0.12	0.00
div5	Dummy variable if adminstrative division is Rajshahi (=1)	0.15	0.01
div6	Dummy variable if adminstrative division is Rangpur (=1)	0.13	0.00
div7	Dummy variable if adminstrative division is Sylhet (=1)	0.06	0.00

Table A.3 Paddy Farmer Month-specific per capita rice stocks regression results, 2013-14, with current period harvest variables

Month	Expenditure Per capita	Aman harvest Per capita	Boro harvest Per capita	Aus harvest Per capita	HH size	Inverse Mills Ratio	Constant	R-squared
December 2013	0.0126**	0.152***	0.00471	0.0473**	1.740	-26.23***	25.82*	0.280
	(2.052)	(24.04)	(1.230)	(2.537)	(0.890)	(-10.65)	(1.908)	
January 2014	0.0201***	0.103***	-0.0173***	0.0107	3.321*	-32.65***	24.76*	0.189
	(3.445)	(17.24)	(-4.762)	(0.604)	(1.791)	(-13.98)	(1.930)	
February 2014	0.00939**	0.0932***	-0.0146***	0.0195	1.005	-22.41***	25.84***	0.272
	(2.390)	(23.03)	(-5.980)	(1.640)	(0.805)	(-14.25)	(2.991)	
March 2014	0.00733**	0.0806***	-0.0137***	0.00227	0.583	-17.97***	24.24***	0.236
	(2.009)	(21.45)	(-6.023)	(0.205)	(0.503)	(-12.31)	(3.021)	
April 2014	0.0956***	-0.0938***	0.0487***	-0.0370	18.09***	-96.27***	-25.84	-
	(5.547)	(-5.284)	(4.545)	(-0.708)	(3.300)	(-13.94)	(-0.681)	
May 2014	0.0950***	-0.0400**	0.320***	-0.0161	19.74***	-75.49***	-63.35*	0.288
	(5.644)	(-2.310)	(30.61)	(-0.316)	(3.689)	(-11.20)	(-1.711)	
June 2014	0.0926***	-0.0679***	0.204***	0.0484	18.95***	-74.44***	-57.66*	0.146
	(6.229)	(-4.436)	(22.05)	(1.074)	(4.009)	(-12.50)	(-1.763)	
July 2014	0.0518***	-0.0646***	0.164***	0.0847**	7.755*	-65.19***	8.740	0.193
	(4.129)	(-4.998)	(20.97)	(2.226)	(1.943)	(-12.97)	(0.316)	
August 2014	0.0268***	-0.0470***	0.114***	0.308***	2.439	-50.91***	32.88*	0.243
	(2.992)	(-5.098)	(20.43)	(11.36)	(0.856)	(-14.19)	(1.669)	
September 2014	0.0202***	-0.0272***	0.0951***	0.197***	3.597**	-32.83***	11.81	0.333
	(3.689)	(-4.814)	(27.91)	(11.86)	(2.065)	(-14.96)	(0.980)	
October 2014	0.00866	-0.0102*	0.0849***	0.187***	-0.157	-25.60***	26.36**	0.293
	(1.585)	(-1.821)	(24.98)	(11.31)	(-0.0901)	(-11.70)	(2.194)	
November 2014	0.0637***	0.212***	0.118***	0.293***	15.62***	-26.42***	-96.22***	0.279
	(5.541)	(17.86)	(16.47)	(8.391)	(4.270)	(-5.734)	(-3.801)	

Notes: T-statistics in parentheses, and significance levels: *, **, and *** represent 10%, 5%, and 1% significance, respectively. Expenditure_pc is predicted as a function of areaplanted, hhmale, hheduc, tlu, and tt250k_2010_minute. Administrative division dummy variables were also included as controls in these regressions, but the coefficients are not reported in this table. The total number of observations in all regressions is 5,098.

Source: Authors' estimates from BIHS survey data.

Table A.4 Paddy Farmer Month-specific per capita rice stocks regression results, 2013-14, with all lagged harvest variables

Month	Expenditure Per capita	Aman '11 harvest Per capita	Boro '11 harvest Per capita	Aus '11 harvest Per capita	HH size	Inverse Mills Ratio	Constant	R-squared
December 2013	0.0201***	0.0633***	-0.00420	-0.0206	0.699	-49.70***	62.24***	0.169
	(3.083)	(7.792)	(-0.926)	(-1.018)	(0.335)	(-18.63)	(4.326)	
January 2014	0.0281***	0.0827***	-0.0243***	-0.0173	4.388**	-40.97***	29.27**	0.112
	(4.675)	(11.04)	(-5.807)	(-0.924)	(2.283)	(-16.65)	(2.205)	
February 2014	0.0132***	0.0736***	-0.0211***	-0.0226*	0.846	-30.96***	38.64***	0.202
	(3.271)	(14.57)	(-7.480)	(-1.796)	(0.653)	(-18.66)	(4.318)	
March 2014	0.00986***	0.0692***	-0.0202***	-0.0126	0.324	-24.33***	34.48***	0.185
	(2.661)	(14.96)	(-7.818)	(-1.094)	(0.273)	(-16.01)	(4.208)	
April 2014	0.140***	-0.176***	-0.0125	0.0331	29.05***	-120.5***	-80.37**	-
	(7.594)	(-7.641)	(-0.972)	(0.577)	(4.922)	(-15.95)	(-1.972)	
May 2014	0.145***	-0.0760***	0.172***	-0.0447	28.70***	-125.3***	-96.35**	0.034
	(7.540)	(-3.159)	(12.77)	(-0.744)	(4.648)	(-15.85)	(-2.259)	
June 2014	0.134***	-0.0913***	0.0977***	-0.0347	27.44***	-108.8***	-94.77**	-
	(8.060)	(-4.391)	(8.417)	(-0.669)	(5.143)	(-15.92)	(-2.572)	
July 2014	0.0787***	-0.0802***	0.0769***	0.0217	12.56***	-93.22***	-7.592	0.043
	(5.849)	(-4.777)	(8.210)	(0.519)	(2.916)	(-16.91)	(-0.255)	
August 2014	0.0414***	-0.0647***	0.0544***	0.129***	4.044	-74.54***	40.19*	0.136
	(4.389)	(-5.498)	(8.290)	(4.410)	(1.341)	(-19.30)	(1.929)	
September 2014	0.0299***	-0.0274***	0.0468***	0.0885***	4.494**	-49.44***	16.71	0.186
	(5.019)	(-3.684)	(11.28)	(4.767)	(2.356)	(-20.25)	(1.269)	
October 2014	0.0162***	-0.0245***	0.0474***	0.0255	-0.0412	-43.08***	40.09***	0.193
	(2.817)	(-3.417)	(11.84)	(1.428)	(-0.0224)	(-18.29)	(3.157)	
November 2014	0.0915***	0.0686***	0.0739***	0.205***	17.74***	-70.63***	-63.57**	0.080
	(7.150)	(4.294)	(8.295)	(5.140)	(4.331)	(-13.47)	(-2.247)	

Notes: T-statistics in parentheses, and significance levels: *, **, and *** represent 10%, 5%, and 1% significance, respectively. Expenditure_pc is instrumented with variables amanharv_pc ausharv_pc boroharv_pc hhsize IMR div2 div3 div4 div5 div6 div7 areaplanted hhmale hheduc tlu tt250k_2010_minute. Administrative division dummy variables were also included as controls in these regressions, but the coefficients are not reported in this table. The total number of observations in all regressions is 5,098.

Source: Authors' estimates from BIHS survey data.

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