Deadweight Losses or Gains from In-kind Transfers? Experimental Evidence from India

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Abstract

Are in-kind transfers associated with deadweight losses? To answer this, we conducted an incentivized field experiment in India, which offered low-income households the choice between a free quantity of rice and varying amounts of cash to elicit their willingness to pay for rice. Contrary to expectation, we find evidence of deadweight gain on average, though with a striking contrast between a deadweight loss among respondents from female-headed households and a deadweight gain among respondents from male-headed households. Our results highlight the role of gender differences in bargaining power in shaping the choice between cash or rice.

Keywords: deadweight loss, in-kind transfer, cash transfer, food subsidy, field experiment

JEL codes: C93, D13, I38, J16, Q18

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1. Introduction

Supporting the poor is a central concern of the modern welfare state. There are essentially two ways to provide assistance to those who cannot afford to meet their basic needs. One is to provide basic goods to entitled poor households for free or at a subsidised price. Examples are food or fuel subsidies, free textbooks, and council housing. The other is to support the poor household's income directly with cash payments, which enables the beneficiaries to supply themselves with the goods from the market.

Which one is the better way to support poor households? Orthodox economic theory has a clear favourite. Suppose a household consumes x units of a basic good (say, grains) at a subsidised price p_s which is below the market price p_m. The government thus pays $(p_m - p_s)x$ to facilitate the low price. Now imagine the government cancels the food subsidy and pays the household exactly the same amount in cash. For the government this move would be budget neutral, the same amount is spent in different ways. For the household the new situation is at least as good as the old. It now has to pay the higher market price, but has the means to do so. The household gains, however, an element of choice. It is no longer confined to consume the subsidised good, but can spend the money according to its preferences. A classic win-win situation, as it seems.

The welfare loss that in-kind benefits create is called the deadweight loss. It can be conceptualised in a straightforward way. In the above example the subsidy paid is $(p_m - p_s)x$. As seen above, the household would definitely accept a cash subsidy of $s = (p_m - p_s)x$, since this would enable it to exactly replicate the consumption bundle it had before. Unless the consumption of x is exactly the bundle the household would consume at market prices, it would likely also accept a cash transfer slightly smaller than s. Denote by s^* the cash transfer that makes the household exactly indifferent between a cash transfer of s^* and the option to buy at a subsidised price p_s. The difference between s and s^* is the deadweight loss of the in-kind benefit. This is the extra expense that the government incurs without benefitting the beneficiary.

Given the compelling case against in-kind benefits, why are they still so common? Many reasons can be put forward to explain this phenomenon. Some are paternalistic, e.g. the provision of free textbooks aims to ensure that the children benefit from the subsidy by making it harder for parents to divert an equivalent cash transfer for other purposes. Sometimes equivalent cash transfers are politically unfeasible. While there are other reasons why in-kind benefits are so persistent (Currie and Gahvari, 2008), our focus in this paper is to test the

existence of the deadweight loss of in-kind benefits and quantify its magnitude through an incentivized field experiment. Such measurement of deadweight loss has not received much attention in the literature. Our experiment is located in the context of a mature food subsidy program in India, which has been in operation for decades. We conducted the experiment in selected low-income urban neighbourhoods in the state of Maharashtra, where we offered households the choice between a free quantity of rice and a cash transfer. In an incentive compatible procedure, we elicited the amount of cash the households considered equivalent to the rice. We repeated this procedure monthly over the course of three months. From this data we could then quantitatively calculate the deadweight loss associated with the food subsidy.

The results came as a surprise. Equivalent cash transfers were predominantly *above* the cash value of the rice. Thus, there appeared to be not a deadweight loss, but a deadweight *gain* from in-kind benefits, something that seems theoretically implausible. Granted, the experimental environment was set up against big deadweight losses. The quantity of rice we offered was infra-marginal (i.e., less than the quantity of rice the households were already buying from the market), thus ensuring that the rice offered through the experiment does not generate deadweight losses simply because the households have already met their total rice requirements. We also made sure that transaction costs were the same in both choices, and that quality differences between the subsidised product and the market product could not interfere. However, these factors can at best explain the absence of a deadweight loss, but not a consistent bias in the opposite direction.

To address this puzzle, we abandon the view of the household as a monolithic block with uniform preferences, the traditional view in economic theory (Becker 1981), and turn our attention to the issue of intra-household bargaining (Chiappori 1992, Munro 2018). If the spouse who controls and makes decisions about the subsidised product is not the same as the one who controls the cash, then a bias in favour of in-kind benefits can indeed occur.[1]

We develop a simple model of intra-household bargaining that, in a stylised manner, can explain why decision-makers may have preferences biased towards in-kind benefits. In the typical Indian setting, the woman is often in charge of managing the food supply, while the husband controls the household's finances. An in-kind benefit of rice can thus benefit the wife more directly than a cash transfer. In most households in our experiment, the respondents were

[1] However, we should be careful not to interpret this bias as a welfare-enhancing deadweight gain for the household because such gains only accrue to the decision maker. Any normative evaluation would need to address preference aggregation across all household members.

women who made incentivized choices between free rice and cash transfers. Hence the overall observed bias towards in-kind benefits.

Our study contributes to three main strands of the literature. First, it contributes to the literature on measuring deadweight loss of in-kind transfers or gifts. Using evidence from surveys, Waldfogel (1993), and Principe and Eisenhauer (2009) show that gift giving can lead to a deadweight loss, reflecting the sub-optimal nature of the gift selected by the gift-giver that does not match the recipient's preferences. On the other hand, surveys conducted by Solnick and Hemenway (1996) show evidence of substantial deadweight gain as respondents appreciated the thought that went into choosing a gift. List and Shogren (1998) compare survey-based results with incentivised auctions and report a deadweight loss using surveys and a modest deadweight gain using incentivised methods. Cunha et al. (2019) study the welfare effects of in-kind transfers, operating through a price effect, in the context of a program in Mexico that randomly assigned villages in-kind transfers, equivalently-valued cash, or no transfers. They find that in-kind transfers increased supply of the good in the recipient community, reduced price, and had a substantial (positive) welfare impact on poor villages. In contrast to these studies, our paper takes a different approach. We conduct an incentivised field experiment where households are offered a choice between cash and an in-kind transfer, for different amounts of cash, and the point at which they switch from in-kind to cash allows us to construct a more direct measure of their deadweight loss.

Second, our study connects with the debates around the Public Distribution System (PDS) in India, the world's largest safety net program based on in-kind transfers of highly subsidized food (mainly wheat and rice) with an estimated coverage of about two-thirds of the country's population or nearly 900 million people (Khera and Somanchi 2020). Historically, a major concern with the PDS has been the diversion of subsidized grains to the open market, with the estimates of such "leakage" ranging between 35 and 47 percent of the total grain offtake for 2011-12 (Dreze and Khera 2015, Gulati and Saini 2015, Himanshu and Sen 2013). This has led to calls for reforms to introduce the option of direct cash transfers in lieu of in-kind subsidy (Basu 2011, Muralidharan, Niehaus and Sukhtankar 2019). However, little is known about the potential welfare implications of introducing the choice between cash or in-kind transfers. There is some survey-based evidence on beneficiary preferences when presented with hypothetical choices between cash or in-kind transfers (Khera 2011, 2014; Muralidharan, Niehaus and Sukhtankar 2011) or in the context of pilot programs that rolled out direct cash

transfers to replace subsidized food (Muralidharan, Niehaus and Sukhtankar 2017). However, incentivized experimental evidence on this important policy issue has been lacking.

Third, our paper also advances the research on decision-making within households. Researchers have used observational studies, experimental games and impact evaluations to understand household behaviour. The main themes in this literature revolve around the idea that while many resources are owned and managed jointly by household members and several decisions are made jointly, not all parties necessarily have equal voice in these decisions. Further, households often do not reach efficient outcomes.[2] For instance, for the United States, a higher propensity for food consumption out of food stamps than out of cash income has been explained in terms of intra-household allocations when there are multiple earning members, but only one of them contributes to food spending (Breunig and Dasgupta 2005). Closer to the context of our study, survey evidence suggests that heterogeneity in terms of class, caste, gender and political affiliation can influence preferences for the delivery mechanism of the food support system in India (Khera 2014; Pradhan et al. 2019). In contrast to this literature, we focus on eliciting preferences for in-kind benefits versus cash in male and female headed households to gain an insight into how bargaining power differences influence household choices. We find that, overall, households exhibit a bias towards in-kind benefits as compared to cash. However, in female headed households where the control of cash and control of the subsidised in-kind product rests with the same person, this bias is not observed.

The remainder of the paper is organised as follows. Section 2 presents a simple theoretical framework incorporating the considerations discussed above and the predictions that arise from it. Section 3 describes the experimental design, and section 4 presents the results of the experiment. Section 5 summarises and concludes.

2. Theoretical framework

Consider a household that makes a choice between receiving a cash benefit or the option to buy rice at a subsidised price p_s per unit. The market price is $p_m > p_s$. We assume that the maximum quantity of subsidised rice R_s is smaller than the household's total rice consumption over a given time period, and that the household's demand for rice is perfectly inelastic, i.e. total rice consumption R is fixed. Thus, the subsidy is infra-marginal. We assume that market

[2] For surveys of this literature, see Munro (2018) and Doss and Quisumbing (2020).

rice and subsidised rice are perfect substitutes. This was the case in our experiment since the subsidised rice we offered to the respondents was of comparable quality and sourced from the same local shops where the respondents bought their market rice. In practice, there may be quality differences between government-supplied subsidised rice and market rice, which may be a possible source of a deadweight loss, but this is ruled out by design in our experiment.

The household has a fixed budget of Y in the given time period, say, a month. We assume that in each household, the woman and the man of the household[3] have control over a certain part of the budget, but the woman is responsible for food spending. The woman controls a fraction of αY, hence the man controls $(1-\alpha)Y$. The parameter α reflects the woman's intra-household bargaining power. The expenditure for food is taken from the woman's budget.

The total expenditure for rice is $E_R = p_m R_m + p_s R_s$, where R_m is the quantity of rice purchased on the market, with $R_s + R_m = R$.

If the woman is asked to decide whether to accept a cash transfer T or the option to buy R_s units of subsidised rice at p_s, she seeks to maximise the fraction of the budget she has left after food expenditures, $\alpha Y - E_R$. If she accepts the cash transfer, the total household income increases by T and she must buy all rice at market prices. We assume that the bargaining power parameter α is constant, hence the cash transfer increases her budget by αT. In-kind benefits do not expand her budget αY, but lower the amount she must spend on rice taken from her share. The amount she saves is the price difference between the market rice and the subsidised rice, multiplied by the maximum infra-marginal quantity of rice she can buy (note that since the two varieties are perfect substitutes, there is no reason to buy any less than the maximum quantity). Hence her savings are $(p_m - p_s)R_s$.

When deciding for in-kind benefits or cash transfers, the woman simply compares her savings from the subsidised rice against the budget expansion through a cash transfer. She is indifferent between subsidised rice and a cash transfer if $(p_m - p_s)R_s = \alpha T$. Hence, only if the value of the cash transfer T is greater than $T^* = \frac{p_m - p_s}{\alpha} R_s$, would she prefer cash over subsidized rice, where T^* represents her willingness to pay for subsidized rice. It is obvious that T^* is inversely related to α. Thus, in cases where the woman has lesser (greater) control of the budget, her willingness to pay for subsidized rice is higher (lower), in turn implying a lower (higher)

[3] We use the terms "woman/ man of the household" to refer to the key female or male figure in the household with decision-making authority, though such authority need not be equal.

deadweight loss. This is because the woman realises the full value of the subsidy if she receives subsidised rice, but only a fraction α of it if she accepts the cash transfer.[4] Thus, for instance, in male-headed households where α is low, we could expect a relatively greater preference for rice and a lower deadweight loss or possibly even a deadweight gain, while in female-headed households with a high α, we would expect to observe larger deadweight losses.

3. The Experiment

This section provides details of the sample, the baseline survey, and the experiment. The experiment was conducted in low-income urban neighborhoods (hereafter "slums") of Nashik, a city in the western state of Maharashtra, India. All the questionnaire modules and experiment rounds were designed and implemented using the World Bank's Survey Solution suite of Computer Assisted Personal Interview (CAPI) software system.[5]

To identify the survey slums, we first extracted the list of all the slums in Nashik from the Census of India 2011 and randomly selected 10 slums from that list. For the selection of households in each slum, a two-step procedure was used. First, we conducted a listing operation where approximately 100 households were selected in each slum using a random route method. Thus, for a slum with N total number of households, the surveyors walked around the slum and listed every (100/N)-th household. Table A1 in the Appendix A provides the details of the listing operation. The listing operation provided us with the sample frame for each slum. In addition, the listing operation was designed to help us identify inframarginal households for our final sample selection. This was done by collecting data on the households' monthly purchases of rice from the open market. As discussed below, our experiment involved offering the households a choice between cash and 5 kilos of subsidized rice. The inframarginal households were thus identified as those who bought at least 5 kilograms of rice in the open market. Hence, in the second step of our sampling procedure, 25 households were randomly drawn from the list of inframarginal households in each slum. The resulting 250 households constitute our final sample for the experiment.

[4] If however the man of the household were to make the choice between subsidised rice and cash transfer, the framework predicts that he will always prefer any positive cash transfer over subsidised rice. Choosing the cash option expands his budget by $(1-\alpha)T$, while the subsidised rice option leaves his budget unchanged and only benefits the woman by lowering what she needs to spend for the total quantity of rice R consumed by the household.

[5] Survey Solutions is an open-source software designed and developed by the World Bank that has been used extensively to conduct household surveys around the world.

A baseline survey was conducted prior to the experiment which collected detailed information for sample households, including: household's social group and religion; member characteristics such as age, gender, relationship to the head, marital status, educational attainment, employment status, major source of income and disability if any; details about their dwellings and asset ownership; details about their grain purchases both from the public distribution system and the market; weekly purchase of food items and their prices; details of bank accounts and their usage; and decision-making within the household.

The experiment consisted of three rounds in which households were offered a choice between rice and varying amounts of cash ranging between values both below and above the market value of the rice. At the time of the experiment the going price of rice in the local markets was Rs 32 per kilograms with no significant variation across slums. Hence, in each round of the experiment, a household was offered choices between (the inframarginal amount of) 5 kilograms of rice and nine alternative cash amounts. The choices ranged from the lowest cash value of Rs 50 increasing thereafter in 50 rupee increments up to Rs 400 and a final choice with the highest value of Rs 500. Given the market value of Rs 160 (for 5 kilos of rice), the end points of this range were selected to ensure that there was an unambiguous incentive to choose rice (cash) at the lower (upper) bound. In total, therefore, the households were offered nine choices which correspond to our nine treatments.

As the households were offered increasing cash amounts against 5 kilos of rice, we expect the cash option to become increasingly attractive. Thus, for instance, if a household initially chose rice against, say, Rs 50 or Rs 100 as the cash option, they could be expected to switch to cash when offered sufficiently higher cash amounts. A key aim of the experiment is to identify for each household the switch point where the cash option becomes preferable. This switch point offers us a measure of the household's willingness to pay (WTP) for 5 kilos of rice, and hence a measure of deadweight loss (DWL) as $DWL = 160 - WTP$. It is important to note that the WTP measure is not based on hypothetical scenarios, and is instead derived from household choices that were incentivized in the experiment as described below.

The surveyors were instructed to identify the member who usually made rice purchases for the household and ask that person to participate in the experiment. If such a person was absent, then they were instructed to identify any other adult. Once the respondent was identified, the surveyor read the following statement explaining the experiment to the respondent.

"We will now be asking you to make choices between receiving 5 kilos of rice or receiving different amounts of cash. We will be asking you to make a choice nine times. Each time, we will be asking you to tell us whether you would prefer to get a particular amount of cash or 5 kilos of rice. Please choose carefully because these are not just hypothetical choices. Later, one of these choices will become real when you draw a number from the lottery bag. The number you draw from the bag will tell us which of the nine choices is selected, and that will determine what you will get. For example, if you picked the number 300, then we will look at your preference between 300 rupees and 5 kilos of rice, and if you had chosen 5 kilos of rice, you will get 5 kilos of rice, not 300 rupees. Or instead, if you had chosen 300 rupees, you will get 300 rupees, not 5 kilos of rice. So, your choices will matter to what you can get. Hence, make your choice thoughtfully. So, let's now begin by asking you about your choices. Please note that at the current market price of about Rs 32 per kilo of rice, the value of 5 kilos of rice is about 160 rupees."

After this statement was read out, the respondents were shown the cash and rice choices one by one on the tablet. Figure 1 presents an example of the choice question shown to the respondent. Once all the choices were made, the respondent was asked to draw a chit from a bag, which contained nine chits bearing one of the nine cash amounts. For example, if the respondent drew a chit with number 250 printed on it and for the choice option of Rs 250 versus rice the respondent had chosen rice, then the respondent was given a voucher for 5 kilos of rice; otherwise, they were given a voucher for Rs 250.

Figure 1. Snapshot of the choice question

The image shows a sack of 5 kilograms of rice and 400 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

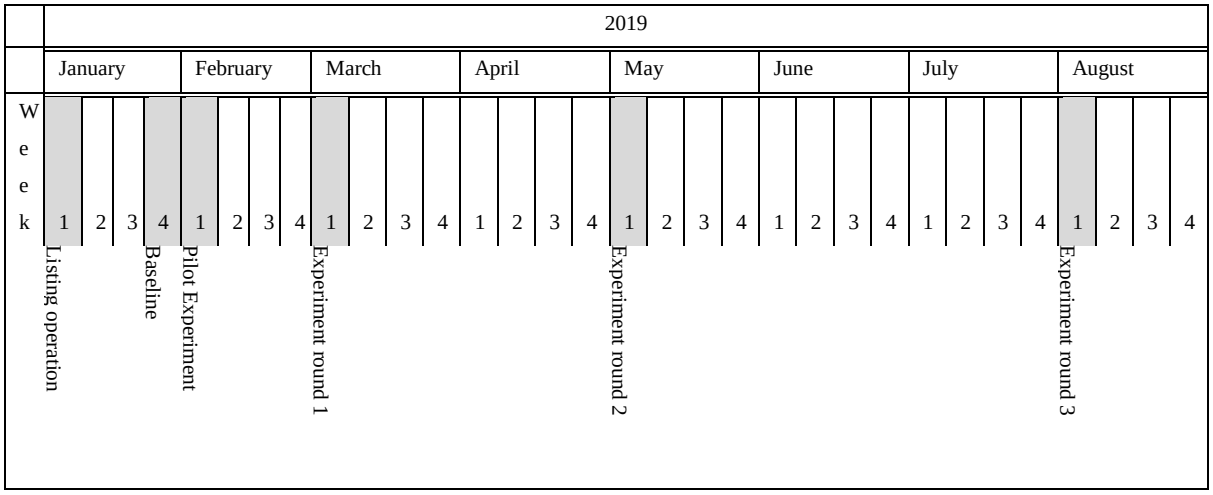
Select one of the two options listed below	SINGLE-SELECT ch400 01 ○ I want 5 kilogram rice 02 ○ I want 400 rupees

Notably, to rule out the influence of transaction costs on households' choices of rice or cash, households were given a voucher for both rice and cash. The households could redeem their vouchers at their slum's local shopkeeper. One shopkeeper per slum was selected and assigned the task of disbursing rice and cash to the selected households. The shopkeepers were instructed to first match the voucher number in the household list that we provided to them, and then

distribute cash or grain as indicated on the voucher. Figure A1 shows images of the vouchers and the surveyors interviewing the households using the tablet.[6]

The timeline of the experiment is presented in Figure 2. The listing operation was completed and the final sample was selected by the second week of January 2019. A baseline survey was completed in the last week of January 2019. We conducted a pilot of the experiment in the first week of February 2019, and the experiment procedures were revised based on the experience with the pilot. Three rounds of the experiment were conducted in March, May and August 2019 respectively.

Figure 2. Timeline of the experiment



4. Results

Table A2 presents the descriptive statistics of our sample from the baseline survey. For nearly 90% of the households, the respondents were female. This is as expected since our experiment targeted adult members responsible for rice purchases who are mostly women in our setting. The average age of respondents was 37 years, and 26% of the households were female-headed. The Table also shows that the households' consumption of PDS rice is far less than their total rice consumption, and their consumption of market rice is well above the 5 kilos of rice offered in the experiment, thus confirming the infra-marginality of the rice offer.

Table 1 presents the distribution of households' choices against each of the cash amounts pooled over all three rounds. As expected, at higher cash amounts, a greater proportion of

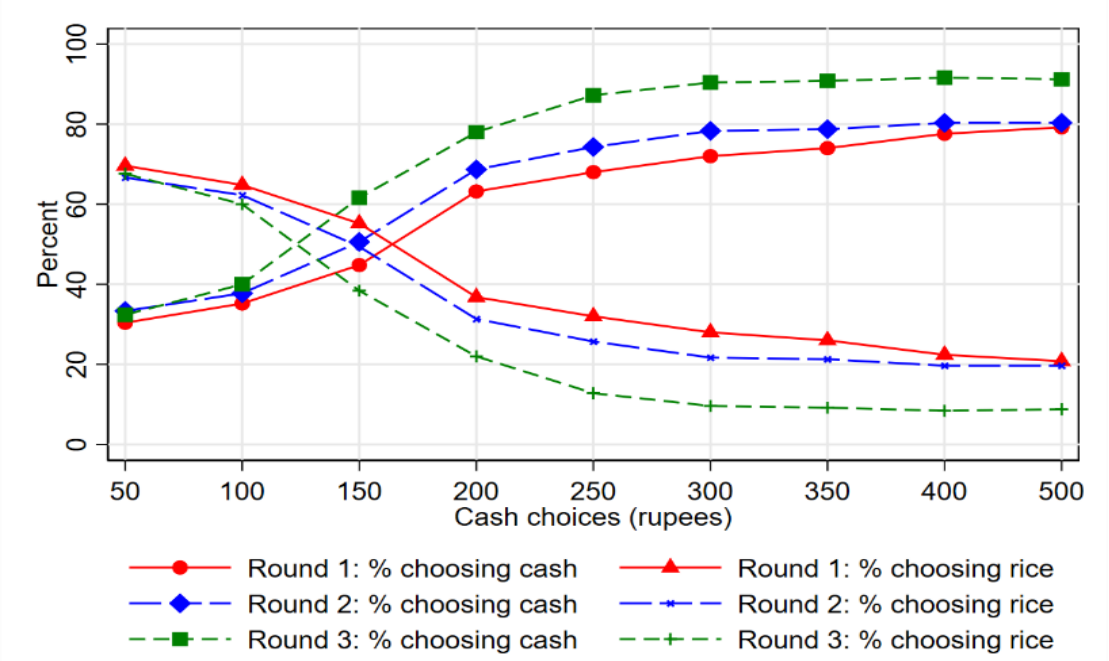
[6] The full set of experimental instructions are shown in Appendix B.

households opt for cash rather than rice, ranging from 32% choosing cash when offered the minimum amount of Rs 50 to about 84% when offered the maximum of Rs 500. This pattern holds for all three rounds (Figure 3).

Table 1: Percentage of households choosing rice for each cash choice, pooled across rounds

Cash choices (Rs)	50	100	150	200	250	300	350	400	500
% of households choosing cash over rice	32.0	37.7	52.3	70.0	76.5	80.2	81.2	83.2	83.6

Figure 3. Percentage of households choosing cash or rice against each cash amount across the three rounds



Based on the type of choices made by respondents, we can distinguish three types of households: first, the "single-switch households" as those who made a single switch from rice to cash as higher cash amounts were offered; second, "rice-only households" as those who chose rice for all nine cash amounts offered; and third, "cash-only households" as those who always chose cash. There were also a small number of households (3.5% of the pooled sample) who switched multiple times between rice and cash. Multiple switches are hard to interpret and hence we exclude these households from our analysis. Thus, our final pooled sample consists of a panel with 723 observations (232, 246 and 245 households from rounds 1, 2 and 3 respectively). The proportions of single-switch, rice-only and cash-only households in the final pooled sample are 52, 15 and 33 percent respectively (Table 2).

Table 2. Number and percentage of cases for each type of household

Type	Round 1		Round 2		Round 3		Combined	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Single-switch	113	45.2 (48.7)	117	47.0 (47.6)	147	58.8 (60.0)	377	50.3 (52.1)
Rice-only	45	18.0 (19.4)	46	18.5 (18.7)	19	7.6 (7.8)	110	14.7 (15.2)
Cash-only	74	29.6 (31.9)	83	32.9 (33.7)	79	31.6 (32.2)	235	31.4 (32.5)
>1 switch	18	7.2	3	1.2	5	2.0	26	3.5
Total	250	(100)	249	(100)	250	(100)	749	(100)
Final sample	232	92.8	246	98.8	245	98.0	723	96.5

Note: The figures in parentheses are percentages of the final sample. The final sample excludes multiple-switch households.

While WTP is in principle a continuous variable that cannot be elicited in an experiment with a finite number of treatments, our experiment allows us to observe an interval containing the WTP. For example, if a single-switch household opted for rice at Rs 100 but switched to cash at Rs 150, then its WTP lies in the switch interval [100, 150]. On the other hand, for rice-only households, their WTP is bounded below by Rs 500. Similarly, the WTP for cash-only households is bounded above by Rs 50. We thus construct our measure of WTP for the three types of households as follows: we approximate the WTP for single-switch households as the midpoint of their switch interval; for rice-only households, we assume their WTP to be Rs 550; and the WTP for cash-only households is assumed to be Rs 25. The deadweight loss for a household can then be defined as

$$DWL = \begin{cases} (160 - WTP) & \text{if single switch} \\ (160 - 550) & \text{if rice only} \\ (160 - 25) & \text{if cash only} \end{cases}$$

where Rs 160 is the market value of 5 kilograms of rice. The deadweight loss is thus not necessarily always positive, and a negative value of DWL indicates that the household's willingness to pay for rice exceeds its market value.

Table 3 presents the estimates of WTP and DWL by household type. By construction, DWL for cash-only households is positive and that for rice-only households is negative. It also turns out that cash-only households account for more than twice as many cases as rice-only households. However, since the positive DWL for the former (135) is dominated by the negative DWL for the latter (-390), the combined average DWL for these two types of non-

switching households is notably negative. A more striking result is that the average DWL for single-switch households is also negative. This further implies that for our sample as a whole, the average DWL is negative, i.e., a deadweight gain overall.

Table 3. Willingness to Pay (WTP) and Deadweight Loss (DWL) by household type

Household type	Switch interval (Rs)	WTP (Rs)	DWL (Rs)	Number of cases	Percent of cases
Cash-only	<50	25	135	236	32.6
Single-switch	50-100	75	85	40	5.5
	100-150	125	35	110	15.2
	150-200	175	-15	121	16.7
	200-250	225	-65	51	7.1
	250-300	275	-115	28	3.9
	300-350	325	-165	10	1.4
	350-400	375	-215	12	1.7
	400-500	450	-290	5	0.7
Rice-only	>500	550	-390	110	15.2
Average/Total for single-switch		178	-18	377	52.2
Average/Total for all types		185	-25	723	100

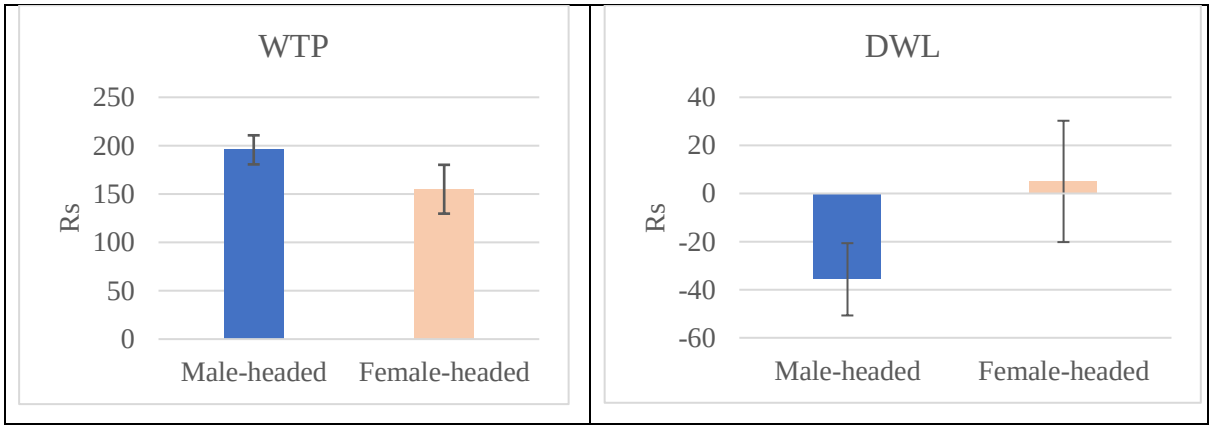
Note: We define willingness to pay (WTP) for rice for a household as the midpoint of the cash choice interval at which the respondent switched to cash from rice. The deadweight loss for household i is defined as $DWL_i = 160 - WTP_i$ where 160 rupees is the market value of 5 kilograms of rice. Households with multiple switches are not included. For rice-only households, we assume their WTP to be Rs 550. For cash-only households, we assume their WTP to be Rs 25.

The prevalence of deadweight gain is widespread in our sample and is observed for about 47% of all cases. A priori, this result appears puzzling. However, as outlined in our theoretical framework in section 2, gender differentials in control over household budget could offer a potential explanation. According to this framework, the choice between rice or cash will depend on intra-household bargaining power (α), i.e., how much of the household budget is controlled by the woman of the household. A prediction from the framework is that in the case where the woman is in control of the whole budget, she would choose cash over rice so long as the cash transfer amount is at least as high as the value of the subsidised rice. By comparison, in a household where the woman has only partial control over the budget, she would prefer cash over rice only when the cash transfer amount is higher than the value of subsidized rice by a margin high enough to compensate for her limited control over the budget. Effectively,

this implies that we should observe a relative preference for cash that is increasing in the woman's degree of control over the household budget.

An indicator for gender differentials in control over household budget that we can identify in our data is the gender of the head of the household. We would expect female-headed household to have a relative preference for cash over rice. This is indeed what we find in Figure 4, which shows that female-headed households have a significantly lower WTP for rice (Rs 155 as against Rs 196; *p*-value=0.006), i.e., a relatively greater preference for cash than male-headed households. As a result, in contrast to a deadweight loss for female-headed households on average of Rs 5 (3% of the value of subsidized rice), we observe a deadweight *gain* for male-headed households of Rs 36 (22% of the value of subsidized rice). This finding is consistent with survey-based evidence from Muralidharan, Niehaus and Sukhantar (2011), who report that the minimum value of cash for which respondents were willing to forgo their food ration was higher, on average, than the value of the food subsidy that they were receiving,

Figure 4. Willingness to Pay (WTP) and Deadweight Loss (DWL) by the gender of household head (Rs)



The next two subsections report our detailed results on the respondents' choice between cash or rice and the implications for deadweight loss.

4.1 Cash-or-rice?

We utilize the full dataset related to household choices for all the nine cash options across the three rounds to estimate the following model:

$$Y_{cist} = \beta_c + \gamma Female\_head_{is} + X_{is}\delta + \theta_s + \mu_t + v_i + w_{ist} \qquad (1)$$

where subscript c denotes the cash option, i denotes the household, s denotes the slum and t denotes the round of the experiment. Y is a binary variable which equals 1 if the respondent chose cash instead of rice, and 0 otherwise. β_c are the parameters for the nine cash options representing the marginal effects on the probability of choosing cash as the amount of cash offered increases. $Female\_head$ is a binary variable representing female headship of the household, while X is a vector of respondent and household controls at baseline. θ_s and μ_t represent slum and round effects respectively. v_i represent random effects for each household and w_{ist} is the white-noise error term of the regression. Equation (1) is estimated using the random effects estimator. Our parameters of interest are β_c and γ. We expect β_c to be increasing in the cash amounts offered as the rice option becomes progressively less attractive. Further, in line with the foregoing discussion, we expect households with female heads to have a higher probability of choosing cash (i.e., $\gamma > 0$).

The first two columns of Table 4 report the estimates of equation (1). Column (1) presents estimates of β_c without any covariates, and essentially reproduces the findings in Table 1. Consistent with expectation, relative to the reference cash offer of Rs 50, all β_c's are positive, significant, and increase montonically as the cash offer increases. Column (2) introduces female headship; the associated parameter γ is found to be positive and statistically significant. Female headship increases the probability of choosing cash by 8 percentage points. Insofar as women's bargaining power is likely to be higher in female-headed households relative to male-headed households, this result is in line with our theoretical framework which predicts that with a greater control of the household budget women are more likely to prefer cash.

Table 4. Random effects linear probability model of choice between cash and rice options

Dependent Variable: 1 if household chose cash, 0 if they chose rice	(1)	(2)	(3)	(4)	(5)
Cash 100	0.06***	0.06***			
	(0.01)	(0.01)			
Cash 150	0.21***	0.21***			
	(0.02)	(0.02)			
Cash 200	0.37***	0.37***			
	(0.02)	(0.02)			
Cash 250	0.45***	0.45***			
	(0.02)	(0.02)			
Cash 300	0.48***	0.48***			
	(0.02)	(0.02)			
Cash 350	0.50***	0.50***			
	(0.02)	(0.02)			

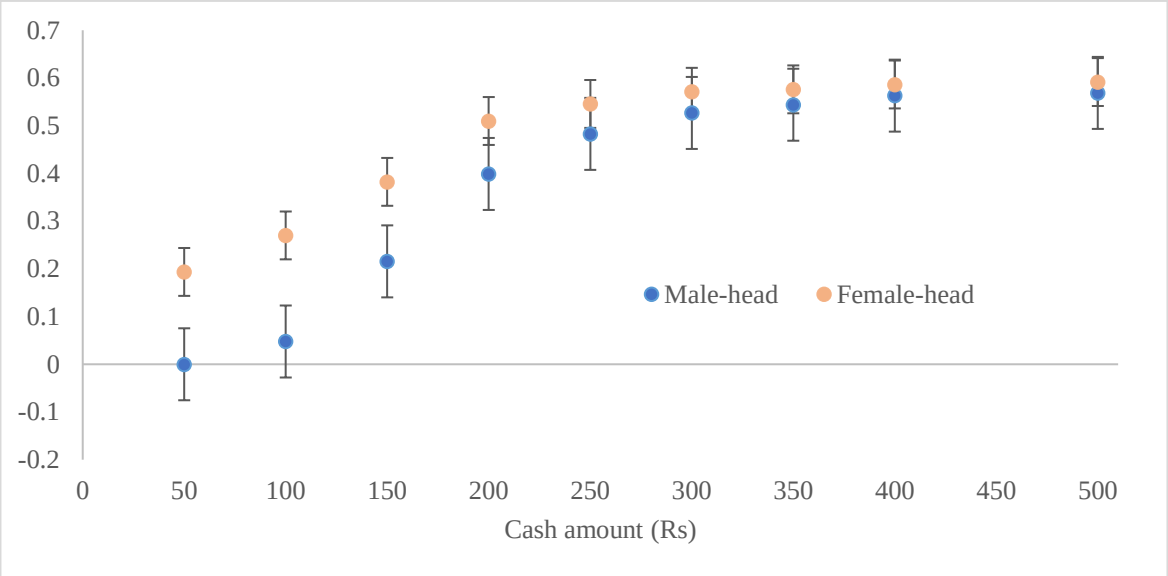
Cash 400	0.51***	0.51***			
	(0.02)	(0.02)			
Cash 500	0.52***	0.52***			
	(0.02)	(0.02)			
=1 if female head 0 otherwise		0.08**			
		(0.04)			
Male head # Cash 100			0.05***	0.05***	0.05***
			(0.01)	(0.01)	(0.01)
Male head # Cash 150			0.21***	0.21***	0.22***
			(0.02)	(0.02)	(0.02)
Male head # Cash 200			0.40***	0.40***	0.40***
			(0.03)	(0.03)	(0.03)
Male head # Cash 250			0.48***	0.48***	0.48***
			(0.03)	(0.03)	(0.03)
Male head # Cash 300			0.52***	0.52***	0.53***
			(0.03)	(0.03)	(0.03)
Male head # Cash 350			0.54***	0.54***	0.54***
			(0.03)	(0.03)	(0.03)
Male head # Cash 400			0.56***	0.56***	0.56***
			(0.03)	(0.03)	(0.03)
Male head # Cash 500			0.56***	0.56***	0.57***
			(0.03)	(0.03)	(0.03)
Female head # Cash 50			0.18***	0.18***	0.18***
			(0.05)	(0.05)	(0.05)
Female head # Cash 100			0.25***	0.26***	0.25***
			(0.05)	(0.05)	(0.05)
Female head # Cash 150			0.37***	0.37***	0.37***
			(0.05)	(0.05)	(0.05)
Female head # Cash 200			0.49***	0.50***	0.49***
			(0.04)	(0.05)	(0.05)
Female head # Cash 250			0.53***	0.53***	0.53***
			(0.04)	(0.04)	(0.05)
Female head # Cash 300			0.56***	0.56***	0.56***
			(0.04)	(0.04)	(0.04)
Female head # Cash 350			0.56***	0.56***	0.56***
			(0.04)	(0.04)	(0.04)
Female head # Cash 400			0.57***	0.57***	0.57***
			(0.04)	(0.04)	(0.05)
Female head # Cash 500			0.58***	0.58***	0.58***
			(0.04)	(0.04)	(0.04)
=1 if respondent female 0 otherwise				-0.04	-0.04
				(0.05)	(0.05)
=1 if female used voucher 0 otherwise				0.01	0.01
				(0.04)	(0.04)
Round 2	0.05*	0.05*	0.05*	0.05*	0.05*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Round 3	0.13***	0.13***	0.13***	0.13***	0.12***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Constant	0.19***	0.19***	0.16***	0.19***	0.12
	(0.04)	(0.04)	(0.04)	(0.06)	(0.13)
Slum effects	Yes	Yes	Yes	Yes	Yes
Respondent/household-level controls	No	No	No	No	Yes
N	6507	6507	6507	6507	6480

R^2	0.20	0.21	0.21	0.21	0.22

Note: * p<0.10, ** p<0.05. *** p<0.01. Standard errors in parentheses are clustered at the household level. Respondent/household-level controls include: age of the respondent, binary variable =1 if the respondent is Hindu, binary variable =1 if the respondent belongs to a scheduled caste or scheduled tribe, proportion of literate members in the household, dependency ratio, the count of household assets, baseline monthly per capita expenditure of the household, binary variable =1 if the household owns their house, and binary variable =1 if the household has a ration card.

This finding on the significance of female headship for the choice between cash or rice also suggests the possibility that the marginal effect of female headship varies by the amount of cash offered. Column (3) explores this by interacting the cash options with female/male headship. The results show that while β_c is increasing in the cash amount for both male and female-headed households, notably β_c for female-headed households is higher at every cash option. The difference in the marginal effects is larger at lower cash offers and gradually reduces as cash offers increase, with the marginal effects eventually converging across male and female-headed households. For instance, the difference in marginal effects is about 18-20 percentage points at cash 50-cash 100, and it falls to 1-2 percentage points at cash 400-cash 500. Testing for statistical significance, we find that the marginal effects for female-headed households remain significantly higher up to cash 200, but not thereafter (Figure 5). Column (4) further controls for whether the respondent was female and whether a female household member redeemed the voucher, while column (5) introduces additional controls for a number of baseline characteristics of the respondent (age, caste and religion) and the household (proportion of literate members, dependency ratio, the count of assets, monthly per capita expenditure, house ownership, and whether the household has a ration card). These additional controls turn out to be insignificant, and our parameters of interest remain unchanged both in magnitude and significance.

Figure 5: Marginal effects of the cash amount on the probability of choosing cash for male- and female-headed households



Note: Based on parameter estimates reported in column (5) of Table 4.

Our main findings thus indicate that women in male-headed households (in light of their lower bargaining power) are more likely to choose rice than women in female-headed households so long as the difference between the market value of rice and the cash offer is not too large. When subject to conditions of lower bargaining power, women are willing to forgo a certain amount of cash as a strategy to protect their share of the household budget. This is the basis of the deadweight gain we observe in our experiment.

In all specifications, we also control for round effects, and find that the probability of choosing cash increases in later rounds. This is consistent with survey-based evidence of an increasing preference for cash over time observed by Muralidharan, Niehaus and Sukhantar (2017) for a pilot program, which introduced cash transfers in lieu of food rations, in three Union Territories of India. They find that while initially 39% of beneficiaries preferred cash over food, by the end of their year-long survey this rose to 65%. This likely reflects the respondents' increasing confidence and familiarity with the new cash alternative.

4.2 Deadweight loss or gain?

We now take a closer look at the deadweight loss or gain for households estimated from their willingness to pay for rice using information on the switch points or their rice-only or cash-

only choices, as explained above. Thus, we now use one data point per household per round to estimate the following model:

$$DWL_{ist} = \gamma^{DWL} Female\_head_{is} + X_{is}\delta^{DWL} + \theta_s^{DWL} + \mu_t^{DWL} + v_i^{DWL} + w_{ist}^{DWL} \qquad (2)$$

where DWL_{ist} is the deadweight loss for household i in slum s in round t, and the other parameters and variables are analogous to equation (1). Our parameter of interest again is that for $Female\_head$, which we expect to be positive in light of the foregoing discussion.

Columns (1) to (3) of Table 5 present random effects estimates of equation (2) with varying sets of controls as in Table 4. Consistent with what we noted above in Figure 4, in all these specifications of DWL, female headship is positive and highly significant. For the specification with the full set of controls (column 3), we find that female headship increases DWL by Rs 43, or about 27% of the market value of 5 kilos of rice. Put differently, relative to female-headed households, women in male-headed households put a 27% premium on subsidized rice.

Table 5: Regressions of deadweight loss

	RE				RE Interval
Dependent Variable: Deadweight loss	(1)	(2)	(3)	(4)	(5)
=1 if female head 0 otherwise	48.05**	45.93**	43.11**	50.56**	82.39***
	(20.00)	(20.52)	(20.57)	(25.10)	(31.60)
=1 if respondent female 0 otherwise		17.61	18.43	24.63	32.05
		(26.94)	(27.42)	(33.42)	(38.39)
=1 if female used voucher 0 otherwise		0.78	1.24	-0.44	5.21
		(19.77)	(19.97)	(24.22)	(29.34)
Round 2	19.34	18.98	19.80	21.52	28.31
	(14.02)	(14.20)	(14.41)	(17.59)	(21.74)
Round 3	65.30***	65.61***	64.79***	76.30***	81.03***
	(13.83)	(14.04)	(14.10)	(17.21)	(21.69)
Constant	-86.69***	-104.38***	-151.44**	-176.43**	-243.96**
	(18.38)	(28.68)	(67.46)	(82.06)	(106.54)
Slum effects	Yes	Yes	Yes	Yes	Yes
Respondent/household-level controls	No	No	Yes	Yes	Yes
N	723	723	720	720	720
R^2	0.08	0.08	0.09	0.09	n.a.

Note: * p<0.10, ** p<0.05. *** p<0.01. Standard errors in parentheses are clustered at the household level. Respondent/household-level controls include: age of the respondent, binary variable =1 if the respondent is Hindu, binary variable =1 if the respondent belongs to a scheduled caste or scheduled tribe, proportion of literate members in the household, dependency ratio, the count of household assets, baseline monthly per capita expenditure of the household, binary variable =1 if the household owns their house, and binary variable =1 if the household has a ration card. RE refers to random effects estimates; RE Interval refers to estimates from random effects interval regression. Column (4) uses a WTP of zero for cash-only households and Rs 650 for rice-only households.

Table 5 reports two additional specifications which explore the robustness of these results to how the DWL measure is constructed in our experiment. First, recognizing that the measures of WTP and DWL are not well-defined for the cash-only and rice-only households, in column (4), as a robustness check, we set the WTP (for rice) for the former at zero, and that for the latter at Rs 650 (about four times the market value of 5 kilos rice). Second, we go further in recognizing the discrete nature of all the cash options in our experiment that allow us to observe only an interval for WTP and DWL, and hence estimate equation (2) using a random effects interval regression estimator in column (5) (Stewart 1983; McDonald, Stoddard and Walton 2018). In both columns (4) and (5), female headship continues to be positive and highly significant. The point estimates are larger than in column (3), indicating a 32-51% premium on rice among respondents in male-headed households.

The results in sections 4.1 and 4.2 highlight the role of women's bargaining power in how households may choose between cash and in-kind transfers. When those who make this choice have limited bargaining power over the household budget, their preference and willingness to pay for in-kind transfer is higher. Within our theoretical framework, it is possible to infer the implicit bargaining power of women (α) from the revealed switch points from rice to cash, as the standardized ratio of the market value of rice to WTP (i.e., $160/WTP$). For single-switch households, the average value of α is 0.4. As expected, the average α for female-headed households (0.47) is significantly higher than that for male-headed households (0.38) with a *p*-value of 0.007 for the difference.

5 Conclusion

Despite a significant interest amongst researchers and policymakers in understanding the relative merits of cash vs in-kind transfers, behavioral evidence on recipients' choices between these options and their underlying drivers remains scant. Our study fills this gap by designing an incentivized experiment which investigates this issue in the context of the world's largest food subsidy program in India. The experiment offered respondents, mostly women in our setting, a choice between varying amounts of cash and a fixed quantity of rice. The revealed choices are then used to construct estimates of the recipients' willingness to pay for rice and hence the associated deadweight loss.

Contrary to standard theory, instead of a deadweight loss of in-kind transfers, we find evidence of deadweight gain on average in our experimental data. While this may appear puzzling, our

data reveal a striking contrast between respondents from male- and female-headed households, which sheds light on the underlying role of gender differences in bargaining power in influencing respondent choices. We find that the overall deadweight gain is the consequence of a deadweight loss among respondents in female-headed households and a deadweight gain among those in male-headed households. Given that most households are male-headed, the deadweight gain dominates.

Our results suggest that deadweight gains from in-kind transfers can arise in contexts where bargaining power considerations are salient. Most welfare programs are designed to provide either only cash or only in-kind transfers. The existence of deadweight gains associated with in-kind transfers as in our experiment does not necessarily imply that in-kind transfers are the preferred policy option. Rather, a key policy insight of our study is that there is a strong case for offering respondents a choice between cash or kind. The offer of such a choice can be important for those with weaker bargaining power to sustain a measure of control over the household budget.

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Appendix A

Table A1. Listing operation sample

Code	Slum	Household population census 2011	Number of households listed
1	Lekha Nagar (CIDCO)	307	81
2	Indira Gandhi Nagar (Upnagar, Nasik Road)	457	103
3	Sant Kabir Nagar (Dwarka Poona Road)	252	102
4	Rahul Nagar (Golfclub, West)	133	93
5	Sahjeevan Nagar (Ganesh Wadi, Panchavati)	147	111
6	P. C. Tolls Prabudha Nagar (Mahindra Front Satpur)	1333	100
7	Sant Kabir Nagar (Canal Satpur Bhosala)	767	99
8	Kolivada (Nashik East)	208	101
9	Mahatma Phule Nagar (Peth Road, Panchavati)	1985	101
10	Wadarvadi, Nagar (Phule Nagar)	155	100
	Total	5744	991

Figure A1. Vouchers for cash and rice and the surveyors interviewing households

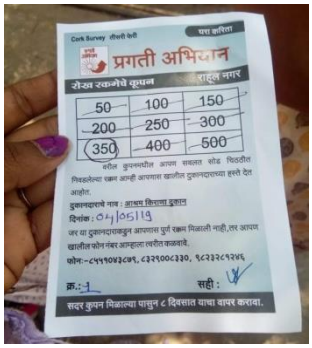

Table A2. Summary statistics for sample households

Variable	Mean	SD
Female respondent	0.89	0.32
Age of the respondent	37	12
Female head	0.26	0.44
Total household consumption of rice per month (kg.)	17.33	16.18
Household consumption of PDS rice per month (kg.)	4.93	4.41
Household consumption of market rice per month (kg.)	12.38	15.75
Proportion of literate members	0.70	0.21
Dependency ratio	0.69	0.61
Social group: scheduled castes	0.50	0.50
Social group: scheduled tribes	0.14	0.34
Social group: other backward castes	0.31	0.46
Social group: general	0.05	0.21
Religion: Hindu	0.65	0.48
Owned house	0.84	0.37
Ration card	0.82	0.38
Asset count	7.11	2.50
Monthly per capita consumption expenditure (Rs)	1932	760
Female respondent used the voucher	0.46	0.50

Appendix B (supplementary online material)

Experimental instructions

STATIC TEXT

We will nowbe asking you to make choices between getting 5 kilos of rice or getting different amounts of cash. We will be asking you to make a choice nine times. Each time, we will be asking you to tell us whether you would prefer to get a particular amount of cash or 5 kilos of rice.

Please choose carefully because these are not just hypothetical choices. Later, one of these choices will become real when you drawa number from the lottery bag. The number you drawfrom the bag will tell us which of the nine choices is selected, and that will determine what you will get. For example, if you picked the number 300, then we will look at your preference between 300 rupees and 5 kilos of rice, and if you had chosen 5 kilos of rice, you will get 5 kilos of rice, not 300 rupees. Or instead, if you had chosen 300 rupees, you will get 300 rupees, not 5 kilos of rice.

So, your choices will matter to what you can get. So, please choose thoughtfully. So, let's nowbegin with asking you about your choices. Please note that at the current market price of about Rs. 32 per kilo of rice, the value of 5 kilos of rice is about 160 rupees.

CHOICE 500

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 500 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT ch500 01 ○ I want 5 kilogram rice 02 ○ I want 500 rupees

CHOICE 400

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 400 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT 01 ○ I want 5 kilogram rice 02 ○ I want 400 rupees	ch400

[C] EXPERIMENT
CHOICE 350

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 350 rupess in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT 01 ○ I want 5 kilogram rice 02 ○ I want 350 rupees	ch350

[C] EXPERIMENT
CHOICE 300

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 300 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT 01 ○ I want 5 kilogram rice 02 ○ I want 300 rupees	ch300

CHOICE 250

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 250 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT ch250 01 ○ I want 5 kilogram rice 02 ○ I want 250 rupees

[C] EXPERIMENT
CHOICE 200

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 200 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT ch200 01 ○ I want 5 kilogram rice 02 ○ I want 200 rupees

[C] EXPERIMENT
CHOICE 150

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 150 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT ch150 01 ○ I want 5 kilogram rice 02 ○ I want 150 rupees

CHOICE 100

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 100 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT 01 ○ I want 5 kilogram rice 02 ○ I want 100 rupees	ch100

[C] EXPERIMENT

CHOICE 50

STATIC TEXT

The image shows a sack of 5 kilograms of rice and 50 rupees in cash. Please look at the two images carefully and tell us which one do you choose.

Select one of the two options listed below	SINGLE-SELECT 01 ○ I want 5 kilogram rice 02 ○ I want 50 rupees	ch50

STATIC TEXT

Nowwe will drawa chit

What number came up in the lottery?	NUMERIC: INTEGER |----------	lottery
The lottery resulted in	SINGLE-SELECT 01 ○ Cash 02 ○ Rice	lotteryresult

What is the primary reason for choosing cash? E `lotteryresult==1`	SINGLE-SELECT `choicecsh` 01 ○ I chose cash because the cash amount is more than the value of 5 kilos of rice 02 ○ I chose cash because already have rice at home 03 ○ I chose cash because I can use it to buy other things or rice itself 04 ○ I chose cash because I can use it to buy a different quality of rice 05 ○ Others
What is the primary reason for choosing rice? E `lotteryresult==2`	SINGLE-SELECT `choicerice` 01 ○ I chose rice because the cash amount is less than the value of 5 kilos of rice 02 ○ I chose rice because cash will get spent on less useful things than rice 03 ○ I chose rice because we are running short of rice 04 ○ I chose rice because it is hard to control how cash will get spent 05 ○ Others
Who will go to the shop to collect cash/rice?	SINGLE-SELECT `shpcollect2` 01 ○ Me 02 ○ My husband 03 ○ My wife 04 ○ Other male family member 05 ○ Other female family member
In the last experiment, what did you win?	SINGLE-SELECT `lastoutcome` 01 ○ Cash 02 ○ Rice
In the last round, who went to the shop to collect cash/rice?	SINGLE-SELECT `shpcollect1` 01 ○ Me 02 ○ My husband 03 ○ My wife 04 ○ Other male family member 05 ○ Other female family member