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IN-KIND TRANSFERS AND HOUSEHOLD FOOD CONSUMPTION: IMPLICATIONS FOR TARGETED FOOD PROGRAMS IN BANGLADESH

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ABSTRACT

This paper examines the impact of wheat transfers and cash incomes on wheat consumption and wheat markets. Using propensity score-matching techniques, the total marginal propensity to consume (MPC) for wheat is, on average, 0.33, ranging from essentially zero for Food For Work (a program with large transfers) to 0.51 for Food For Education. Econometric estimates indicate that the MPC for small wheat transfers to poor households is approximately 0.25, while the MPC for wheat out of cash income is near zero. This increase in demand for wheat reduces the potential price effect of three major targeted programs involving small rations (Food For Education, Vulnerable Group Development, and Vulnerable Group Feeding) by about one-third.

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1. INTRODUCTION

In the ongoing debate on the merits of food and cash transfers, one key factor is the extent to which food transfers have a greater positive impact on food consumption than do cash transfers of an equal monetary value.[1] In other words, to what extent is the marginal propensity to consume food greater for in-kind transfers than for cash transfers? The magnitude of this effect is important, because food transfer programs incur high costs in handling and transportation, thus making them less efficient in terms of the cost incurred per unit value of food or cash delivered to the target household.[2] Moreover, if food transfers do not lead to significant increases in consumption, then market prices of food are more likely to be depressed by the increase in supply, to the detriment of local producers.

Traditional neoclassical theory suggests that the size of the transfer matters in determining its effect on consumption. If the in-kind transfer is less than the amount of the food the household would normally purchase, then it simply replaces cash purchases and thus has the same effect as an income transfer.[3] If there are significant transaction

[1] Numerous econometric analyses of household consumption data (e.g., Devaney and Fraker 1989; Senauer and Young 1986), as well as experimental evidence (Fraker, Martini, and Ohls 1995), have demonstrated empirically that the marginal propensity to consume food out of in-kind transfers (in the form of commodities or food stamps) is higher than the marginal propensity to consume out of cash income.

[2] The efficiency of cash transfers may not be greater than the efficiency of food transfers if leakages from cash transfers are significantly larger than leakages from food transfers. Leakages from Food For Work programs in Bangladesh are estimated at about 30 percent (Hossain and Akash 1993; WGTFI 1994; del Ninno 2000).

[3] An in-kind transfer that is less than the size of consumption without the transfer is termed an infra-marginal transfer. See Southworth (1945) and Senauer and Young (1986).

costs of reselling food, however, a large in-kind transfer might result in more food consumed than a cash transfer of equal value.

The modern theory of the household suggests that *who* receives or controls the transfer is also important. For example, transfers-in-kind received by female members of the household might result in higher levels of household food consumption than do cash transfers, particularly if cash transfers are controlled by male members of the household (Haddad, Hoddinott, and Alderman 1997). Thus, the characteristics of program participants may influence household consumption behavior.

This paper uses data from a 1998/99 survey of rural households in Bangladesh to econometrically estimate marginal propensities to consume (MPCs) out of wheat transfers in several distribution programs. The resulting MPCs are then used to calculate the potential impacts of these programs on household wheat consumption and wheat market prices.[4]

Section 2 provides a brief description of various in-kind distribution programs in Bangladesh. Section 3 contains a description of the survey design, and data on household characteristics, types and quantities of transfers received, and consumption and sales out of transfers. Section 4 presents empirical estimates of the marginal propensity to consume wheat out of in-kind transfers, using two alternative methodologies: propensity-score matching of consumption of program participants and a "similar" group of nonparticipants, and direct econometric estimates of Engel functions. Section 5 examines

[4] Earlier analysis by Dorosh and Haggblade (1995) used an assumed MPC for wheat transfers based on data on wheat consumption by Food For Work participants; this paper extends that analysis by using econometrically estimated measures of marginal propensities to consumer that vary by program.

the implications of the results for wheat demand and market prices in Bangladesh. Finally, Section 6 presents policy implications and conclusions.

2. FOODGRAIN DISTRIBUTION PROGRAMS IN BANGLADESH

Table 1 shows distribution of foodgrain through the Public Foodgrain Distribution System (PFDS) in 1998/99, a year marked by widespread floods from July through September 1998. During the fiscal year, 2.13 million tons of foodgrain were distributed: 0.53 million tons of rice and 1.60 million tons of wheat. Eighty-eight percent of the

Table 1—Foodgrain distribution by channels, budget and actual 1998/99 (thousand tons)

	Budget 1998/99			Actual 1998/99		
	Rice	Wheat	Total	Rice	Wheat	Total
Priced Channels						
Essential Priorities (EP)	124	85	209	127	85	212
Open Market Sales (OMS)	200	0	200	2	0	2
Fair Price Campaign (FPC)	0	0	0	9	5	14
Other Priority (OP)	6	6	12	7	5	12
Large Employee Industries (LEI)	0	15	15	0	14	14
Non-Priced Channels						
Food For Work (FFW)	125	400	525	8	690	698
Vulnerable Group Development (VGD)	60	120	180	11	193	204
Food For Education (FFE)	150	200	350	60	227	287
Test Relief (TR)	40	16	56	37	53	90
Vulnerable Group Feeding (VGF)	20	10	30	167	297	464
Gratuitous Relief (GR)	66	24	90	66	8	74
Others	22	29	51	37	24	61
Total	813	905	1,718	530	1,603	2,133

Source: FPMU, Ministry of Food.

foodgrain was distributed through programs targeted to poor households or those in need of emergency relief. The remaining 255 thousand tons was sold at subsidized prices to select groups, including the military, or to the poor through Open Market Sales and Fair Price Shops.[5]

Substantial food aid inflows in response to the flood situation enabled a large increase in public distribution of wheat from an originally planned 905 thousand tons to an eventual 1.603 million tons for the July 1998–June 1999 fiscal year. Food For Work (FFW) was the largest distribution channel, though this program operates mainly from January through May when drier soil conditions permit heavy earthwork. Case studies from five FFW sites in 1998 found that in three of the sites, workers were paid in cash rather than foodgrain (del Ninno 2000). Similarly, a survey done to collect data on work norms for FFW (WFP 1997) found that 50 percent of the workers received payments in cash instead of in kind. The second largest program, Food For Education (FFE), a program targeted to elementary school-aged children in poor households, in principle operates nearly year round, though almost no distribution took place from July through December 1998, as FFE was postponed until December 1998 to conserve foodgrain stocks for distribution to flood-affected households.[6]

The major channels for government food relief efforts following the flood were Gratuitous Relief (GR), designed to provide emergency relief to disaster victims, and

[5] The Open Market Sales distribution channel involves subsidized sales of small amounts of grain (about 3 kilograms) to individuals. A measure of targeting is achieved because prospective buyers must wait in line in order to buy the subsidized grain.

[6] The other major targeted program, Vulnerable Group Development (VGD), targets poor women, providing training and a food transfer.

Vulnerable Group Feeding (VGF), aimed at assisting households over a longer period (ultimately, from September 1998 through April 1999). Immediate short-term relief through GR was targeted by location. In contrast, the VGF program included all areas of the country (both flooded and nonaffected areas), and was administratively targeted to poor households through selection by local committees (del Ninno et al. 2001). The size of these programs was limited, however, both by available wheat stocks (up through early November when government commercial imports and food aid arrivals added to government stocks) and the financial cost of the programs (covered to a large extent by food aid).[7]

In the initial budget for 1998/99, VGF was only a small program, but it was rapidly expanded in August 1998 with an initial distribution of 1.3 million cards that entitled the holder to 8 kilograms of rice per month. During August and September, a total of 28,500 tons of rice were distributed through this program. At 8 kilograms per card, an estimated 1.35 and 2.13 million households received VGF rations in August and September, respectively. Almost no wheat was distributed through relief channels in the initial months of the flood. At the urging of the World Food Program (WFP), the Government of Bangladesh expanded the VGF program to 4 million cards with an allotment of 16 kilograms of grain per card, half rice and half wheat in October, and all wheat thereafter.

[7] See del Ninno et al. (2001) for further details on Government of Bangladesh foodgrain distribution in 1998/99.

3. UTILIZATION OF IN-CASH AND IN-KIND TRANSFERS: SURVEY EVIDENCE

The data on household characteristics, expenditures, and transfers are taken from a multi-round survey of 757 households in seven flood-affected *thanas*.[8] The first round was conducted from 28 November to 23 December 1998, shortly after the massive floods that inundated much of Bangladesh (July–September 1998). The second round was conducted from 26 April to 22 May 1999.

In the immediate post-flood period until the end of November, more than half of the people in the sample had received small transfers of rice. In fact, average rice transfers were twice the value of wheat transfers (280 taka per household versus 165 taka per household). GR (47.9 percent) and VGF (43.0 percent) accounted for 90.9 percent of the transfers recorded in the survey. VGF distribution to sample households generally included both rice and wheat; GR was mainly rice, though some of the households receiving GR received some wheat and cash. Overall foodgrain distribution, and especially wheat distribution, was constrained at this time by a shortage of public stocks and uncertainties about food aid deliveries (see del Ninno et al. 2001).

Our analysis focuses, however, on the period after December 1998, when the scope of public distribution of foodgrain had greatly expanded, and the value of wheat

[8] The seven flood-affected *thanas*, representing all six divisions of the country, were selected according to three criteria: the severity of flood as determined by the Water Board, the percentage of poor people in the district in which the *thana* is located, and the inclusion in other studies. Households were randomly selected using multiple stages probability sampling technique (with the exception of one *thana*). First, three unions per *thana* were randomly selected, then six villages were randomly selected from each union with PPS, then two clusters (*paras*) were randomly selected per village. Finally, three households were randomly selected in each cluster. As a result, we selected approximately six households per village, 36 per union, 108 per *thana* for a final sample size of 757 households in 126 villages (see del Ninno et al. (2001) for a more detailed description of the sampling frame).

distribution was much greater than the value of rice distribution. Thus, in the data collected in April 1999, 267 out of the 295 households that received transfers received at least some of those transfers in wheat (Table 2). In April 1999, as in the previous period, households receiving transfers were, on average, poorer than households not receiving transfers, as measured by per capita expenditures. In particular, calorie consumption and per capita expenditure of households receiving transfers were 93 and 85 percent of those of nonreceiving households.

Table 2—Characteristics of households receiving transfers, January to April 1999

	Receiving		Nonreceiving		All
	Number	Average	Number	Average	Average
Cash (taka per household)	50	272	698	-	18
Wheat (taka per household)	267	493	481	-	176
Rice (taka per household)	192	203	556	-	52
All (taka per household)	295	625	453	-	247
Household size	295	5.31		5.42	5.38
Per capita monthly expenditure (taka)	295	597		738	683
Per capita daily calorie consumption	295	2,415		2,586	2,518
Number of households		295		453	748

Source: FMRSP-IFPRI Bangladesh Flood Impact Survey, 1998–1999.

Most households in the sample received wheat transfers mainly through VGF and FFE. Nearly all VGF participants received both rice and wheat transfers, though the wheat transfers were, on average, nearly twice the value of the rice transfers. Sixty-six households, 8.9 percent of the total sample, received FFE transfers, almost exclusively in the form of wheat (Table 3).

In both rounds, the average value of transfers received was greater for poor than for nonpoor households. Nevertheless, del Ninno and Dorosh (2001) have shown that the percentage of households receiving GR in the period immediately after the 1998 flood was more evenly distributed across expenditure quintiles, though the degree of exposure to the flood was a major determinant of participation in GR.

In the period under consideration, January–May 1999, 54.6 percent of households in the lowest expenditure quintile (the poorest 20 percent of the households) received transfers, while only 39.8 percent of the households in the top quintile received transfers (Table 4). VGF transfers were well-targeted to poorer households; 33.6 percent of the households in the lowest expenditure quintile received VGF in the first round, compared with 11.8 percent in the top expenditure quintile. FFE appears to have been well-targeted to the bottom 60 percent of the expenditure distribution in round 2, though the share of households participating in the first quintile (11.2 percent) is very similar to that in the third quintile (10.6 percent).

As shown in Table 5, the average amount of wheat consumption per capita per day and the share of calories from wheat were all significantly larger for households receiving transfers, compared to households that did not receive transfers. Average per capita wheat consumption of households receiving transfers rose dramatically, in part because of the larger number of households receiving wheat transfers after January 1999. Among those receiving rice, wheat, or cash transfers, the percentage of households consuming wheat was 79.3 percent; the average amount of per capita daily quantity of

Table 3—Value of transfers of rice, cash, and wheat, by type, round, and period for receiving households, January to April 1999

Program	January to May 1999								January-April		April-May	
	Wheat		Rice		Cash		All		All		All	
	Number	Value (Tk)	Number	Value (Tk)	Number	Value (Tk)	Number	Value (Tk)	Number	Value (Tk)	Number	Value (Tk)
FFE	63	328	1	375	4	73	66	323	65	306	6	243
Stipends							21	111	15	43	8	211
GR	5	237	4	106	21	111	15	167	13	151	2	270
TR	1	2,205	2	745	8	111	3	1,281	3	1,230	1	155
VGF	182	358	182	187	1	150	183	544	183	427	129	167
VGD	20	593	2	152	8	46	20	609	19	512	13	188
FFW	17	1,804	1	2,271	3	840	18	1,970	14	2,314	7	438
Other NG Assist.	1	75	1	20	6	1,183	7	1,027	7	834	3	450
Total	267	494	192	203	50	273	295	625	287	530	163	198

Source: FMRSP-IFPRI Bangladesh Flood Impact Survey, 1998–1999.

Notes: FFE = Food For Education; GR = Gratuitous Relief; TR = Test Relief; VGF = Vulnerable Group Feeding; VGD = Vulnerable Group Development; FFW = .Food For Work.

Table 4—Percentages of households receiving transfers, by type and quintiles, January to April 1999

Program	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5		Total	
	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount
FFE	11.2	369	14.6	284	10.6	324	4.0	354	3.3	298	8.8	323
Stipends	-	-	2.6	191	2.0	111	2.6	53	6.6	101	2.8	111
GR	2.0	369	2.0	117	1.3	28	3.3	66	1.3	326	2.0	167
TR	0.7	438	0.7	150	0.7	3,256	-	-	-	-	0.4	1,281
VGF	33.6	520	27.2	544	27.8	544	20.5	599	11.8	521	24.5	544
VGD	6.6	725	2.6	409	2.0	486	2.0	611	-	-	2.7	609
FFW	3.9	1,461	3.3	2,779	1.3	3,754	1.3	235	2.0	1,609	2.4	1,970
Other NG Assist.	-	-	2.6	781	2.0	1,355	-	-	-	-	0.9	1,027
Total	54.6	607	48.3	664	41.1	721	27.2	574	23.7	482	39.5	625
Number of households	152		151		151		151		152		747	

Source: FMRSP-IFPRI Bangladesh Flood Impact Survey, 1998–1999.

Notes: FFE = Food For Education; GR = Gratuitous Relief; TR = Test Relief; VGF = Vulnerable Group Feeding; VGD = Vulnerable Group Development; FFW = Food For Work.

Table 5—Households consuming food commodities, average food budget share, and calorie shares, by receiving households, January to April 1999

	Receiving transfer				Not receiving transfer				All			
Food group	**Consuming households (%)**	**Average amount (gm/pc/day)**	**Budget share (%)**	**Calorie share (%)**	**Consuming households (%)**	**Average amount (gm/pc/day)**	**Budget share (%)**	**Calorie share (%)**	**Consuming households (%)**	**Average amount (gm/pc/day)**	**Budget share (%)**	**Calorie share (%)**
Rice	100.00	433.82	39.69	62.54	100.00	473.66	36.52	64.47	100.00	457.95	37.77	63.71
Wheat	79.32	112.01	8.40	16.28	64.46	86.33	5.25	10.82	70.32	97.75	6.65	13.25
Other cereals	31.19	11.32	1.29	1.80	41.72	12.55	1.42	1.80	37.57	12.15	1.37	1.80
Pulses	91.19	26.76	3.98	3.82	92.72	27.58	3.56	3.64	92.11	27.26	3.73	3.71
Oil	98.98	7.86	3.00	3.00	99.12	9.83	3.18	3.59	99.06	9.06	3.11	3.36
Vegetables	100.00	243.22	14.67	6.71	100.00	299.25	15.01	7.52	100.00	277.15	14.88	7.20
Meat	40.00	16.29	6.30	0.72	52.98	23.90	7.69	1.05	47.86	21.39	7.23	0.94
Egg	62.37	5.46	2.16	0.39	75.28	6.48	2.05	0.43	70.19	6.13	2.09	0.42
Milk	58.98	49.32	3.88	1.26	71.30	56.39	4.25	1.43	66.44	53.91	4.12	1.37
Fruits	77.29	69.51	6.04	1.89	88.52	104.40	7.55	2.53	84.09	91.75	7.00	2.30
Fishes	93.56	24.33	6.86	1.29	96.69	32.33	7.66	1.58	95.45	29.24	7.35	1.47
Spices	100.00	24.52	4.30	1.40	99.34	26.46	4.43	1.53	99.60	25.69	4.38	1.48
Snac/etc.	89.15	28.24	5.12	4.37	94.04	36.48	5.95	5.31	92.11	33.33	5.63	4.95
Tea/Bete	79.32	11.13	6.10	0.42	80.57	13.45	5.65	0.41	80.08	12.54	5.83	0.41
Prepared	24.41	35.43	4.23	5.14	27.15	24.40	2.73	3.09	26.07	28.47	3.28	3.85
No. of households	295				453				748			
Total household food expenditure			2,420				3,182				2,821	
Calories per capita per day				2,415				2,586				2,518

Source: FMRSP-IFPRI Bangladesh Flood Impact Survey, 1998–1999.

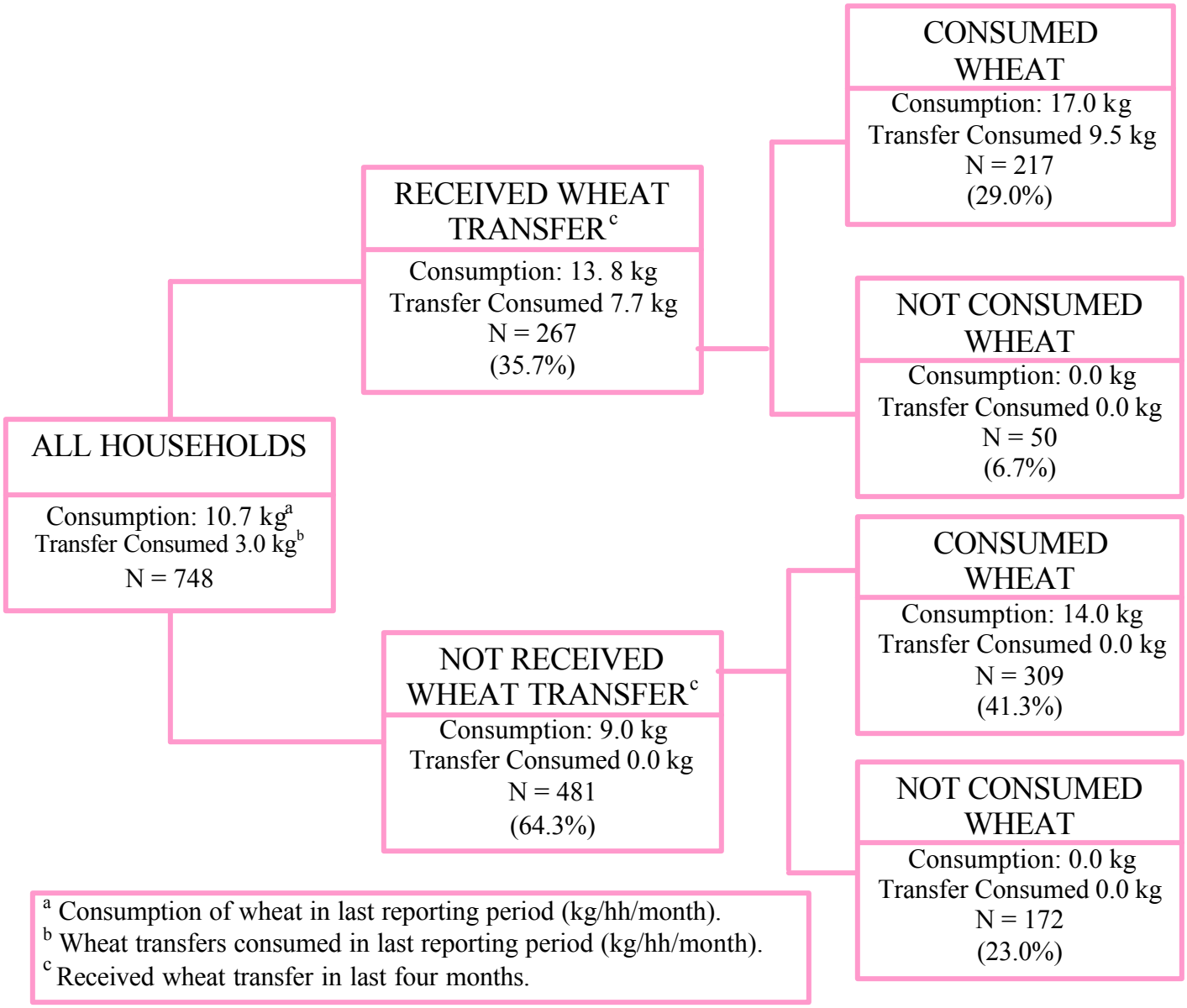
wheat consumed was 112 grams per capita per day and the share of calories derived from wheat was 16.3 percent.

Wheat consumption among non-receiving households rose as well in this period, most likely due to greater wheat availability and lower wheat prices after the wheat harvest in March and April 1999; 64.5 percent consumed wheat, with average per capita daily quantity consumed of 86.33 grams per capita per day, and the share of calories derived from wheat was 10.8 percent.

In comparison with wheat consumption, rice consumption has been more stable across the two rounds of the survey, with 100 percent of households consuming rice in both periods. Nevertheless, households receiving transfers still consume smaller quantities of rice (434 grams versus 474 grams per capita per day) with respect to nonparticipants, reflecting the fact that they are generally poorer and consume more wheat.

The difference in wheat consumption between wheat consumers who received and consumed wheat transfers and those who did not receive wheat transfers in April/May 1999 was significant (Figure 1). Average current wheat consumption of the 35.7 percent of the households who received a wheat transfer during the previous four months was 13.8 kilograms per household per month, compared to 9.0 kilograms per household per month for the 64.3 percent of households who did not receive a wheat transfer during that period. This 35.7 percent includes nonconsumers who received wheat transfers.

Figure 1—Household participation in wheat transfer program and wheat consumption, April/May '99



Considering only those households who consumed wheat in April/May 1999, average wheat consumption for the 29.0 percent of households who received a wheat transfer in the previous four months was 17.0 kilograms per household per month compared with 14.0 kilograms per household per month for wheat-consuming households not receiving a wheat transfer. Thus, among households that consumed wheat in April/May 1999, consumption per household of those receiving wheat transfers was 21.4 percent greater than the consumption per household of those not receiving a transfer in the previous four months. Though wheat-consuming households that received a wheat transfer in the previous four months consumed 9.5 kilograms per household per month of transfer wheat in the survey period, their consumption was 3.0 kilograms per household per month greater than wheat-consuming households that did not receive a transfer.

The observed difference in wheat consumption between households receiving a wheat transfer and those not receiving a wheat transfer is not due to sales of the wheat transfers. As shown in Table 6, sales out of wheat transfers are small. Only 15.7 percent of households receiving a wheat transfer in round 2 sold their wheat, and, on average, sales by these households were only 190 taka, equal to 42.1 percent of the amount of the transfer. What accounts for the small increase in wheat consumption for households receiving transfers? Households receiving wheat transfers purchase less wheat than they would if they did not receive a wheat transfer, so their wheat consumption increases by less than the amount of the transfer.

Table 6—Utilization of transfers of wheat and rice, January to April 1999

Program	Households receiving transfers			Households selling transfers				Households consuming transfers			
	Number of households	Average	Amount	Number of households	Average	Amount	Sale price	Number of households	Average	Amount	Price[a]
		(kilograms)	(taka)		(kilograms)	(taka)			(kilograms)	(taka)	
Rice											
FFE	0	0	0	0	0	0	-	0	0	0	0.0
GR	3	14	192	0	0	0	-	3	14	192	13.7
VGF	176	16	217	3	4	39	9.7	171	15	202	13.3
VGD	1	70	833	0	0	0	-	1	70	833	11.9
FFW											
Total	180	16	220	3	4	39	10.0	175	16	2,065	13.2
Wheat											
FFE	62	51	448	15	17	136	7.8	59	49	375	7.7
GR	4	37	324	0	0	0	-	4	37	278	7.5
VGF	182	42	373	16	16	123	7.9	177	40	332	8.3
VGD	20	77	675	9	31	245	7.9	19	63	509	8.1
FFW	16	222	1,939	4	67	540	8.2	15	219	1,647	7.5
Total	262[b]	57	498	41[b]	24	190	8.0	254[b]	53	475	8.9

Source: FMRSP-IFPRI Bangladesh Flood Impact Survey, 1998–1999.

Notes: FFE = Food For Education; GR = Gratuitous Relief; VGF = Vulnerable Group Feeding; VGD = Vulnerable Group Development; FFW = Food For Work.

[a] Average purchase price of consumes in the same region

[b] The number of observations is smaller than the total due to a few missing values

4. IMPACT OF TRANSFERS ON FOOD CONSUMPTION: EMPIRICAL ANALYSIS

The empirical calculation of the marginal propensity to consume wheat out of wheat transfers has been estimated using two alternative methodologies. First, we use propensity score matching (PSM), in which the set of program participant households that receive wheat is compared to a set of counterfactual households drawn among nonparticipants that "look like" program participants. As an alternative, we use the parameters of an econometrically estimated Engel function to calculate the MPC for wheat out of income and wheat transfers.

PROPENSITY SCORE MATCHING

Following recent empirical examples in the estimation of program impact in the economic literature (Rosenbaum and Rubin 1983; Jalan and Ravallion 2001; Ravallion et al. 2001; Dehejia and Wahba 1998, 1999; Heckman, Ichimura, and Todd 1997; Heckman et al. 1998; Lechner 1999), we use propensity-score matching (PSM) methods to extract from the sample of nonparticipating households a set of matching households that "look like" the participating households. The PSM method for the calculation of MPC for different groups of households is particularly appropriate in this context, since the households were drawn from the same survey and a large number of observable characteristics were available to help identify the matching households.[9]

[9] Nonetheless, bias due to unobservable characteristics that have an impact on program participation cannot be ruled out.

Ideally, we would compare the level of consumption of program participants to that of the same program participants if they had not participated in the program. Mathematically, defining R as equal to 1 for program participants and 0 otherwise, Q_1 and Q_0 as the amount of wheat consumed by program participants and nonparticipants, respectively, we would like to compare $E[Q_1 \mid R = 1]$ to $E[Q_0 \mid R = 1]$.

The counterfactual group here has been constructed by extracting from the sample of nonparticipants a set of matched households using the propensity score $P(XP) = \text{Prob}[R = 1 \mid XP]$, (the probability of participating in any program that distributed wheat), based on a logit model with observable characteristics (XP) as explanatory variables (See Appendix Table 13). Two different matched samples were created using individual matching and neighborhood matching estimators, though the results below show only the neighborhood matching results.

Figure 2 compares the probability of participation in any program derived from the Logit model for participant and nonparticipant groups. With the exception of the nonparticipating households with a predicted probability of participation of zero, the predicted probability distribution of nonparticipants and participants is similar. The marked difference in per capita expenditures in the matched sample compared to nonparticipants overall is another indication of the quality of the matching. Monthly per capita expenditures for participants are Tk 570, compared to Tk 747 for nonparticipants, and Tk 609 for the matched sample.

Table 7 reports the results of the estimated level of wheat consumption for the participating and the matched sample. Considering first, participation in any of the

Figure 2—Distribution of predicted probability of program participation: Participants and nonparticipants

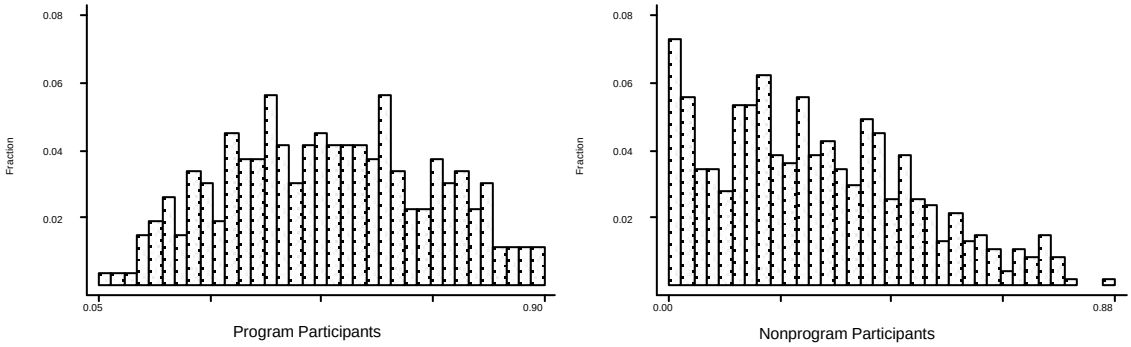


Table 7—Marginal propensity to consume estimates for wheat consumption in Bangladesh using propensity score matching, January to April 1999

	All	VGD	VGF	FFE	FFW
	(kilograms per household per month)				
Consumption of participants	13.887	16.757	14.522	15.855	6.574
	(0.85)	(5.20)	(0.96)	(2.09)	(1.92)
Consumption of matched nonparticipants	9.619	13.009	8.858	10.737	10.509
	(2.39)	(2.70)	(1.89)	(2.78)	(2.14)
Difference in consumption	4.268	3.748	5.664	5.118	-3.935
	(2.54)	(5.85)	(2.12)	(3.55)	(2.04)
Size of the transfer	13.050	17.035	11.132	12.397	47.01
	(0.93)	(1.83)	(0.54)	(1.49)	(9.57)
Marginal propensity to consume wheat	0.327	0.220	0.509	0.413	-0.084
Number of participants	263	19	177	62	17

Source: FMRSP-IFPRI Bangladesh Flood Impact Survey, 1998–1999.

Note: Standard errors are reported in parenthesis. VGD = Vulnerable Group Development; VGF = Vulnerable Group Feeding; FFE = Food For Education; FFW = Food For Work.

programs, wheat consumption of participants is 4.27 kilograms per household per month greater than the wheat consumption of the matched sample.[10] With an average transfer of 13.05 kilograms per household per month, the estimated marginal propensity to consume wheat out of a wheat transfer is 0.327. Similar calculations for the effects of wheat transfers in individual programs result in a range of MPCs from 0.509 for VGF transfers and essentially zero (-0.084) for Food For Work.

As a check on the approximate magnitudes of the MPCs derived above, Table 8 presents estimates of the MPC for wheat based on a simple, naïve comparison of sample

Table 8—Marginal propensity to consume estimates for wheat consumption in Bangladesh using sample means, January to April 1999

	All	VGD	VGF	FFE	FFW
	(kilograms per household per month)				
Consumption of participants	13.887	16.757	14.522	15.855	6.574
	(0.85)	(5.20)	(0.96)	(2.09)	(1.92)
Consumption of nonparticipants	8.974	8.974	8.974	8.974	8.974
	(0.62)	(0.62)	(0.62)	(0.62)	(0.62)
Difference in consumption	4.913	7.783	5.548	6.881	-2.400
	(1.189)	(6.069)	(1.415)	(2.813)	(3.830)
Size of the transfer	13.050	17.035	11.132	12.397	47.01
	(0.93)	(1.83)	(0.54)	(1.49)	(9.57)
Marginal propensity to consume wheat	0.376	0.457	0.498	0.555	-0.051
Number of participants	267	19	177	62	17
Number of nonparticipants	481	481	481	481	481

Source: FMRSP-IFPRI Bangladesh Flood Impact Survey, 1998–1999.

Note: Standard errors are reported in parenthesis. VGD = Vulnerable Group Development; VGF = Vulnerable Group Feeding; FFE = Food For Education; FFW = Food For Work.

[10] The standard errors of the mean level of wheat consumption for the matched nonparticipants, reported in parentheses, have been calculated bootstrapping the matching procedure and adding an adjustment factor that takes into account the number of times a matched value has been associated with a single participant.

means of the consumption level of wheat for participants and nonparticipants. In other words, the comparison group is not a matched sample, but simply the set of all nonparticipants. As before, the MPCs have been calculated as the difference in the average level of consumption of wheat of wheat transfer program participants and nonparticipants divided by the average level of the wheat transfer. Using these averages to directly calculate MPCs for wheat, of course, overlooks potential serious biases, including the endogeneity of program participation. The resulting MPCs calculated using simple sample means are in general slightly higher than those using the propensity score matching. The average MPC for all program participants is equal to 0.372 (compared to 0.327) with substantially higher MPCs for VGF transfers and FFE transfers.

ECONOMETRIC ESTIMATES OF ENGEL CURVES

As an alternative to propensity score matching, we also econometrically estimate the parameters of an Engel function, using the following functional form:

$$w = a0 + a1*HHSIZE + b1*Y + b2*Y^2 + c1*WT + c2*WT^2 + e, \qquad (1)$$

where w is the budget share of wheat consumption in the month preceding the interview, HHSIZE is the household size, Y is total income (expenditure) per household per month (less the value of the in-kind transfer), WT is the average monthly value of the wheat transfers received by the households since January 15, 1999, and e is the error term,

assumed to have a normal distribution. Including the squared terms for *Y* and *WT* allows for curvature in the relationship between these variables and the budget share.[11]

The estimation of this model required corrections for endogeneity of several variables. First, in order to correct for the endogeneity of total expenditures (a proxy for household income), we used the fitted value of total expenditures from a regression using instrumental variables. Second, because not all households are wheat consumers, we also estimated a second equation (Model 2), correcting for selectivity bias using the inverse Mills ratio from a probit regression on whether households consume wheat (see Heien and Wessells 1990 and Byrne, Capps, and Saha 1996 for a similar approach to estimate demand systems with microdata).[12] Third, we corrected for the endogeneity of program participation. Here we used the standard treatment effect model (see Green 2000 for general references on treatment effect models) in which the regression specified is augmented by the inverse Mills ratio calculated using the probability of participating in the program. Thus, the appropriate inverse Mills ratio was added as an explanatory variable along with dummy variables for individual program participation in Model 3.[13] Finally, in all regressions, we calculate robust standard errors corrected for cluster effects.

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[11] In an alternative model specification, we also included an interaction term ($Y * WT$), but the estimated coefficient was very small and statistically insignificant.

[12] Note that when all the observations are used in the estimation of the Engel function, the inverse Mills ratio is equal to $\lambda = \phi(B'X)/\Phi(B'X)$ for consuming households and $\lambda = \phi(B'X)/(1-\Phi(B'X))$ for non-consuming households.

[13] Here the inverse Mills ratio is equal to $\lambda = \phi(B'X)/\Phi(B'X)$ for participating households and $\lambda = -\phi(B'X)/(1-\Phi(B'X))$ for nonparticipating households.

Table 9 shows the regression results. In Model 1, all the coefficients are significantly different from zero at the 5 percent confidence level except for the coefficient on income squared (Y^2). In Model 2, the coefficient on the inverse Mills ratio is also significant, and the explanatory power of the regression is considerably improved as evidenced by the increase in R-squared from 0.115 to 0.233.

The positive sign of $c1$, the coefficient of the value of wheat transfers (WT), together with the negative sign of $c2$, the coefficient of the squared term (WT^2), indicates

Table 9—Impacts of wheat transfers and cash income on wheat consumption

Dependent variable: Budget share of monthly household consumption of wheat

	Model 1		Model 2		Model 3	
Variables	**coefficient**	**t-test**	**coefficient**	**t-test**	**coefficient**	**t-test**
Constant	3.786	2.500	4.166	5.410	3.413	3.250
Household Size	0.362	-5.030	0.390	2.730	0.271	1.750
Tot Hh Expenditure (Pred.)	-0.847	2.270	-0.928	-5.270	-0.619	-2.860
Square of Tot Hh Expenditure (Pred.)	0.000	4.090	0.000	2.430	0.000	1.220
Value of Total Wheat Transfer	19.158	-4.020	11.276	1.700	9.185	1.800
Square of Value of Total Wheat Transfer	-0.015	5.380	-0.010	-2.200	-0.006	-1.710
Receive VGD					4.924	1.510
Receive VGF					1.824	1.100
Receive FFW					-5.112	-2.020
Receive FFE					1.644	1.650
Inverse Mills Ratio - Wheat consumption			0.934	2.090	-0.826	-1.290
Inverse Mills Ratio – VGD					0.429	0.380
Inverse Mills Ratio – VGF					1.016	0.960
Inverse Mills Ratio – FFW					1.272	1.170
Inverse Mills Ratio – FFE					-0.480	-2.690
R2	0.104		0.114		0.163	
Observations	744		744		744	
Number of Clusters	24		24		24	

Source: FMRSP-IFPRI Bangladesh Flood Impact Survey, 1998–1999 and authors' calculations.

Notes: Household expenditure and value of transfers are expressed in thousands of taka. VGD = Vulnerable Group Development; VGF = Vulnerable Group Feeding; FFW = Food For Work; FFE = Food For Education.

that at low levels of transfers, an increase in the transfer tends to increase the budget share of wheat, but as the size of the transfer increases, the marginal increase in the share of wheat diminishes. Similarly, the negative sign on the coefficient $b1$, the coefficient of the fitted value of total expenditures per household (T), together with the positive sign of $b2$, the coefficient of the squared term, indicates that the budget share of wheat tends to decline as income increases, but at a decreasing rate.

The third regression (Model 3) includes dummy variables for the participation in some of the wheat distribution programs: DVGD for the Vulnerable Group Development (VGD) program, DVGF for the Vulnerable Group Feeding (VGF) program, and DFFW for the Food For Work (FFW) program.[14] The coefficients on DVGD and DVGF are positive and significant at the 10 percent confidence level, suggesting that the budget shares for wheat of VGD and VGF participants are significantly higher than for other households, taking into account the other determinants of the wheat budget share included in the regression.

The marginal propensities to consume wheat out of wheat transfers (WT) and cash income (Y) can be calculated from the regression equations by taking the partial derivatives of the wheat expenditures with respect to WT and YT. Since $w = p_w q_w/(Y + T)$, using equation 1, we have

[14] We also tested for selection bias in the Food For Work program by including an inverse Mills ratio variable estimated from a probit regression of Food For Work participation. The estimated coefficient was statistically insignificant. Note that participants in Vulnerable Group Feeding, the program with the most participants from our sample, were not self-selected, but rather chosen by local committees on the basis of household characteristics including level of poverty and gender of the household head.

$$p_w q_w = Y * w = Y * (a0 + a1*HHSIZE + b1*Y + b2*Y^2 + c1*WT + c2*WT^2 + e) \quad (2)$$

and

$$d(p_w q_w)/dYT = w + b1*Y + 2b2*Y^2 = \text{MPC of wheat out of total income.} \quad (3)$$

Similarly,

$$d(p_w q_w)/dWT = w + (Y + WT) * (c1 + 2*c2*WT)$$

$$= \text{MPC of wheat out of wheat transfers.} \quad (4)$$

Using an average monthly household income of wheat recipients of 3,072 taka and an average wheat transfer equivalent to 155 taka per month per household, the calculated marginal propensity to consume wheat out of wheat transfers is 0.358 using the coefficients from Model 2 and 0.216 using the coefficients from Model 3. These MPCs show the change in the value of wheat consumption, given a marginal change in the value of wheat transfers.

However, in order to calculate the total change in wheat consumption as a result of the wheat transfer programs, we use the regression coefficients to compute "arc" MPCs, equal to estimated consumption with the transfer less estimated consumption without a transfer, divided by the size of the transfer (Table 10). Using the parameters from Model 3 and the average income of households in the lowest income tercile, the "arc" marginal propensity to consume wheat out of a small wheat transfer (of 120 taka per household per month) ranges from 0.170 to 0.239. For the same programs and household income, the "arc" marginal propensity to consume wheat out of a large wheat transfer (500 taka per household per month) ranges from only 0.081 to 0.149. Using the average total household expenditures of each program's participants and the average size

of transfers in each program, the "arc" marginal propensity to consume ranges from 0.029 for Food For Work (a program that involves a very large wheat transfer equal to 650 Taka per household per month) to 0.276 for Vulnerable Group Feeding, a program with small transfers targeted to poor women.

Table 10—Marginal propensity to consume (MPC) wheat out of wheat transfers and total income, by income level and size of transfer

	MPC from wheat transfer by program					MPC from income	Income elasticity
	VGD	VGF	FFW	FFE	All		
MPC Model 2							
Tercile 1, small transfer	0.230	0.233	0.234	0.237	0.234	0.029	0.586
Tercile 1, large transfer	0.169	0.172	0.173	0.176	0.173	0.026	0.521
Tercile 2, small transfer	0.339	0.342	0.343	0.346	0.343	0.010	0.245
Tercile 2, large transfer	0.227	0.230	0.230	0.234	0.231	0.007	0.173
Program Means	0.362	0.380	0.256	0.379	**0.375**	0.003	0.092
MPC Model 3							
Tercile 1, small transfer	0.236	0.207	0.138	0.208	0.189	0.026	0.525
Tercile 1, large transfer	0.167	0.138	0.069	0.139	0.121	0.024	0.481
Tercile 2, small transfer	0.324	0.295	0.226	0.296	0.278	0.013	0.317
Tercile 2, large transfer	0.204	0.175	0.107	0.177	0.158	0.011	0.266
Program Means	0.339	0.327	0.126	0.322	**0.302**	0.008	0.220
Means used for the calculations							
Amount of transfer							
Small transfer	100	100	100	100	100		
Large transfer	500	500	500	500	500		
Mean program transfer	154	100	485	119	124		
Level of total expenditure							
Tercile 1	1,906	1,906	1,906	1,906	1,906		
Tercile 2	3,153	3,153	3,153	3,153	3,153		
Mean program participant	3,589	3,589	3,589	3,589	3,589		
Household size	4.35	5.09	5.29	6.17	5.38		

Source: Authors' calculations.

Notes: VGD = Vulnerable Group Development; VGF = Vulnerable Group Feeding; FFW = Food For Work; FFE = Food For Education.

Note that, in general, the MPCs for wheat transfers are significantly higher than the MPCs for total income.[15] Using average incomes of the lowest tercile of households, the MPC wheat for an increase in income is only 0.049 with Model 2 and 0.046 with Model 3. Thus, small in-kind transfers result in significantly higher wheat consumption than do increases in total cash income. The marginal propensity to consume wheat out of the large Food For Work transfers for tercile 1 using Model 3 coefficients (0.069) is, however, similar in magnitude to the MPC wheat out of cash income (0.024).

5. IMPLICATIONS OF TRANSFER PROGRAMS FOR WHEAT MARKETS

The higher marginal propensity to consume out of direct food transfers as compared to cash transfers has important implications for market prices of wheat. Table 11 presents estimates of the impact on wheat demand of various distribution programs in recent years in Bangladesh. In 1998/99, wheat distribution through the three major targeted programs with small ration size (FFE, VGD, and VGF) was relatively high, 717,000 tons. Using the MPCs calculated with the Propensity Score Matching technique (Table 7), we estimate the total estimated increase in wheat demand from these programs to be 287,000 tons. Food For Work distribution, with a transfer more than three times the average transfer of the small ration size programs, actually reduced wheat demand by 58,000 tons, however. In 1999/2000 and 2000/01, years with good rice and wheat harvests, public wheat distribution through these targeted programs was about half that of

[15] The difference between the coefficient on predicted income and the coefficient on wheat transfers in Model 3 (Table 10) is statistically significant at the 5 percent confidence interval. The same holds true for the difference between the coefficients on the respective squared terms.

1998/99. The demand creation impact of the programs is thus correspondingly less: 105,000 tons for FFE, VGD, and VGF combined, and 82,000 tons including FFW in 2000/01.

Table 11—Effect of wheat transfer programs on demand: 1998-99-2000/01

Program	Average wheat transfer	Estimated MPC out of wheat transfers[a]	Total distribution	Increase in wheat demand
	(kg/hh/month)		('000 tons)	('000 tons)
FFE	22.1	0.413		
1998/99			227	94
1999/00			174	72
2000/01			160	66
VGD	23.5	0.220		
1998/99			193	42
1999/00			155	34
2000/01			124	27
VGF	15.0	0.509		
1998/99			297	151
1999/00			23	12
2000/01			23	12
Subtotal				
1998/99		0.401	717	287
1999/00		0.335	351	117
2000/01		0.351	307	105
FFW	77.4	-0.084		
1998/99			690	-58
1999/00			420	-35
2000/01			274	-23
Total[b]				
1998/99			1,407	229
1999/00			772	82
2000/01			581	82

Source: Authors' calculations.

Notes: FFE = Food For Education; VGD = Vulnerable Group Development; VGF = Vulnerable Group Feeding; FFW = Food For Work.

[a] The marginal propensities to consume (MPCs) are from Table 7.

[b] The total shown is for distribution programs listed in the table and does not include other programs.

The impact of this additional demand on the wheat market depends on the relationship of domestic wheat prices to international (import parity) prices. As shown in Figure 3, during the period of the survey, national average wholesale wheat prices were approximately equal to the estimated import parity Dhaka (calculated using the price of U.S. hard red winter wheat #2 with a 10 percent discount for quality differences), for most of 1998/99 and 1999/2000. Private-sector imports these two years were 606,000 and 724,000 tons, respectively. Because Bangladesh domestic prices were at import parity, these programs had no effect on domestic prices in these years; instead, they replaced private-sector imports.

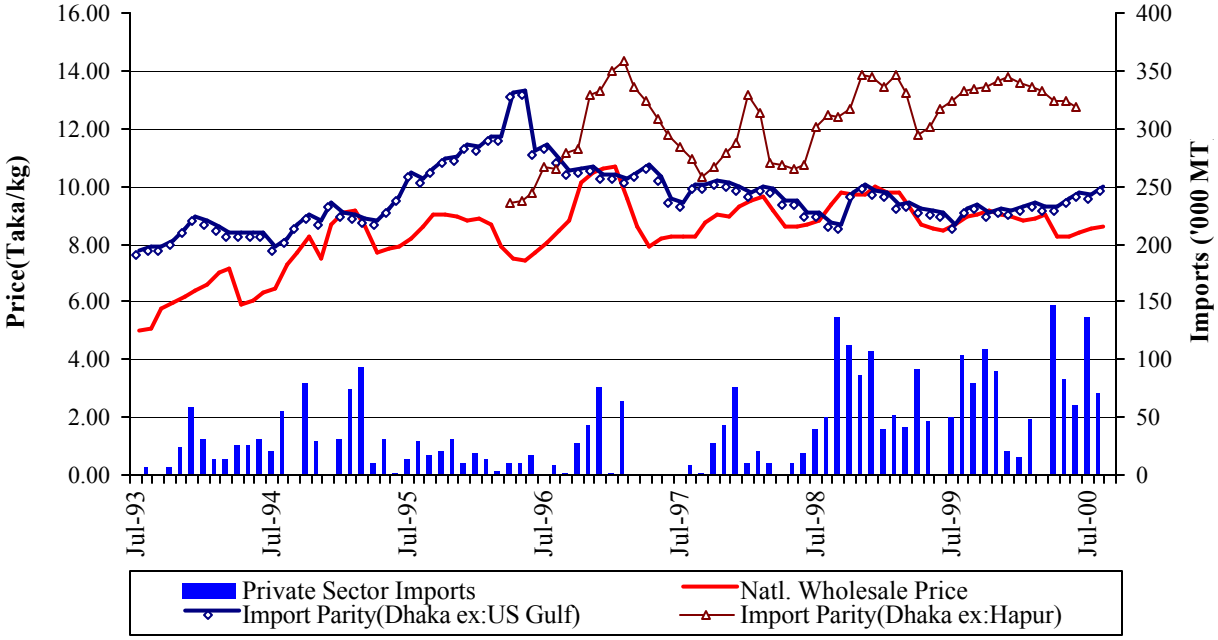
By early 2000, however, successive excellent rice harvests led to substantial declines in the domestic price of wheat, as lower rice prices reduced domestic wheat demand. Private-sector imports in the first half of 2000 continued, nonetheless, in part because lower priced wheat was imported from non-U.S. sources (Australia, Turkey, and central Asia).[16] Later in 2000, private-sector imports of wheat essentially stopped, as domestic prices of wheat fell substantially below import parity prices.[17] In this new market situation, targeted distribution programs did have an impact on domestic prices.

Table 12 presents estimates of the impacts on domestic prices of some major wheat distribution programs in 2000/01. These estimates assume an own-price elasticity of wheat demand of –0.82 (from Goletti 1994) and an elasticity of wheat supply

[16] Personal communications with private wheat importers.

[17] Some imports of high gluten content wheat used by commercial baking firms continued.

Figure 3—Wheat prices and quantity of private wheat imports in Bangladesh, 1993-2000



Source: FPMU, DAM, MIS DG Food, USDA and CMIE (1998, 1999, 2000).

Note: Import parity (Dhaka) price is based on US #2 HRW and includes import tariffs. From November 1998, the carrying cost from Hapur has increased by 1.1 taka/kg to 4.1 taka/kg.

Table 12—Effect of wheat transfer programs on wheat markets in Bangladesh: 2000/01

Program	Estimated MPC out of wheat transfers[a]	Total distribution	MPC effect on wheat demand	Change in wheat supply[b]	MPC effect on wheat demand	Effect of program on wheat price[c]	
						No MPC effect	With MPC effect
		('000 tons)	('000 tons)	(percent)	(percent)	(percent)	(percent)
FFE	0.413	160	66	6.2%	2.5%	-7.5%	-4.6%
VGD	0.220	124	27	4.7%	1.0%	-5.8%	-4.6%
VGF	0.509	23	12	0.8%	0.4%	-1.1%	-0.5%
Subtotal	0.342	307	105	12.5%	4.0%	-15.6%	-11.4%
FFW	-0.084	274	-23	11.0%	-0.8%	-12.6%	-13.6%

Source: Authors' calculations.

Notes: FFE = Food For Education; VGD = Vulnerable Group Development; VGF = Vulnerable Group Feeding; FFW = Food For Work.

[a] The Marginal Propensities to Consume (MPCS) are from Table 7.

[b] Total demand (availability) of nonmilling wheat in 2000/01 = 2.760 million tons; production = 2.400 million tons; net public wheat distribution = 0.600 million tons, losses equal to 10 percent of production.

[c] Assumed own-price elasticity of demand for wheat: -0.82, from Goletti (1994) and own-price elasticity of supply of 0.3.

(domestic production) of 0.3.[18] As indicated, nonzero MPCs for wheat transfers make a significant difference in the price impact of these programs. For example, an increase in wheat supply equal in magnitude to the FFE program lowers wheat prices by 6.2 percent.[19] Increase in wheat demand partially offsets the effect of increased wheat supply, however, so that the net effect is a reduction in wheat prices of only 4.7 percent. In total, the positive MPCs for the FFE, VGD, and VGF programs reduce the total effect of these programs on market prices from –15.6 to –11.4 percent. Assuming more inelastic own-price elasticities of supply (0.15) and demand (-0.41) that are arguably more representative of short-run responses results in larger price impacts of the programs, estimates of the price impact of the FFE program rise to –14.4 percent without MPC effects and –8.9 percent with MPC effects. Similarly, the total price effect of the FFE, VGD, and VGF programs combined increases to –28.8 and –21.5 percent, without and with MPC effects, respectively.[20]

These calculations suggest that program channel is an important determinant in calculating the impact of net public distribution (distribution less domestic procurement), and thus the impact of food aid, on domestic prices and imports. The maximum volume of net public foodgrain (from food aid, government commercial imports, and change in

[18] Note that this simple model is based on national wheat supply and demand calculated on an annual basis. Baulch et al. (1998) have shown that wheat wholesale markets are well integrated across space and time. To the extent that the timing and size of the distribution programs is known to market participants, estimating the price effects based on annual national distribution of the wheat programs, is a valid approximation, particularly for distribution programs that are spread out relatively evenly throughout the year.

[19] Note that the percentage changes in price are expressed as a percentage of the simulated price without the program(s).

[20] The estimated effects of the programs in 2000/01 without and with the MPC effect are –11.3 and –9.0 percent, respectively, for VGD, –2.2 and –1.1 percent for VGF, and –23.7 and –25.3 percent for FFW.

public stocks) that can be distributed without depressing market prices below import parity levels depends on the level of international prices, the domestic price of rice, and the distribution channel.[21] In the early 1990s, the maximum "safe" level of food aid (assuming no government commercial imports or change in public stocks) was on the order of 600,000 to 800,000 tons (Dorosh 2000). The estimated 120,000-ton increase in wheat demand due to the positive MPCs in the small ration channels (FFE, VGD, and VGF) thus represents a significant share of estimated "safe" levels of food.[22]

6. CONCLUSIONS

This paper has presented evidence that the marginal propensity to consume (MPC) wheat out of wheat transfers is significantly higher than the MPC wheat out of income, and that this addition to demand is large enough to potentially have significant effects on market prices. Using propensity score matching techniques, the MPC for wheat is, on average, 0.33, ranging from essentially zero for Food For Work (a program with large transfers) to 0.51 for VGF. Similarly, using a functional form that allows for differences in MPCs according to size of transfers and income levels, regression results indicate that the total MPC wheat out of small wheat transfers (15 to 25 kilograms per household per month) is approximately 0.30. Thus, small wheat transfers do not lead to an equivalent increase in consumption, but are partially offset by lower purchases of

[21] Dorosh and Haggblade (1997) use a multi-market model to analyze the implications of the timing of food distribution on seasonal market prices.

[22] See Dorosh et al. 2002 for an analysis of the impact of food aid in Bangladesh under various world price, production, and policy scenarios.

wheat (and to a lesser extent, sales of transfer wheat). Programs that involve larger transfers of wheat, such as Food For Work, have much smaller MPCs, however.

The econometric evidence suggests that increases in cash incomes (and cash transfers) do not lead to significant increases in wheat consumption. Calculated MPCs for wheat out of cash income range are near zero. Overall, programs involving small rations of direct transfers in wheat (FFE, VGD, and VGF) are estimated to have increased wheat demand by 287,000 tons in 1998/99 from their transfer of 717,000 tons. Cash transfers of an equivalent value would likely have resulted in only a very small increase (or possibly even a decrease) in wheat demand. Thus, the potential impact of these wheat transfer programs on market prices (when prices are below import parity) is approximately only two-thirds the magnitude of the impact of cash transfer programs (and a release of the same amount of wheat in the market). The demand-enhancing effect of direct distribution in small rations does not necessarily imply that targeted direct distribution programs are preferable to other programs or open market sales, however, since other factors, including cost of delivery, efficiency of targeting and policy objectives, are also important determinants of policy choice.

Further analysis is needed to explain the reasons behind the varying MPCs in terms of the opportunity costs of households' time, stigma effects, and other factors. Nonetheless, the econometric analysis of the survey data presented in this paper clearly indicates that in-kind transfers targeted to poor women and children in Bangladesh lead to greater wheat consumption than would result from an equivalent increase in cash income. Moreover, this increased marginal propensity to consume wheat from wheat

transfers is large enough to have significant implications for wheat consumption, market prices, and program design.

APPENDIX TABLES

Table 13—Results of the Logit participation model

Dependent variable: Receiving wheat transfers

Variables	Coefficient	z
Household size	-0.525	-3.15
Age hh head	0.003	0.42
Female head of household	1.355	2.98
Dependency ratio	-0.022	-3.86
Male education: none	0.842	4.44
Male education: primary	0.880	4.42
Male education: primary completed	0.711	3.11
Male education: secondary	0.721	2.81
Male education: secondary completed	-0.515	-0.73
Fem. education: none	0.739	3.87
Fem. education: primary	0.746	3.67
Fem. education: primary completed	0.663	2.77
Fem. education: secondary	-0.167	-0.46
No people working as dependent	-0.168	-0.83
No people working as daily labor	-0.212	-1.25
No people working on own farm	-0.398	-2.00
N working in business	-0.270	-1.57
Total value of assets in ’97	-0.006	-3.44
Amount of credit in ’97	-0.527	-1.61
House with tin roof	-1.140	-3.94
Electricity	-0.162	-0.53
Dummy for thana 2	1.309	2.79
Dummy for thana 3	1.016	1.76
Dummy for thana 4	1.357	2.42
Dummy for thana 5	1.114	2.32
Dummy for thana 6	0.160	0.38
Dummy for thana 7	1.185	2.51
Log price index: rice	0.994	1.55
Log price index: wheat	-3.004	-3.40
Log price index: o. cereals	-0.089	-0.27
Log price index: pulses	-0.130	-0.22
Log price index: oil	-0.693	-1.44
Log price index: vegetables	0.515	0.89
Log price index: meat	0.530	1.11
Log price index: eggs	0.304	0.98
Log price index: milk	-0.082	-0.13
Log price index: fruit	0.152	0.73
Log price index: fish	-0.027	-0.10
Log price index: spices	-0.501	-0.88
Log price index: snacks	-0.063	-0.19
Log price index: tea	-0.086	-0.30
Log price index: prepared food	-0.542	-1.39
Constant	-1.268	-2.21
Number of observations = 734		
LR chi2(42) = 167.34		
Prob > chi2 = 0.0000		
Pseudo R2 = 0.1741		

Table 14—Results of the estimations of the predicted income (expenditure) and participation probit models

	(1) Y	Y2	(2)	(3) Rec. wheat	(4) DVGD	(5) DVGF	(6) DFFW	(7) DFFE	(8) Con. wheat
Household size	541.53		6,900,376.21	-0.26	-0.45	-0.24	-0.04	-0.02	0.18
	(6.80)**		(3.98)**	(3.50)**	(1.84)+	(3.08)**	-0.17	-0.1	(2.11)*
Age hh head	4.10		-42,931.67	0	0.04	0	0	0.01	0.01
	(-0.76)		(-0.37	(-0.08	(2.74)**	(-0.66	(-0.03	(-0.61	(-1.10)
Dependency ratio	-6.9		-91,825.96	-0.01	-0.02	-0.01	0	0	0.01
	(1.86)+		-1.14	(3.64)**	(2.36)*	(2.77)**	-0.09	-0.58	(3.32)**
Male education: None	11.69		542,007.13	0.45	0.75	0.37	-0.06	0.14	-0.25
	(-0.12)		-0.25	(5.04)**	(2.29)*	(3.94)**	-0.22	-0.8	(2.16)*
Male education: primary	0.43		-562,186.29	0.45	0.05	0.37	0.09	0.31	-0.24
	0		-0.24	(4.66)**	-0.18	(3.56)**	-0.31	-1.56	(1.88)+
Male education: primary completed	79.99		-1,662,761.69	0.39	0.98	0.27	0.16	0.15	-0.21
	-0.63		-0.6	(3.32)**	(2.25)*	(2.16)*	-0.51	-0.63	-1.59
Male education: secondary	311.11		74,480.16	0.34	-0.28	0.32		0.15	-0.29
	(2.27)*		-0.02	(2.57)*	-0.48	(2.26)*		-0.56	(2.19)*
Male education: secondary completed	355.14		-7,969,496.31	-0.45		-0.23			0.09
	-1.47		-1.51	-1.15		-0.61			-0.38
Fem. education: None	-167.46		-2,240,687.10	0.37	0.5	0.3	0.08	0.07	-0.31
	(1.72)+		-1.05	(4.14)**	(1.79)+	(3.20)**	-0.31	-0.41	(2.86)**
Fem. education: primary	-173.18		-4,659,662.20	0.4	-0.09	0.29	-0.07	0.55	-0.24
	-1.53		(1.89)+	(4.02)**	-0.25	(2.78)**	-0.24	(2.67)**	(1.95)+
Fem. education: primary completed	290.85		7,870,797.87	0.34	0.57	0.26	-0.07	0.01	-0.18
	(2.13)*		(2.64)**	(2.76)**	-1.45	(1.99)*	-0.15	-0.05	-1.31
Fem. education: secondary	536.92		10,503,744.85	-0.16	0.17	-0.14	0.33	-0.5	-0.28
	(2.93)**		(2.63)**	-0.78	-0.19	-0.64	-0.49	-1.05	(1.68)+
Fem. education: secondary completed	-919.05		-44,995,969.30						-0.44
	-1.2		(2.69)**						-0.54
No people working as dependent	81.38		-1,112,011.09	-0.24	-0.34	-0.09	0.03	-0.3	0.07
	-0.67		-0.42	(2.09)*	-0.95	-0.74	-0.1	-0.92	-0.63
No people working as daily labor	-212.09		-2,087,891.83	-0.15	-0.27	-0.2	0.24	0.31	0.17
	(1.81)+		-0.82	-1.54	-0.74	(1.92)+	-1.13	-1.61	-1.53
No people working on own farm	144.74		728,123.18	-0.27	-1.56	-0.2	0.09	0.34	0.23
	-1.13		-0.26	(2.35)*	(2.25)*	-1.63	-0.28	-1.55	(1.71)+
N working in business	137.17		476,158.71	-0.17	-0.03	-0.12	0.07	0.23	-0.06
	-1.18		-0.19	(1.75)+	-0.1	-1.17	-0.26	-1.3	-0.52

(continued)

Table 14 (continued)

	(1) Y	(2) Y2	(3) Rec. wheat	(4) DVGD	(5) DVGF	(6) DFFW	(7) DFFE	(8) Con. wheat
Total value of assets in '97	5.54	155,292.69	0	0	0	-0.01	0	0
	(11.16)**	(14.35)**	(3.47)**	-0.3	(2.60)**	-1.46	-0.75	(2.53)*
Amount of credit in =97	368.93	3,632,361.92	-0.19	0.34	-0.26		-0.24	0
	(1.67)+	-0.75	-0.98	-0.65	-1.25		-0.61	0
House with tin roof	406.24	928,155.51	-0.56	0.55	-0.73	0.38	0.19	0.31
	(2.34)*	-0.25	(3.42)**	-1.04	(3.88)**	-0.87	-0.55	-1.61
Electricity	1,136.08	10,224,033.13	-0.1		-0.05	0.43	-0.74	0.19
	(5.95)**	(2.46)*	-0.52		-0.26	-0.81	-1.09	-1.09
Dummy for thana 2	-1,407.64	-32,082,067.31	0.23	7.94	0.52	-0.96		2.79
	(1.80)+	(1.89)+	-1.06	(.)	(2.27)*	(1.69)+		(3.49)**
Dummy for thana 3	-1,501.11	-32,210,198.58	0.37	8.67	0.26	-0.75	1.89	3.73
	(2.04)*	(2.01)*	(1.69)+	(13.60)**	-1.1	-1.38	(2.03)*	(4.60)**
Dummy for thana 4	-469.27	-20,260,243.42	0.25		0.32	-0.22	-2.41	3.1
	-0.43	-0.86	-0.76		-0.94	-0.19	(1.87)+	(2.83)**
Dummy for thana 5	-1,642.48	-24,027,444.56	0.58	6.74	0.41	-0.53	-0.11	2.23
	(2.51)*	(1.68)+	(2.37)*	(7.19)**	-1.55	-0.91	-0.17	(3.35)**
Dummy for thana 6	-335.49	-11,654,729.98	-0.06		1.03			2.33
	-0.51	-0.81	-0.17		(3.02)**			(3.47)**
Dummy for thana 7	-1,288.14	-35,240,233.74	0		0.72	-1.03		3.11
	-1.22	-1.53	-0.01		(2.82)**	-1.55		(2.91)**
Union level shops Nov '98	-2.9	-41,870.19						0
	-1.22	-0.81						-1.12
Union level traders Nov '98	3.96	45,585.00						0.01
	-1.61	-0.85						(3.47)**
Union level factories Nov '98	-319.42	-5,827,055.17						0.35
	-1.63	-1.36						(1.86)+
Union level poultry farms Nov '98	161.63	3,654,618.24						-0.2
	-1.31	-1.36						(1.73)+
Union level shops Apr '99	5.7	110,207.52						0
	(2.05)*	(1.82)+						-0.04
Union level traders Apr '99	-5.79	-74,921.25						-0.01
	(1.90)+	-1.13						(2.92)**
Union level factories Apr '99	323.47	5,603,218.71						-0.35
	-1.48	-1.18						(1.65)+

(continued)

Table 14 (continued)

	(1) Y	(2) Y2	(3) Rec.	(4) DVGD	(5) DVGF	(6) DFFW	(7) DFFE	(8) Con. wheat
Union level poultry farms Apr '99	-178.05	-4,241,610.97						0.24
	-1.27	-1.39						(1.79)+
Union level wage Nov '98	8.56	29,349.81						0
	-0.53	-0.08						-0.3
Union level wage Apr '99	-6.35	-124,452.64						0.02
	-0.35	-0.32						-1.03
Female head of household			0.85	1.22	0.51		0.88	
			(3.21)**	(1.92)+	(1.93)+		-1.2	
Log price index: rice								-0.02
								-0.04
Log price index: wheat								-0.31
								-0.49
Log price index: o. cereals								0.17
								-0.78
Log price index: pulses								0.37
								-0.91
Log price index: oil								0.48
								-1.58
Log price index: vegetables								1.08
								(2.72)**
Log price index: meat								0.35
								-1.09
Log price index: eggs								0.01
								-0.04
Log price index: milk								-0.12
								-0.29
Log price index: fruit								0.26
								(1.85)+
Log price index: fish								-0.01
								-0.07
Log price index: spices								0.72
								(1.94)+
Log price index: snacks								-0.07
								-0.3

(continued)

Table 14 (continued)

	(1) Y	(2) Y2	(3) Rec. wheat	(4) DVGD	(5) DVGF	(6) DFFW	(7) DFFE	(8) Con. wheat
Log price index: tea								-0.13
								-0.69
Log price index: prepared food								-0.54
								(1.99)*
Receiving wheat transfers								1.86
								(3.13)**
Lambda 1								-0.72
								(1.98)*
Union level programs Nov '98			0	0	0	0	0	
			(1.92)+	-1.02	-0.17	-0.41	(3.41)**	
Union level emergency prog Nov '98			0	0	0	0	0	
			-1.31	-0.77	-0.29	-0.77	-0.48	
Union level progr ams Apr '99			0	0	0	0	0	
			-0.65	-1.16	(1.73)+	-1.01	(2.93)**	
Union level emergency prog Apr '99			0	0	0	0	0	
			-0.68	-1.38	(2.14)*	-0.52	-1.12	
Moderately flood exposed			0.39	-0.17	0.35	0.06	-0.39	
			(2.40)*	-0.32	(1.99)*	-0.13	-1.03	
Very severely flood exposed			0.4	0.65	0.4	0.24	0.23	
			(2.17)*	-1.03	(2.11)*	-0.5	-0.54	
Severely flood exposed			0.4		0.46	0.34	0	
			(2.39)*		(2.63)**	-0.78	-0.01	
Constant	1,011.80	9,762,194.71	-1.01	-9.02	-1.05	-1.04	-5.9	-4.38
	-0.5	-0.22	(2.81)**	(6.33)**	(2.69)**	-1.29	(3.57)**	(2.21)*
Observations		744	744	739	296	739	414	398 739
R-squared	0.65	0.49						

Notes: Absolute value of t statistics in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%.

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