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Does Women's Status Matter for Food Security? Evidence from Bangladesh

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Abstract

Using data from a survey of Bangladeshi households, this paper investigates the link between female status and food security. Employing three different indicators of female status – husband's and wife's assets brought at marriage, female share of household income and a composite index of women empowerment, the paper finds evidence of women's status influencing food security. By raising the level of food security for some disadvantaged women's groups female status is also found to be instrumental in mitigating the extent of gender-based within-household discrimination. The findings reveal that inferences drawn about food security by observing the changes in various non-food budget shares could be misleading or overemphasized.

Keywords: food security, women's status, intra-household distribution, gender discrimination, Bangladesh

JEL classification: D13, D63, I0, O53

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1 Introduction

Food security means '[A]ccess by all people at all times to enough food for an active and healthy life. Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods, and (2) an assured ability to acquire acceptable foods in socially acceptable ways (for example, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies)'.[1] Lack of food security is generally thought to be linked to insufficient household resources. This notion rules out the possibility of uneven levels of food security amongst individual members within a household. However, there is a large body of evidence to suggest that, by influencing household decisions, intra-household relations have significant bearings upon households' resource allocation in different activities and welfare of individual members. This in essence would imply that the allocation of household resources on different goods (including food items) and services as well as their distribution amongst members would at least be partly influenced by intra-household resource allocation mechanism. Therefore, it has often been contemplated that a change in the intra-household decision making mechanism will change the distributional outcomes, and particularly women's greater role in decision-making is considered to be a determinant of these changes. Since in a patriarchy like Bangladesh, the resource allocating decisions are usually undertaken by males, improved women's status may alter the household behaviour in this regard. But will this shift in within-household decision making power influence the household resource allocating outcomes in a way to improve food security? This is the question that has been attempted to answer in this paper.

Examining the link between female's within-household status and food security will require one to look into the intra-household resource allocation behaviour. In economics, there are contrasting suppositions with reference to household members' resource sharing out behaviour. The unitary or common preference model, credited to Becker (1965, 1981), assumes a single preference for each household irrespective of the number, and gender and sex composition of members the family embodies. The collective model, by contrast, acknowledges the existence of multiple decision makers, and consequently the resource share reflects the relative bargaining power of the individual. Following the common preference model, intra-household distribution is unaltered by changes in women's status. On the contrary, in the collective models intra-household allocation is an outcome of bargaining, which thus recognizes the role of women's status. Testing the validity of the unitary and collective models and the subsequent implications for intra-household resource allocation has been documented by a growing body of literature.

The evidence emerging out of a very large number of studies on the whole seems to suggest that women's control over resources may imply more resources allocated to basic needs (such as food), and children, contributing to children's well-being. These studies have been undertaken under many different contexts. Therefore, while in the UK a policy change transferring child allowances to mothers is shown to have had the impact of raising the expenditure on children's clothing relative to that of fathers (Lundberg et al. 1997), in Brazil an increase in mothers' unearned income is found to

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[1] This definition was published in 1990 by the Life Sciences Research Office (LSRO) of the Federation of Americal Societies for Experimental Biology (cited in Bickel et al. 2000).

have a higher positive influence on family health outcomes including the child survival probabilities, when compared to the effect of a rise in the same income due to fathers (Thomas 1990, 1996). Similarly, the studies by von Braun et al. (1991), Handa (1996), Schultz (1990), Doan and Bisharat (1990), and Castle (1995) have shown the importance of mothers' status for their children's nutritional status in Rwanda, Jamaica, Thailand, Jordan and Malawi, respectively. Using micro data from a big sample of Taiwanese households, Thomas and Chen (1993) find the significant impact of women's income share, both earned as well as non-earned, on the family budget allocated to staples, alcohol, cigarettes, and education, which is also confirmed by Hoddinott and Haddad's (1995) results from the Côte d'Ivoire. For the Philippines, Garcia (1991) offers the evidence of female income share being positively and significantly associated with household-level calorie availability and preschoolers' weight-for-age, and negatively with the probability of preschooler's suffering from such diseases as fever and diarrhea. For Guatemala, Engle (1991) reveals significant positive relationship between the mother's share of family earnings and children's health status as measured by height-for-age, weight-for-age, and weight-for-height. For Pakistan, Guha-Khasnobis and Hazarika (2005) analyse the impact that women's within-household status have upon children's food security and reveal a positive association. By comparing the gender of household heads, studies have also found evidence to draw inference about female headed households' better food security status. For example, Levin et al. (1999) show that female-headed households are spending more on basic goods, particularly food and health services and less on leisure, which is again corroborated by Lloyd and Gage-Brandon's (1993) finding of households with a woman as the primary head to spend the highest on food consumption.

In the context of Bangladesh as well, there is evidence of women's status playing an important role in the composition of household expenditures and health outcomes of children. While Quisumbing and Maluccio (2003) find the relative bargaining power of women in Bangladeshi households having significantly different impacts on different types of expenditure, Quisumbing and Brière (2000) observe a greater propensity of allocation in favour of children's clothing and education out of the resources controlled by women.[2] Turning to children's health outcomes, Pitt and Khandaker (1998) and Khandaker et al. (2003) show that the increased resources in the hands of women, due to borrowing from the non-government organizations (NGOs), contribute to improving the anthropometric measures for children.

Despite the above evidence, the relationship between women's status including greater control over resources and overall household food security has not been studied unswervingly and convincingly. Better anthropometric measures of children may not represent overall food security as children's improved welfare can be achieved at others', particularly of adult women's, costs. On the other hand, drawing inferences on the basis of an association between women's status and household food consumption expenditures can be misleading because of two main reasons. First, when the nature of distribution within the household is not known, food expenditure data cannot provide food security of individuals. And, second, food consumption expenditure data cannot take into account the possibility of substitution of relatively expensive foods with low

2 Quisumbing and Maluccio (2003) also provide similar evidence from three other countries, namely Ethiopia, Indonesia, and South Africa.

energy content (such as meat and fish) for relatively inexpensive food with high energy content (such as rice), leading to over-assessment of calorie-intake and food security situation. In addition, calories, which are generally used as a proxy for food security, derived from food expenditures fail to make a distinction between calorie availability and actual calorie intake by household members. There can be substantial wastages, either because of cooking and eating practices or because of the nature of the food items, and leakages, which can result from, *inter alia*, hosting guests and giving away foods to others.[3]

In this backdrop, the main objective of this paper is to explore the relationship between food security and female status by considering individual household members' characteristics and their food consumption. More precisely, measured by the calorie adequacy ratio (CAR), which is computed for individual household members, considering their calorie requirements arising from physical characteristics (such as weight and height) and the level of physical activity vis-à-vis actual calorie intake, food security is correlated with several indicators of women's status. This is made possible by making use of a specialized survey data on Bangladesh that provides information on actual food intake, anthropometric measures, and time allocation to different types of activities by every household member. As calorie adequacy focuses only on the quantity aspect of food sufficiency ignoring the 'quality' of the diet (for example, see Levin et al. 1999), an attempt is also made to study the relationship between women's status and the quality of household diet. In addition, the food security issue is also analysed by capturing the effect of women's status on the household budget share of food, addictive goods and eating-out behaviour. The rest of the paper is organized as follows: Section 2 describes the methodology and the data; Section 3 presents the regression results, while Section 4 concludes the paper.

2 Methodology and data

The basic approach in this paper is to correlate the various measures of food security with a number of indicators representing women's within household status, controlling for other factors through the multivariate regression analyses. For making this possible, the most important tasks at the outset are to define and construct the indicators of food security and women's status.

Let us first consider food security. As mentioned above, food security at the individual level is to be measured by the individual-specific calorie adequacy ratio (CAR_i), which is the proportion of energy requirement that is met by the individual. There are two broad components of energy requirement, namely (1) the resting energy need which is the energy expended at rest and (2) energy need due to physical activities. Both types of energy requirements depend on individual specific characteristics such as age, sex, body weight and composition, and the nature of physical activities performed. WHO (1985) has developed a set of equations based on which the resting energy expenditure (REE)

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3 This is a serious concern given that the relationship between household expenditures and calories has been a subject matter of intense controversy in the empirical literature with the corresponding elasticity estimates varying wildly: from zero to greater than one (Bouis and Haddad 1992; Strauss and Thomas 1995).

needs of individuals of different age and sex groups can be predicted (see Annex 2).[4] Obtaining energy requirements due to physical activities, on the other hand, is a much more involved task. Energy-intensities associated with different activities differ widely and the energy need of a particular type of activity is to be an increasing function of time allocated to it. As different types of activities are performed by individuals throughout each day, the consequent activities related-energy requirement will necessitate some measure of energy intensity of all activities performed and on time allocated to each one of them. To keep things tractable, following NRC (1989), all activities can be classified into four broad categories, namely, very light, light, moderate and heavy, and it will then be possible to compare energy expenditures due to these different activity types with REE. Therefore, calorie requirements for sustaining such sedentary activities like sleeping, eating and drinking can be treated same as REE, while given the guideline in NRC (1989) heavy physical works like earth digging may imply energy expenditure as much as seven times of resting time. Given all the four activities in which individuals are involved in, a weighted energy requirement index can be constructed in relation to REE, where the actual time spent on different activity-types will be considered as weights.[5]

As against the energy requirement, the data on energy intake is to be available from all foods (including drinks), individuals consume during a day. Different types of food have different calorie contents, which are energy sources. Ingredients such as cooking oils and spices added during cooking also affect calorie content in prepared meals. As a result, when the information on all ingredients used in preparing meals and the actual measure of consumption by the individuals is available, the individual-specific calorie intake can be computed. Under usual circumstances, calorie intakes lower than the energy requirements should imply inadequate food security for individuals.[6]

An argument that is often put forward against the calorie approach is that it cannot make distinction between ordinary and preferred food items. Some relatively inexpensive foods such as cereals although are rich in calories, they are not necessarily the most preferred items. In the context of Bangladesh, because of taste and desirability food items such as fish, egg, meat and sugar and sugar-content items are usually considered as good/preferred foods despite their relatively low calorie content, particularly in comparison with cereals. As a result, there might be a tendency of substituting good foods for cereals. To take this into consideration, the ratio of calories from good food to total calories consumed can be worked out both for individuals and households provided that information on actual food consumption by individuals is available.

While assessing the food security, a common practice in the literature has been to analyse various budget shares of the household and to observe the impact of female status on them. Following this strand, three different budget shares of the household,

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4 REE specifications rely on sex, age and weight of individuals. These specifications can allow for normal growth requirements of children along with their maintenance of physical health given the activity level. Additional allowances are also added for pregnant and lactating women.

5 Annex I describes the approximate energy requirement from different types of activities following the guideline as provided in NRC (1989).

6 Usual circumstances would include, *inter alia*, individuals not suffering from illness affecting his normal eating behaviour and deliberate attempts to reduce calorie intake.

that is, the shares of food, addictive goods and eating-out are also analysed in this paper. When the share of food budget increases while that of addictive goods declines, an improvement in food security is generally recognized.[7] The relevance of eating out to food security is probably not straightforward as in low income countries such necessity is mostly associated with people who work outside home. However, the outside-home foods consumed are likely to differ from the in-house meals prepared given that outside home consumption has a clear bias towards preferred and relatively expensive food items. The mere necessity of the individuals working outside home cannot probably justify the consumption of preferred food items at much bigger quantities than their availability in-house consumption. As a 'fair' allocation of household resources requires individuals taking as much a share of preferred food items as he/she would have received within the household, a more than proportionate consumption of preferred foods while eating outside home entails a foregone opportunity to raise the household's total energy (calorie) available for allocation. Given the labour market characteristics in a developing and conservative setting like Bangladesh, where women's outside home work is considered to be of secondary importance, males are likely to constitute the overwhelming portion of the eating-out population. Again, males command greater control over household resources and play the leading role in household decision making process. Consequently, resource allocation in a way that satisfies their desire for better foods through eating-out, even at the cost of better nourishment of other household members, can be a direct outcome of the patriarchal norms. Whether improved female status restrains such behaviour would therefore be of great interest.[8]

Turning to women's status, one significant problem is the difficulty associated with measuring it precisely. In the absence of any concrete methodology and/or indicators, different proxy measures are used to reflect women's bargaining power or relative position. These include the share of women's income (either earned or non-earned or both) in total household income, and possession of current assets, and assets brought at marriage (Quisumbing and Maluccio 2003). The search for a suitable indicator of the relative bargaining power was catapulted into prominence in the backdrop of a growing interest in testing the empirical validity of the unitary versus collective models of intra-household resource allocation. As Quisumbing and Brière (2000) have elucidated, none of the indicators are free from limitations. Labour income reflects time allocation and labour force participation, both of which may be the outcome of intra-household bargaining, while non-labour/unearned/non-wage income is not independent of tastes and labour market conditions when pensions, unemployment benefits and earnings from asset accumulation generate much of it. In addition, while searching for the appropriate bargaining power proxy, apart from the exogeneity of the variable (with regard to the

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7 The budget share of food can be computed as the total monthly food expenditure of a household as a proportion of total monthly expenditure of that household. In the context of Bangladeshi households, addictive goods generally include cigarettes/bidis (used for smoking), betel leaf and nuts, and dried tobacco leaves along with alcoholic drinks and drugs in other cases. Hence, the budget share of addictive goods in total household expenditure is to be calculated as the combined monthly expenditure made on all these items as proportion of the total household monthly expenditure.

8 By summing together the expenses related to individual members' outside home food consumption and dividing it by the total monthly household expenditure, the budget share of eating-out can be determined. If female status is to contribute to household food security, the proportion of household budget allocated to eating out is expected to fall with the improvement in women's status.

within-marriage bargaining), one must also consider the 'cultural relevance' of the indicator (Quisumbing and Brière 2000).[9]

Despite their inherent limitations, following the empirical literature, three different indicators of women's empowerment have been used in this paper.[10] In the first of these cases, assets brought at marriage are considered as the measure of the relative bargaining power.[11] The second measure of female status that is used is the female share of household income.[12] Finally, apart from the relative bargaining power, a measure of absolute status of women, using a methodology as employed in Hashemi et al. (1996), is also used. Under this methodology women's status is assessed by taking into consideration a number of factors, for example, if they can take decisions, make purchases themselves, enjoy mobility, have some political awareness and are subject to abusive behaviour from husbands and in-laws. Several specific questions help assess their empowerment status, which are then summed together by assigning specific values to the types of answers received. Therefore, in this particular case the female status is proxied by a constructed woman empowerment index.

This paper takes advantage of a unique survey of Bangladeshi households, with a special emphasis on intra-household issues, which was conducted by the Bureau of Economic Research (BER) at Dhaka University under one of its research projects titled, 'Capturing Intra-Household Distribution and Poverty Incidence: A Study on Bangladesh'. The survey, administered during November 2004–February 2005, covered 1,039 households in Bangladesh, of which about 70 per cent of households were located in rural areas while the rest belonged to the urban communities. Like any other household surveys, the BER survey collected data on a wide variety of subjects, including household characteristics (such as age and sex of household head, location of residence, ownership of assets, exposure to natural calamities and coping practices, etc.), educational attainment, health endowment (as reflected in height and weight), economic activities of individual household members, and consumption expenditures on food and non-food items. Nevertheless, the survey possesses, as described below, several unique features, which make it possible to construct the indicators of food security and women's status discussed above.

First, unlike the most widely used technique of obtaining information on consumption through the 'recall method', the BER survey, by using specially trained enumerators, recorded the actual individual specific dietary intake by directly weighing the consumption of food items by individual members. To reduce the measurement errors associated with recording of food intake, and to minimize the problem of distorted food

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9 Usually the practice has been to use the proxies for bargaining power as the indicator of female status. That is, no distinction is made between bargaining power and female status.

10 The reason for choosing these particular indicators is their availability in the database that has been used for the empirical exercises in this paper.

11 This indicator, however, would not be exogenous to the decisions made within marriage. For instance, educational attainments of the partners will affect both marital assets and decision made within marriage (Quisumbing and Maluccio 2003).

12 Both earned and unearned incomes have been used while constructing this indicator of empowerment. Note that, as Hoddinot and Haddad (1995) and Guha-Khasnobis and Hazarika (2005) have pointed out, both earned and unearned incomes are not exogenous in all instances.

intake behaviour due to the presence of enumerators, data on dietary intake of members for each household was collected for three days during the survey period. The food preparation techniques were also keenly observed and all the ingredients used during cooking were recorded to work out the food nutrients intake by individual members. Apart from measuring the food consumption, the survey also considered the amount of food sent outside home and plate wastes in order not to overestimate the food intake. Another important feature of the survey was to record the time spent by individual household members on different types of activities. A '24-hour time allocation chart' on individual members was filled in for three days using a combination of participatory and recall method of data collection. A large number of activities were listed in the chart so that the energy-intensities associated with different activities could be linked closely to the NRC (1989) guideline.

Given the nature of the survey, it was possible to compute the individual-specific actual calorie intake. To work out the calorie requirement of individuals, first the REE was calculated using the methodology described in WHO (1985), for which the information on height and weight of individuals from the BER dataset had to be exploited. For determining the energy need resulting from the physical activities performed, the record of individuals' activities was used in classifying the activities in terms of their intensities relative to REE, as suggested in NRC (1989), which were then weighted by the time spent on each of them and summed across the activity groups. Since the calorie intake and requirement were determined as the individual level, the corresponding information at the household level could be easily obtained by aggregating the respective figures for household members.

The BER dataset also allows one to take into account the quality of diet as the data on individual members' consumption of each item and their quantity are available. Based on the literature and our knowledge of Bangladeshi households, certain items such as fish, meat, dairy products, and sugary products were identified as good foods on a priori basis and then the ratio of calories taken from good foods to total intake was computed. The corresponding household level variable, i.e., the calories from preferred foods to total calories consumed, could be constructed using these individual level variables.

The BER survey had detailed information regarding the household expenditure pattern, both food and nonfood. The households on average were spending 54 per cent of their monthly expenditure for foods. For an average household a mere 7 per cent of the total calories are generated by good food items like meat, fish, eggs, etc. Turning to addictive consumption, more than 75 per cent of the surveyed households reported the existence of some kind of such expenditure. The data reveal that households in the lowest 10 percentile of per capita expenditure have a mean per capita daily calorie intake of 1,679, which in the absence of any addictive consumption could have increased by another 73 Kcal.[13] For households with higher per capita food expenditure the amounts of calorie foregone are even larger.[14] Nearly 53 per cent of the households are found to

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13 According to one yardstick used in assessing poverty in Bangladesh, the households with less than daily per capita calorie consumption of 1,805 Kcal are the extreme poor households. Therefore, even for this group of households there exist some significant addictive consumption expenditures.

14 For households with the monthly per capita food expenditure in 10-25 percentile, 25-50 percentile, 50-75 percentile, 75-90 percentile and above 90 percentile the calorie forgone per capita due to the consumption of addictive goods are 75 Kcal, 81 Kcal, 94 Kcal, 138 Kcal and 176 Kcal respectively.

have at least one smoker member and 94 per cent of the smokers are males. Amongst the betel leaf consumers the male-female distribution is more even; 54 per cent are males while the remaining 46 per cent are females. When both cigarette and betel-leaf are considered, the consumption of addictive goods is dominated by males.

The survey also provided information about the eating out practice. According to the data the average unit price of in-house calorie is less than the average unit price of outside-the-home calorie. To illustrate this a little further, for households in the lowest 10 percentile of monthly per capita food expenditure, the price of 1,000 'in-house calorie' is 15.80 taka and the price of 1,000 'eating-out calorie' is 48.75 taka. For households in the highest 10 percentile of monthly per capita food expenditure the corresponding figures are 28.22 taka and 82.49 taka respectively. Also, preliminary investigations reveal that regardless of the level of monthly food expenditure, individuals take good food in a higher proportion when they eat out.[15] At higher levels of 'eating out expenditure', the proportion of male consumer is larger, suggesting that males greater eating out practices involve more expensive food intake. If individuals could spend the 'eating out expenditure' to raise their within-house food consumption, they would have experienced a boost in their in-house calorie level. The average amount of calorie forgone due to eating out ranges from 9.93 Kcal (0.81 per cent of daily in-house calorie) for households with monthly per capita food expenditure in the lowest 10 percentile to 481.10 Kcal (18.70 per cent of daily in-house calorie) for households with monthly per capita food expenditure in the highest 10 percentile. Also the average amount of calorie forgone owing to dining off the home rises with the household's food expenditure level.

Yet another interesting dimension of the BER survey was to gather very detailed information on married women within the households in order to assess their relative status, as reflected in a number of socioeconomic and cultural aspects. All data corresponding to individual women's off-home income-earning works, within household income earning activities, ability to make decisions on a wide variety of matters, assets brought at marriage, other unearned income, being subject to domestic violence, etc. were recorded by following a quasi-participatory approach to information gathering. From these data it was possible to construct a composite index of women empowerment, as explained in Annex 2.

3 Estimation and results

The household calorie adequacy ratio (CAR_{hh}) and the household good food availability ratio (GF_{hh}) are explained using a number of household attributes like income, household size, head's sex, within household demographic composition, location of the household (i.e. whether in rural or urban areas), and female status. The same set of household characteristics is also used while explaining the various budget shares (i.e. of food, addictive goods and eating out). In addition to household level assessment, given the availability of data, three individual level regressions are also run to explain (i) the individual calorie adequacy ratio (CAR_i), (ii) individual good food share (GF_i) and

15 For instance, for households with monthly per capita expenditure in the highest 10 percentile, 18 per cent of the foods consumed at home were good foods while for the same group of households 52 per cent of the foods consumed outside the home were good foods.

(iii) individual-specific monthly food expenditure (FE_i) using the corresponding household level attributes as mentioned above, individual level characteristics such as age and physical activity, female status indicator and interactions between female status and demographic groups.[16]

Instead of using income as the measure of household command over resources, the regressions eventually make use of household expenditure since the latter is often regarded as a more reliable measure of households' permanent income.[17] However, considering expenditure as a determinant of calorie and food availability could lead to endogeneity problem. This problem is addressed by instrumenting the per capita expenditure variable on a set of its determinants including household landholding, household head's age, household head's education, household size, sex of the household head, location and prices of a number of important food items.[18] Annex Table A1 provides the results of the instrumenting regression from which the predicted value of household expenditure is retained to be used in the specification showing the relationship between food security and women's status.[19] In the following, the results of the regression analyses have been reported under the three different indicators of women's status used.

3.1 Asset brought at marriage[20]

A problem with using marital assets as proxy of bargaining power is that both husband's and wife's resources brought at marriage are likely to be correlated with some unobserved characteristics that influence resource allocation or the quantity of assets brought and thus could be endogenous to the marriage market selection process. Therefore, we instrument husband's and wife's assets at marriage using their individual and family characteristics and also taking into account some characteristics of the

16 For the demographic composition, 10 age-sex categories have been defined, namely, male preschoolers, female preschoolers, male schoolers, female schoolers, male young adults, female young adults, male prime age adults, female prime age adults, male elderly and female elderly. Preschooler are aged not more than 6 years, schoolers are aged between 7 to 14 years, young age adults are people in the 15-24 age group, prime age adults are aged between 25 and 59 years and elderly people are those with age exceeding 59 years.

17 Current income is more volatile than current expenditure and that the covariance between current income and food consumption is thought to be lower than permanent income and food consumption. Also, for poorer households in developing countries, reporting income is perhaps much more difficult than reporting expenditures.

18 Since in a typical monthly expenditure of the basket of a Bangladeshi household various food expenditures constitute the lion's share, we also include the prices of a number of food items. The prices considered are those of rice, wheat, fish, egg, meat, sugar and pulse.

19 The instrumenting regression turns out to be quite satisfactory. The household monthly per capita expenditure is found to rise significantly with household landholding and household head's education, while it bears an inverse relationship with household size. The location (rural/urban) of the household is also an important factor, as for urban households the expenditure is significantly higher. A number of food prices also appear to be important determinants.

20 For a woman dowry is a subset of her assets at marriage.

spouse.[21] The relevant regressions are presented in Annex Table A2, from which the predicted values of assets brought by husbands and wives are used in assessing the effects on food security.

Table 1: Impacts of assets at marriage on household calorie adequacy ratio and household good food share: 2SLS estimates

Dependent variable	Household calorie adequacy ratio (CAR_{hh})	Household good food share (GF_{hh})
Variables	Coefficient	Coefficient
Ln (per capita household expenditure), predicted	0.441*** (0.101)	0.088*** (0.019)
Ln household size	0.168*** (0.046)	0.040*** (0.009)
Household head's sex (male = 1)	-0.026 (0.022)	-0.009** (0.004)
Male schoolers in the household (ratio)	-0.060 (0.078)	-0.032** (0.015)
Male young adults in the household (ratio)	-0.018 (0.067)	0.009 (0.015)
Male prime age adults in the household (ratio)	-0.125 (0.086)	0.017 (0.018)
Male elderly in the household (ratio)	0.162 (0.104)	0.028 (0.022)
Female preschoolers in the household (ratio)	0.118 (0.086)	-0.021 (0.016)
Female schoolers in the household (ratio)	-0.116 (0.076)	0.002 (0.017)
Female young adults in the household (ratio)	0.059 (0.078)	0.001 (0.016)
Female prime age adults in the household (ratio)	0.072 (0.081)	0.009 (0.017)
Female elderly in the household (ratio)	0.327*** (0.109)	-0.001 (0.020)
Ln (wife's asset brought at marriage), predicted	-0.006 (0.019)	0.007** (0.003)
Ln (husband's asset brought at marriage), predicted	0.002 (0.014)	0.005** (0.002)
Location (urban = 1)	-0.021 (0.022)	0.006 (0.004)
Constant	-2.37*** (0755)	-0.720*** (0.151)
Number of observations	1038	1034
F-statistics	4.61***	10.73***
R-squared	0.0615	0.1386
F-statistics of restriction		
Wife's asset brought at marriage = husband's asset brought at marriage	0.07	0.18

Note: Statistical significance at the 1, 5, and 10 per cent levels are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses). For the household demographic composition of the households, male preschoolers are considered as the base excluded category.

Regression results reported in Table 1 show the empirical relationship between food security, as represented by CAR_{hh} (column 2) and GF_{hh} (column 3) and husband's and wife's status as measured by resources brought at marriage. It is found that CAR_{hh} is significantly and positively influenced by the monthly per capita household expenditure, the size of the household, and the ratio of female elderly to household size.[22] Neither the wife's nor the husband's resources exert any important influence on food security.

[21] Quisumbing and Maluccio (2003) followed a similar procedure to wipe away the potential endogeneity and measurement errors associated with the husband's and wife's resources brought at marriage.

[22] That is, relative to the excluded category, a higher proportion of female elderly is associated with improved food security. The finding is plausible given the lower calorie requirement of elderly females. Their lower calorie need is largely explained by their low activity level as well as by low calorie-absorption capability.

Furthermore, the effects of husband's and wife's bargaining power do not differ markedly as an F-test hypothesizing the equality of the corresponding two coefficients could not be rejected.

Like their effects on household calorie adequacy ratio, both the household expenditure and size significantly raise the good food availability ratio, GF_{hh} (column 2, Table 1). Household headship also matters for the proportion of household energy generated from preferred food items. If the head is a male, GF_{hh} is significantly lowered, which, in turn, implies that female heads give more attention to improve the quality of the diet. Amongst different household member groups, relative to the base category of male pre-schoolers, only the male schoolers significantly influence the proportion of calories coming from good foods. Turning to our primary interest, it is found that both wife's and husband's resources are positively associated with the good food availability at the household level and the associated impacts are not significantly different from each other, as depicted in the corresponding F-test statistic.

Table 2 reports the results of the budget shares. The food budget share is found to be nonlinearly influenced by the household per capita expenditure, as both the level and its squared terms are statistically significant (column 3). The overall impact of expenditure, considering the coefficients both on the level and square term, is worked out to be negative for households with average income.[23] Household size also turns out to be a statistically significant determinant of food budget share. While the household ratios of male young adults and male elderly are found to be positively associated with the budget share, the corresponding ratio of female prime age adults is inversely related to the budgetary allocation to food. Assets at marriage either by the husband or wife fail to register any significant effect and their impacts are not discernibly different from each other.

The budget share of addictive goods is independent of the level of household expenditure which is persuasive given the nature of the goods (column 3 in Table 2). Apart from household size, the ratio of male elderly in the household raises the budget share markedly. Quite strikingly, husband's asset at marriage is found to be negatively associated with the budget share of addictive goods whereas the wife's asset at marriage bears a positive sign (although insignificant).[24] Here, too, the restriction of the equality of the coefficients associated with husband's and wife's bargaining power could not be rejected.

The budget share of eating outside the home appears to be free from any significant influence of the expenditure, but rises significantly with the household size and also if the household head is a male (column 4 in Table 2). Though both the proxies of bargaining power have significant negative impacts, significantly different gender-specific effects cannot be statistically vindicated.

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23 This is because the marginal propensity to food expenditure out of incremental incomes is likely to be low. As incomes rise, households tend to spend more on non-food items.

24 In this analysis addictive goods consist of betel leaves and nuts and bidi/cigarette. Although only in 3 per cent of the households surveyed, 46 per cent of betel leaf consumers were female, which might result in the positive sign on the coefficient of the asset brought by women. Guha-Khasnobis and Hazarika (2005), while analysing the relationship between women's status and children's food security in Pakistan found women's cash income raising the budget share of adult goods and also the spending on tobacco.

Table 2: Different expenditure shares and assets brought at marriage: 2SLS estimates

Dependent variable	Household budget share of food	Household budget share of addictive goods	Household budget share of eating outside home
Variables	Coefficient	Coefficient	Coefficient
Ln (per capita household expenditure), predicted	-4.53* (2.46)	0.345 (0.529)	-1.61 (1.39)
[Ln (per capita household expenditure), predicted]^2	0.345** (0.170)	-0.022 (0.037)	0.121 (0.097)
Ln (household size)	0.375*** (0.037)	0.026*** (0.007)	0.045** (0.018)
Household head's sex (male = 1)	0.009 (0.016)	0.001 (0.003)	0.016** (0.007)
Male schoolers in the household (ratio)	0.016 (0.055)	-0.009 (0.013)	-0.062** (0.027)
Male young adults in the household (ratio)	0.217*** (0.051)	0.013 (0.013)	-0.038 (0.026)
Male prime age adults in the household (ratio)	0.058 (0.067)	0.023 (0.015)	-0.014 (0.031)
Male elderly in the household (ratio)	0.331*** (0.098)	0.086*** (0.022)	-0.009 (0.039)
Female preschoolers in the household (ratio)	-0.008 (0.060)	-0.005 (0.015)	0.038 (0.032)
Female schoolers in the household (ratio)	0.065 (0.056)	-0.014 (0.015)	-0.022 (0.031)
Female young adults in the household (ratio)	0.068 (0.062)	-0.001 (0.015)	-0.049* (0.028)
Female prime age adults in the household (ratio)	-0.151** (0.066)	-0.016 (0.014)	-0.080*** (0.028)
Female elderly in the household (ratio)	-0.109 (0.081)	-0.016 (0.016)	-0.064 (0.042)
Location (urban = 1)	0.001 (0.016)	0.004 (0.003)	-0.002 (0.007)
Ln (wife's asset brought at marriage)	0.003 (0.012)	0.003 (0.002)	-0.013** (0.005)
Ln (husband's asset brought at marriage)	0.009 (0.008)	-0.003* (0.002)	-0.007** (0.004)
Constant	14.5* (8.91)	-1.35 1.89)	5.52 (4.97)
Number of observations	1038	1038	1038
F-statistics	19.12***	5.82***	3.23***
R-squared	0.2227	0.0672	0.0611
F-statistics of restriction			
Wife's asset brought at marriage = husband's asset brought at marriage	0.09	2.14	0.53

Note: Statistical significance at the 1, 5, and 10 per cent levels are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses). For the household demographic composition of the households, male preschoolers are considered as the base excluded category.

Regression results for individual level food security as proxied by the individual calorie adequacy ratio (CAR_i) are given in Annex Table A3. CAR_i is found to be positively and significantly influenced by household food security (CAR_{hh}), household size and household headship (if a male is the head). On the other hand, urban individuals and individuals with higher activity level are receiving significantly lower calories, normalized by their requirements. Also, relative to the base category, other male age

groups are enjoying higher *CAR*s. More importantly and strikingly husband's marital asset is interacting with female preschoolers only to significantly lower their *CAR*s. Testing of restrictions of equality (in terms of CAR_i) between sexes of the same age group reveal that, controlling for all other things, CAR_i of male schoolers is significantly higher than that of female schoolers. When the impacts of husband's and wife's bargaining powers on various age-sex groups are examined it is found that bargaining powers differ significantly in their impacts on female preschoolers, thus rejecting the unitary hypothesis of household decision making. Also the impact of bargaining power is not always gender neutral as wife's resources at marriage influence male schoolers and female schoolers significantly and differently with the latter enjoying a relative preference by the wife.[25]

When it comes to individual good food share (GF_i), good food availability at the household level (GF_{hh}) influences it positively and significantly, as reflected in Annex Table A3 (column 3). Individual's age is found to have a non-linear impact given the significance of both the level and the squared terms). However, a person's activity level is negatively related to his/her good food share. This might imply when someone performs more demanding physical activities, s/he needs more calories which are perhaps taken from calorie-rich foods like cereals at a much greater portion. Also in female headed households, the proportion of individual energy generated from good food is higher. This is consistent with our previous findings where for male-headed households CAR_i were significantly higher implying that while male-headed households opt for calorie-rich foods, female headed households try to diversify their food basket by giving greater weight to some good foods which consequently reduce those households' CAR_i as good foods are usually calorie-poor. All the age-sex categories except female preschoolers and female schoolers receive significantly higher proportion of their energy from preferred food items when comparison is drawn with male preschoolers, the benchmark category. However, neither the indicators of bargaining power, nor their interaction terms involving age-sex dummies exert any significant influence on GF_i. Switching over to the restrictions we find that there is no discernible distinction between sexes of the same age-groups and unitary framework of household decision-making cannot be rejected owing to the absence of any significant different impacts of the two indicators of bargaining power on a particular age-sex category. Furthermore, the bargaining power indicators are gender neutral in their impacts as for no age-sex category those impacts are significantly different.

Monthly food expenditure allocated to an individual is independent of the level of monthly per capita expenditure of the household providing evidence in support of the fact that food is a basic necessity (see Annex Table A3 column 4 for estimation results). Again, individual age is found to have a non-linear impact. Both household size and location (if urban) exercise significant positive influence on individual food expenditure. If the head of the household is a male, the food expenditure of a member is reduced significantly indicating that female heads allocate more resources to meet the members' individual food requirement. Both the husband's and wife's assets at marriage and some of their interactions with individual age-sex dummies are individually significant. A significant higher amount is spent on male prime age adults compared to their female counterparts. Nonetheless, we cannot reject the unitary model

25 For F-statistics of all the restrictions see Annex Table A3.

and also the husband's and wife's resources at marriage are gender-neutral in their impacts.

3.2 Female share of household income

Table 3 exhibits the regression results of household calorie adequacy ratio and household good food share when the share in household income is used as the indicator of female status. Per capita household expenditure and household size influence CAR_{hh} and GF_{hh} and household good food availability ratio positively and significantly. In some cases, household demographic composition is also an important determinant of the two dependent variables. Also, if the household lives in an urban locality, its good food availability is significantly higher relative to the ones in rural areas. However, the female share of household income fails to generate any significant influence in both the instances.

Table 3: Impacts of female share of household income on household calorie adequacy ratio and household good food share: 2SLS estimates

Dependent variable	Household calorie adequacy ratio	Household good food share
Variables	Coefficient	Coefficient
Ln (per capita household expenditure), predicted	0.433*** (0.094)	0.128*** (0.019)
Ln (household size)	0.165*** (0.045)	0.055*** (0.009)
Household head's sex (male = 1)	-0.031 (0.021)	-0.006 (0.004)
Male schoolers in the household (ratio)	-0.055 (0.077)	-0.046*** (0.015)
Male young adults in the household (ratio)	-0.015 (0.067)	-0.001 (0.015)
Male prime age adults in the household (ratio)	-0.135 (0.09)	0.018 (0.018)
Male elderly in the household (ratio)	0.156 (0.106)	0.024 (0.023)
Female preschoolers in the household (ratio)	0.118 (0.087)	0.028* (0.016)
Female schoolers in the household (ratio)	-0.111 (0.074)	-0.003 (0.017)
Female young adults in the household (ratio)	0.067 (0.078)	-0.005 (0.017)
Female prime age adults in the household (ratio)	0.086 (0.082)	0.008 (0.018)
Female elderly in the household (ratio)	0.337*** (0.110)	-0.006 (0.021)
Female share of household income	-0.016 (0.035)	-0.004 (0.006)
Location (urban = 1)	-0.024 (0.017)	0.007* (0.004)
Constant	-2.34 (0.730)	0.924*** (0.152)
Number of observations	1038	1034
F-statistics	4.90***	9.21***
R-squared	0.0615	0.1081

Note: Statistical significance at the 1, 5, and 10 per cent levels are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses). For the household demographic composition of the households, male preschoolers are considered as the base excluded category.

Turning to the budget share regressions (Table 4), it is found that the share of household budget allocated to food is again significantly and nonlinearly influenced by household expenditure. The other significant determinants are household size and household demographic compositions. The female income share, on the other hand, is again unable to exhibit significant influence. In the case of the budget share to addictive goods, household size, household composition and location become the significant determinants. As people consume these goods from the force of habit, lack of significance of the household expenditure is explainable. Unlike the food budget share, there is now evidence of significantly negative effect of a rise in female share of household income on addictive consumption. When the budget share of eating outside home is considered, the similar effect of female share of household income is also found.

Table 4: Different expenditure shares and female share of household income: 2SLS estimates

Dependent variable	Budget share of food	Budget share of addictive goods	Budget share due to eating outside home
Variables	Coefficient	Coefficient	Coefficient
Ln (per capita household expenditure), predicted	-4.01* (2.40)	0.271 (0.518)	-2.45 (1.54)
[Ln (per capita household expenditure), predicted]^2	0.312* (0.166)	-0.017 (0.036)	0.175* (0.107)
Ln (household size)	0.392*** (0.034)	0.022*** (0.007)	0.018 (0.017)
Household head's sex (male = 1)	0.007 (0.016)	-0.001 (0.003)	0.006 (0.007)
Male schoolers in the household (ratio)	0.003 (0.055)	-0.008 (0.013)	-0.037 (0.026)
Male young adults in the household (ratio)	0.204*** (0.051)	0.011 (0.013)	-0.023 (0.025)
Male prime age adults in the household (ratio)	0.044 (0.069)	0.012 (0.016)	-0.035 (0.033)
Male elderly in the household (ratio)	0.315*** (0.099)	0.076*** (0.021)	-0.015 (0.039)
Female preschoolers in the household (ratio)	-0.018 (0.060)	-0.006 (0.014)	0.048 (0.032)
Female schoolers in the household (ratio)	0.063 (0.056)	0.013 (0.015)	-0.009 (0.031)
Female young adults in the household (ratio)	0.072 (0.062)	0.002 (0.015)	-0.031 (0.028)
Female prime age adults in the household (ratio)	-0.132** (0.067)	-0.008 (0.014)	-0.061* (0.028)
Female elderly in the household (ratio)	0.100 (0.081)	-0.008 (0.016)	-0.043 (0.045)
Location (urban = 1)	-0.002 (0.031)	0.007*** (0.003)	-0.003 (0.005)
Female share of household income	-0.033 (0.027)	-0.018*** (0.005)	-0.021* (0.011)
Constant	12.64 (8.68)	-1.04 (1.85)	8.69 (5.49)
Number of observations	1038	1038	1038
F-statistics	19.38***	7.04***	2.08***
R-squared	0.2214	0.073	0.0331

Note: Statistical significance at the 1, 5, and 10 per cent levels are denoted by *, ** and *** respectively. Robust standard errors are given in the parentheses. Male preschoolers are the excluded category.

Annex Table A4 contains the results of the three individual level regressions. Individual calorie adequacy ratio (CAR_i) is significantly determined by household calorie adequacy ratio (CAR_{hh}), household size, location, and individual activity level, and by various age-sex dummies. The interactive terms involving the female share of household income and female preschoolers, female schoolers, and male prime age adults are found to be significant and positively signed. This therefore provides evidence against the unitary approach to intra-household resource allocation. There is also some evidence of

gender discrimination as for male schoolers CAR_i is higher compared to their female counterparts, controlling for all other factors. However, the relative bargaining power of women is gender-neutral in its impact on other different age categories.

The key determinants of individual good food share are the household good food availability, individual age and activity, household headship, location and individual age-sex dummies. Household good food availability appreciably raises the individual good food share. Individual age is found to have a non-linear impact as both the level and square terms are highly significant. For individuals with higher activity level the proportion of energy generated from preferred food items is lower. If the household head is a female, its members receive relatively more of their total calories from preferred foods. The impacts of a female's relative bargaining power and its interaction terms are unable to yield any significant influence and hence the evidence is in favour of a unitary model. Within a household, there is some evidence of gender-based discrimination as a male prime age adult's IGFS is significantly higher compared to his female counterpart. However the impact of female share of household income is gender-neutral across various age categories.

Monthly food expenditure of an individual is independent of the level of per capita expenditure of the household and is significantly affected by individual age, household size, household headship, location and individual age-sex dummies. The insignificance of household expenditure vindicates the fact that food is a basic necessity and the expenditure allocated to food is not significantly influenced by changes in the household expenditure. Again individual age exerts a non-linear impact as both the coefficients associated with the level and the square terms are significant. Female household heads allocate relatively more amounts to their individual members for defraying the food expenses. Again urban dwellers require significantly higher amounts for food relative to rural people. For female prime age adults and male elderly people, female share of household income appreciably lowers the individual food expenditures and thus yield support against the unitary model. There exists evidence of gender-based discrimination as significantly higher amounts are spent on male young adults, male prime age adults and male elderly, when compared to their corresponding female age categories. Also the impact of female's relative bargaining power is not always gender neutral across the age categories as female elderly people are significantly favoured over their male counterparts.

3.3 The composite index of women empowerment

The final proxy that we use to reflect female status is a composite index of women empowerment. To avoid the potential problems of endogeneity associated with this composite index and to make it more representative of the social and cultural environment in which the women reside, the index is explained using a number of factors such as husband's and wife's education, presence of in-laws in the household, household's socioeconomic status, strength of the wife's network of relatives, her participation in income-generating activities, both off-home and in-house activities including participation in NGO programmes, economic status of the wife's parents, and if the woman has other places, to live for a longer period in case of marriage breakage. Since socioeconomic status may not be captured well by mere income or expenditure of the household, to better apprehend the social, economic and other observed and unobserved cultural aspects determining it, two indices, namely, household asset index

and household status index are constructed, by using the methodology as outlined in Annex 2. We measure the strength of the wife's network-of-relatives by total value of gifts that she received from her close relatives excluding the dowry, parental and own resources at the time of marriage. The underlying hypothesis is that a stronger network-of-relatives may accentuate the status of the woman in her in-laws' house.

Following the regression results as provided in Annex Table A5, female empowerment index is found to be significantly and positively influenced by both wife's education and husband's education. The socioeconomic status of the household is also an important determinant of women empowerment as both household asset index and household status index exert significant positive influences on the empowerment index. Also, the stronger is the woman's network-of-relatives, the higher is her empowerment. Her participation in income generating activities, both in-house and off-house, are individually significant having positive impacts on her empowerment. Again, if the woman participates in NGO activities, a significant higher value of the empowerment index is associated with her. However, the presence of mother-in-law within the household reduces her empowerment appreciably. To gauge the relative importance of comparable determinants of women empowerment a number of restrictions were tested. Based on the F-statistics of the restrictions, displayed in Annex Table A5, it can be said that the impact of the wife's self education is significantly higher compared to the impact of her husband's education, the status of the household is more important relative to the assets the household possesses and the woman's participation in off-home earning activities raises her empowerment significantly in comparison with the influence of her participation in in-house earning activities.

Table 5 displays the regression results of household calorie adequacy ratio and household good food share, using the empowerment index as the measure of female status. Like the previous cases, per capita expenditure, household size, location, and some demographic groups remain significant determinants of CAR_{hh} and GF_{hh} and, urban households receive relatively more of their calories from preferred food items. The empowerment index fails to register statistical significance in calorie adequacy equation, but in the good food availability regression it turns out to be positive and highly significant.

In budget share regressions, the results of which are reported in Table 6, the composite empowerment index is significant in the cases of food and eating-out regressions. Moving from one household to another, as women become more empowered, households tend to allocate more resources on food but less on eating out. In the case of additive goods equation although the sign of the index is negative, the effect is not statistically significant at the conventional levels.

Annex Table A6 reports the individual level regressions. The sign and significance of most variables remain more of less unchanged in comparison with the two other indicators of female status used previously. The indicator of female empowerment and its interactions with individual age-sex dummies do not turn out to be significant in most cases. Nevertheless, some evidence of gender discrimination becomes evident as the restrictions on the equality of various male and female groups in terms of allocation of calories, good food share, and food expenditure, were rejected by the data. Particularly, male schoolers, male prime age adults and male elderly people are found to be treated more favourably compared to their female counterparts. On the other side,

female prime age adults and female elderly were considered to be over their corresponding male age categories.

Individual good food share is positively and significantly determined by the corresponding household level outcome. Again individual age has a nonlinear impact whereas individual activity is negatively associated with his/her proportion of calories generated from good food. Also for an urban resident the good food share is significantly lower compared to a rural individual. The age-sex dummies are not individually significant, nor the female status and its interaction terms. We cannot reject the unitary model here. However, there is evidence of discrimination as for male prime age adults the ratio is significantly higher compared to female prime age adults. Additionally, female status is gender neutral in its impacts across various age groups.

Table 5: Impacts of female empowerment on household calorie adequacy ratio and household good food share: 2SLS estimates

Dependent variable	Household calorie adequacy ratio	Household good food availability ratio
Variables	Coefficient	Coefficient
Ln per capita household expenditure (predicted)	0.405*** (0.100)	0.088*** (0.021)
Ln household size	0.157*** (0.047)	0.040*** (0.009)
Household head's sex (male = 1)	-0.031 (0.021)	-0.005 (0.004)
Male schoolers in the household (ratio)	-0.064 (0.079)	-0.048*** (0.015)
Male young adults in the household (ratio)	-0.024 (0.068)	-0.002 (0.015)
Male prime age adults in the household (ratio)	-0.148* (0.089)	0.013 (0.018)
Male elderly in the household (ratio)	0.142 (0.109)	0.032 (0.023)
Female preschoolers in the household (ratio)	0.104 (0.089)	-0.025 (0.016)
Female schoolers in the household (ratio)	-0.112 (0.076)	-0.010 (0.017)
Female young adults in the household (ratio)	0.052 (0.079)	-0.013 (0.017)
Female prime age adults in the household (ratio)	0.068 (0.081)	-0.002 (0.018)
Female elderly in the household (ratio)	0.315*** (0.113)	-0.006 (0.020)
Ln female empowerment index (predicted)	-0.022 (0.041)	0.049*** (0.008)
Location (urban = 1)	-0.016 (0.017)	0.008** (0.004)
Constant	-2.09*** (0.761)	-0.667*** (0.162)
Number of observations	1000	996
F-statistics	4.39***	11.42***
R-squared	0.0562	0.1349

Note: Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses). Male preschoolers are the excluded category.

Table 6: Different expenditure shares and female empowerment: 2SLS estimates

Dependent variable	Budget share of food	Budget share of addictive goods	Budget share due to eating outside the home
Variables	Coefficient	Coefficient	Coefficient
Ln (per capita household expenditure), predicted	-3.91 (2.71)	0.126 (0.546)	-1.16
[Ln (per capita household expenditure), predicted]^2	0.298 (0.188)	-0.006 (0.038)	0.087
Ln (household size)	0.356*** (0.036)	0.030*** (0.007)	0.032*
Household head's sex (male = 1)	0.008 (0.015)	0.002 (0.003)	0.007
Male schoolers in the household (ratio)	-0.003 (0.056)	-0.007 (0.013)	-0.038
Male young adults in the household (ratio)	0.209*** (0.051)	0.013 (0.013)	-0.020
Male prime age adults in the household (ratio)	0.052 (0.068)	0.026* (0.016)	-0.017
Male elderly in the household (ratio)	0.374*** (0.101)	0.087*** (0.002)	-0.003
Female preschoolers in the household (ratio)	-0.019 (0.061)	-0.005 (0.015)	0.039
Female schoolers in the household (ratio)	0.061 (0.057)	-0.016 (0.015)	-0.011
Female young adults in the household (ratio)	0.042 (0.062)	-0.001 (0.015)	-0.039
Female prime age adults in the household (ratio)	-0.174*** (0.066)	-0.018 (0.015)	-0.069**
Female elderly in the household (ratio)	-0.118 (0.082)	-0.019 (0.017)	-0.064 (0.044)
Location (urban = 1)	0.005 (0.014)	0.005* (0.003)	-0.003
Ln (female empowerment index), fitted values	0.104*** (0.032)	-0.009 (0.007)	-0.056***
Constant	12.5 (9.77)	-0.607 (1.94)	3.95 (5.64)
Number of observations	1000	1000	1000
F-statistics	21.03***	6.19***	2.15***
R-squared	0.2331	0.0700	0.0366

Note: Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses). Male preschoolers are the excluded category.

Individual food expenditure is significantly influenced by individual age (again the impact is nonlinear), household size, location (with urban people spending higher amounts) and individual age-sex categories. Over and above, women empowerment significantly raises individual expenditure and we can reject the unitary model in this instance. However the interactions of female status and individual age-sex dummies are unable to produce any noteworthy impact. The phenomenon of gender discrimination is evident here as significantly higher amounts are allocated to female young adults and male prime age adults relative to their corresponding female age category. Again the impact of female status is independent of the sex of the individual across different age categories.

Female status: related issues and its implications for gender discrimination

From the regression results there is evidence that female status matter for food security. When husband's and wife's assets at marriage are taken as the indicator of their relative bargaining power, only in one instance (in the regression of individual calorie adequacy

ratio), the impacts of husband's and wife's marital assets on female preschoolers differ, yielding an evidence against the unitary model.

If female share of household income is taken as a proxy for her relative bargaining power (her status), the budget share of addictive goods as well as the budget share of eating out practice is reduced significantly because of improved female status. Also in the regression of individual calorie adequacy ratio (for female preschoolers, female schoolers and male prime age adults) and in the individual food expenditure regression (for female prime age adults and male elderly) the impact of female status is significantly discernible.

When the composite indicator of female status is used, its impacts on household good food share, budget share of food and individual food expenditure were significantly positive while for budget share of eating out practice the impact was negative and significant – all the impacts being desirable. However in none of the instances female status played any important role on the household calorie adequacy ratio as well as on individual good food share.

Table 7: Impact of female status: the significant impacts

Dependent variable	Asset at marriage			Female income share	Composite index of women empowerment
	wife	husband	wife ≠ husband		
HHCAR	—	—	—	—	—
HHGFS	+**	+**	—	—	+***
BS of food	—	—	—	—	+***
BS of addictive goods		—*		—***	
BS of eating out	—**	—**	—	—*	—***
Individual CAR	—	—	(female preschoolers*)	(female preschoolers**, female schoolers**, male prime age adults*)	—
Individual GFS	—	—	—	—	—
Individual food expenditure	+*	+**		(female prime age adults*, male elderly*)	+***

Note: '+' and '-' indicate the sign of relationship. Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. '—' implies that no significant relation was found.

Table 7 elucidates another interesting and important point – inferences drawn about food budget shares or about food expenditure on the basis of findings regarding addictive goods consumption (which are exclusively consumed by adults), may not always be true. Our findings show that though budget share of addictive goods is significantly lowered by female income share, budget share of food or individual food expenditure is not necessarily (appreciably) increased. Also though the index of female empowerment significantly raises food budget share as well as individual food expenditure, the index is unable to produce any significant impact on the budget share of addictive goods.

Table 8: Evidence of gender discrimination

	Asset at marriage	Female share of household income	Composite women empowerment index
Individual CAR	Male schoolers	Male schoolers	Male schoolers Male prime age adults Male elderly
Individual GFS	—	Male prime age adults	Male prime age adults
Individual food expenditure	Male elderly	Male young adults Male prime age adults Male elderly	Male young adults Male prime age adults

Note: The name of the favoured age-sex category is given. '—' implies that no discrimination was found.

Table 9: Gender biasedness of female status: the favoured age-sex category

	Asset at marriage	Female share of household income	Indicator of female status
Individual CAR	Female schoolers	—	Female prime age adults Female elderly
Individual GFS	—	—	—
Individual food expenditure	—	Female elderly	—

Note: The age-sex category that is favoured by female status relative to their comparable counterpart is mentioned above. '—' implies that female status was gender neutral in its impacts.

Following Table 8, regardless of the proxy for female status used, there is evidence of gender discrimination. When asset brought at marriage is the proxy for female status, within a household male schoolers are in a better position compared to female schoolers in terms of calorie adequacy ratio and male elderly are favoured over female elderly in terms of food expenditure. When female share of household income is the proxy for female status, within a household male schoolers are in a better position relative to female schoolers in terms of calorie adequacy ratio; male prime age adults are favoured over female prime age adults in terms of good food share; male young adults, male prime age adults and male elderly are in a better position compared to their respective female counterparts in terms of the allocation of food expenditure. When the composite women empowerment index is used male schoolers, male prime age adults and male elderly enjoy a better position relative to their female counterparts in terms of calorie adequacy ratio; male prime age adults are favoured in terms of good food share; male young adults and male prime age adults are favoured in terms of the allocation of food expenditure. The noteworthy point here is that in all the instances males are favoured.

Table 9 portrays the gender biasedness of female status as it reports the age-sex category that is favoured by female status in a particular context. A comparison between Tables 8 and 9 reveals that in the regression of individual calorie adequacy ratio, when asset at marriage is the proxy, female status favours female schoolers who are the disadvantaged people in this instance. Female share of household income favours female elderly in terms of individual food expenditure and they are one of the disadvantaged categories. When the composite empowerment index is considered, it is

found that in terms of individual calorie adequacy ratio the discrimination is against female schoolers, female prime age adults and female elderly people. But female status in this case favours female prime age adults and female elderly, two of the three disadvantaged groups, over their male counterparts. So the apparent discrimination against females of various age categories can be mitigated to a considerable extent by improving female status.

4 Conclusion

In this paper the main objective was to examine the relationship between women's status and food security. The data of this paper comes from a random, representative and intra-household survey of Bangladeshi households, which provides individual level information on dietary intake as well as individual time-allocation to activities of different energy-intensities. Besides, the survey provides detailed information on individual and household expenditures and on various factors related to a married women's within household status.

The paper has contributed to the existing literature in a number of areas. First, it analysed both individual and household food security. Second, it considered two different measures of female bargaining power and a composite index of women empowerment as indicators of women status. Third, along with the budget shares of food and addictive goods the paper also considered the budget share due to the practice of eating outside home. Fourth, it went beyond the conventional budget share approach by considering calorie adequacy ratio, good food share and individual food expenditure.

Regardless of the proxy used, there is the evidence of female status influencing intra-household food distribution, which suggests that the common preference approach is inefficient in modeling intra-household resource distribution patterns. In certain instances female status was also found to reduce some unnecessary spending behaviours (allocation to addictive goods or eating out practice). But it was not mandatory that those saved resources would be channeled through food expenses. However among the three indicators employed, assets brought at marriage perform rather poorly which in turn substantiates the fact that in the context of Bangladesh it is not perhaps a good proxy for female status compared to female share of household income or an indicator of women empowerment.[26]

The incidence of gender-based discrimination was also evident and in all the cases where discrimination was present, it was against females. Women's status was found to be favouring some of those disadvantaged groups implying that increased female status could help mitigate the extent of gender-based discrimination. Findings of this paper

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[26] Marriage, as argued by Quisumbing and Maluccio (2003), is certainly one of the occasions of an individual's lifetime when asset is transferred. But it is probably less significant when compared to the other occasion of asset transference, death. As a result one's assets at marriage are likely to give poor signal of his/her bargaining power. Moreover, the claimed 'symbolic meaning' of assets at marriage 'over and above their economic value' is probably overstated (though Quisumbing and Maluccio 2003, argued the opposite, that is very unlikely to happen to be the case in Bangladesh). There are many other factors that can explain the economic value as well as the cultural relevance of a proxy for female status more directly (like female income share or especially the composite empowerment index). Also, assets at marriage entail valuation of assets that were transferred in distant past; the reporting may not be accurate and are unlikely to be adjusted for changes in price levels.

also seemed to suggest that a statistically significant positive influence of women's status on food budget shares did not necessarily imply a similar opposite effect on all types of non-food expenditures. Therefore, inferences drawn about food security by analyzing the effect of women's status solely on certain types of non-food budget shares (for example, addictive goods) could be misleading or overemphasized.

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Annex 1

Annex Table A1: Determinants of monthly per capita expenditure of the household

Dependent variable	Ln (monthly per capita expenditure of the household)	
Variables	Coefficient	Robust standard errors
Ln (household landholding)	0.008*	0.004
Ln (household head's age)	0.013	0.022
Ln (household size)	-0.393***	0.037
Ln (household head's education)	0.042***	0.008
Household head's sex (male = 1)	-0.010	0.026
Location (urban = 1)	0.104***	0.020
Ln (price of rice)	0.145**	0.064
Ln (price of wheat)	-0.001	0.076
Ln (price of fish)	-0.075*	0.044
Ln (price of egg)	0.078	0.052
Ln (price of meat)	0.025	0.035
Ln (price of sugar)	0.048	0.034
Ln (price of pulse)	0.131**	0.066
Constant	6.42***	0.396
Number of observations	1038	
F-statistics	17.15***	
R-squared	0.2381	

Note: Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors.

Annex Table A2: Determinants of husband's and wife's resources at marriage

Dependent variable	Ln (husband's asset brought at marriage)	Ln (wife's asset brought at marriage)
Variables	Coefficient	Coefficient
Ln (wife's age at marriage)	0.090* (0.055)	0.096** (0.042)
[Ln (wife's age at marriage)]^2	-0.002* (0.001)	-0.002** (0.001)
Ln (husband's age at marriage)	-2.60*** (0.794)	-0.376 (0.540)
[Ln (husband's age at marriage)]^2	0.632*** (0.207)	0.055 (0.139)
Ln (wife's education)	0.671*** (0.168)	0.441*** (0.119)
Ln (husband's education)	0.275* (0.156)	0.147 (0.110)
Average education of husband's parents	-0.350 (0.268)	0.170** (0.069)
Average education of wife's parents	-0.504 (0.589)	0.003 (0.067)
Ln (wife's parents' landholding)	0.697*** (0.096)	0.265*** (0.064)
Ln (husband's parents' landholding)	0.353 (0.286)	0.111 (0.070)
Location (urban = 1)	-0.137 (0.260)	0.559*** (0.165)
Constant	8.09*** (0.346)	7.61*** (0.263)
Number of observations	1039	1039
F-statistics	6.11***	8.58***
R-squared	0.0614	0.0841

Note: Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses).

Annex Table A3: Impacts of marital assets on individual food security, individual good food share and individual monthly food expenditure

Dependent variable	Individual calorie adequacy ratio	Individual good food share	Ln (individual monthly food expenditure)
Variables	Coefficient	Coefficient	Coefficient
Household calorie adequacy ratio, fitted values	0.610*** (0.086)		
Household good food availability ratio, fitted values		1.18*** (0.099)	
Ln (monthly per capita household expenditure), predicted			-5.45 (3.69)
[Ln (monthly per capita household expenditure), predicted]^2			0.401 (0.258)
Ln (individual age)	-0.073 (0.056)	-0.124*** (0.019)	0.459*** (0.074)
[Ln (individual age)]^2	0.011 (0.009)	0.019*** (0.003)	-0.044*** (0.013)
Ln (individual activity level)	-0.735*** (0.022)	-0.025*** (0.005)	-0.020 (0.037)
Ln (household size)	0.025* (0.014)	0.0001 (0.003)	0.113*** (0.027)
Household head's sex (male = 1)	0.031** (0.014)	-0.006** (0.003)	-0.038* (0.023)
Location (urban = 1)	-0.031*** (0.011)	-0.004 (0.003)	0.153*** (0.019)
Individual age-sex dummy			
Male schoolers	0.634** (0.265)	0.155* (0.090)	0.975** (0.409)
Male young adults	0.463* (0.259)	0.198** (0.089)	1.43*** (0.415)
Male prime age adults	0.468* (0.251)	0.211** (0.087)	1.16*** (0.388)
Male elderly	1.18*** (0.398)	0.208** (0.094)	1.69*** (0.522)
Female preschoolers	-0.011 (0.322)	0.126 (0.113)	0.552 (0.462)
Female schoolers	0.339 (0.258)	0.135 (0.090)	0.647 (0.408)
Female young adults	0.238 (0.274)	0.221** (0.090)	0.951** (0.440)
Female prime age adults	0.389 (0.246)	0.179** (0.087)	0.788** (0.385)
Female elderly	0.671 (0.479)	0.288*** (0.093)	2.13*** (0.592)
Bargaining power and interaction terms			
Ln (wife's asset at marriage)	0.006 (0.038)	0.007 (0.014)	0.093* (0.057)
Ln (husband's asset at marriage)	0.004 (0.027)	0.009 (0.009)	0.084** (0.043)
Wife's asset at marriage * female preschoolers	0.081 (0.053)	-0.019 (0.019)	-0.072 (0.079)
Wife's asset at marriage * male schoolers	-0.064 (0.041)	-0.005 (0.014)	-0.133** (0.066)
Wife's asset at marriage * female schoolers	0.003 (0.043)	-0.004 (0.015)	-0.081 (0.068)
Wife's asset at marriage * male young adults	-0.025 (0.041)	-0.009 (0.014)	-0.133** (0.066)
Wife's asset at marriage * female young adults	0.006 (0.041)	-0.013 (0.014)	-0.120* (0.066)
Wife's asset at marriage * male prime age adults	-0.003 (0.039)	-0.008 (0.014)	-0.067 (0.062)
Wife's asset at marriage * female prime age adults	-0.019 (0.039)	-0.008 (0.014)	-0.089 (0.062)
Wife's asset at marriage * male elderly	-0.069 (0.059)	-0.011 (0.015)	-0.145* (0.077)
Wife's asset at marriage * female elderly	-0.019 (0.065)	-0.019 (0.015)	-0.174** (0.080)
Husband's asset at marriage * female preschoolers	-0.079* (0.042)	0.003 (0.013)	0.006 (0.063)

continued ....

Dependent variable	Individual calorie adequacy ratio	Individual good food share	Ln (individual monthly food expenditure)
Variables	Coefficient	Coefficient	Coefficient
Husband's asset at marriage * male schoolers	0.003 (0.030)	-0.011 (0.009)	0.026 (0.049)
Husband's asset at marriage * female schoolers	-0.033 (0.034)	-0.010 (0.010)	0.006 (0.054)
Husband's asset at marriage * male young adults	-0.014 (0.029)	-0.011 (0.009)	-0.004 (0.049)
Husband's asset at marriage * female young adults	-0.018 (0.030)	-0.010 (0.009)	0.018 (0.051)
Husband's asset at marriage * male prime age adults	-0.029 (0.028)	-0.013 (0.009)	-0.035 (0.046)
Husband's asset at marriage * female prime age adults	-0.006 (0.028)	-0.011 (0.009)	-0.003 (0.046)
Husband's asset at marriage * male elderly	-0.038 (0.048)	-0.011 (0.010)	-0.029 (0.062)
Husband's asset at marriage * female elderly	-0.037 (0.048)	-0.013 (0.010)	-0.094 (0.059)
Constant	0.615** (0.261)	0.046 (0.088)	22.1* (13.2)
Number of observations	4859	4859	4859
F-statistics	44.16***	19.30***	54.56***
R-squared	0.2191	0.2124	0.3163
F-statistics of the restrictions			
Male schoolers = female schoolers	2.75*	0.21	1.14
Male young adults = female young adults	1.37	0.35	1.87
Male prime age adults = female prime age adults	0.37	1.68	2.78*
Male elderly = female elderly	0.93	2.27	0.51
Husband's asset at marriage = wife's asset at marriage	0.00	0.01	0.01
Husband's asset at marriage * male schoolers = wife's asset at marriage * male schoolers	1.01	0.08	2.21
Husband's asset at marriage * male young adults = wife's asset at marriage * male young adults	0.03	0.01	1.49
Husband's asset at marriage * male prime age adults = wife's asset at marriage * male prime age adults	0.18	0.04	0.10
Husband's asset at marriage * male elderly = wife's asset at marriage * male elderly	0.10	0.00	0.83
Husband's asset at marriage * female preschoolers = wife's asset at marriage * female preschoolers	3.29*	0.60	0.35
Husband's asset at marriage * female schoolers = wife's asset at marriage * female schoolers	0.24	0.07	0.60
Husband's asset at marriage * female young adults = wife's asset at marriage * female young adults	0.14	0.02	1.66

continued ....

Dependent variable	Individual calorie adequacy ratio	Individual good food share	Ln (individual monthly food expenditure)
Variables	Coefficient	Coefficient	Coefficient
Husband's asset at marriage * female prime age adults = wife's asset at marriage * female prime age adults	0.04	0.02	0.74
Husband's asset at marriage * female elderly = wife's asset at marriage * female elderly	0.03	0.06	0.42
Husband's asset at marriage * male schoolers = husband's asset at marriage * female schoolers	1.79	0.03	0.22
Husband's asset at marriage * male young adults = husband's asset at marriage * female young adults	0.04	0.10	0.34
Husband's asset at marriage * male prime age adults = husband's asset at marriage * female prime age adults	2.47	0.34	1.59
Husband's asset at marriage * male elderly = husband's asset at marriage * female elderly	0.00	0.11	1.15
Wife's asset at marriage * male schoolers = wife's asset at marriage * female schoolers	4.72**	0.02	1.08
Wife's asset at marriage * male young adults = wife's asset at marriage * female young adults	1.47	0.60	0.08
Wife's asset at marriage * male prime age adults = wife's asset at marriage * female prime age adults	0.68	0.03	0.43
Wife's asset at marriage * male elderly = wife's asset at marriage * female elderly	0.50	1.19	0.14

Note: Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses). Male preschoolers are the excluded category.

Annex Table A4: Impacts of female share of household income on individual food security, individual good food share and individual monthly food expenditure

Dependent variable	Individual calorie adequacy ratio	Individual good food share	Ln (monthly individual food expenditure)
Variables	Coefficient	Coefficient	
Household calorie adequacy ratio, predicted	0.527*** (0.083)		
Household good food availability ratio, predicted		1.13*** (0.074)	
Ln (per capita household expenditure), predicted			-828 (3.70)
[Ln (per capita household expenditure), predicted]^2			0.0877 (0.258)
Ln (individual age)	-0.076 (0.056)	-0.126*** (0.019)	0.445*** (0.076)
[Ln (individual age)]^2	0.012 (0.009)	0.019*** (0.003)	-0.041*** (0.013)
Ln (individual activity level)	-0.716*** (0.020)	-0.027*** (0.005)	-0.060 (0.037)
Ln (household size)	0.024* (0.014)	-0.001 (0.003)	0.113*** (0.028)
Household head's sex (male = 1)	0.016 (0.015)	-0.007** (0.003)	-0.053** (0.027)
Location (urban = 1)	-0.032*** (0.008)	-0.004* (0.002)	0.133*** (0.015)
Individual age-sex dummy			
Male schoolers	0.097*** (0.034)	0.018* (0.011)	0.048 (0.055)
Male young adults	0.119*** (0.039)	0.024* (0.012)	0.253*** (0.065)
Male prime age adults	0.163*** (0.046)	0.031** (0.013)	0.301*** (0.077)
Male elderly	0.242*** (0.063)	0.019 (0.013)	0.225** (0.099)
Female preschoolers	-0.006 (0.034)	-0.013 (0.011)	-0.032 (0.052)
Female schoolers	0.053 (0.033)	0.013 (0.011)	0.021 (0.054)
Female young adults	0.126*** (0.041)	0.020 (0.012)	0.085 (0.066)
Female prime age adults	0.161*** (0.045)	0.018 (0.013)	0.015 (0.074)
Female elderly	0.167*** (0.064)	0.010 (0.013)	-0.208** (0.103)
Bargaining power and interaction terms			
Female share of household income	-0.118 (0.077)	0.004 (0.026)	0.092 (0.161)
Female share of household income * female preschoolers	0.286** (0.139)	-0.015 (0.038)	-0.068 (0.212)
Female share of household income * male schoolers	0.134 (0.088)	-0.020 (0.027)	-0.177 (0.172)
Female share of household income * female schoolers	0.197** (0.094)	-0.006 (0.028)	-0.236 (0.181)
Female share of household income * male young adults	0.093 (0.09)	-0.001 (0.027)	-0.087 (0.178)
Female share of household income * female young adults	0.099 (0.087)	-0.002 (0.027)	-0.221 (0.178)
Female share of household income * male prime age adults	0.153* (0.092)	-0.011 (0.027)	-0.249 (0.176)
Female share of household income * Female prime age adults	0.069 (0.082)	-0.008 (0.026)	-0.287* (0.168)

continued ....

Dependent variable	Individual calorie adequacy ratio	Individual good food share	Ln (monthly individual food expenditure)
Variables	Coefficient	Coefficient	
Female share of household income * male elderly	0.117 (0.155)	-0.001 (0.034)	-0.428* (0.231)
Female share of household income * female elderly	0.153 (0.126)	-0.006 (0.029)	0.061 (0.204)
Constant	0.801*** (0.112)	0.191*** (0.023)	6.69 (13.2)
Number of observations	4859	4859	4859
F-statistics	59.83***	21.47***	67.11***
R-squared	0.2118	0.1930	0.2966
F-statistics of the restrictions			
Male schoolers = Female schoolers	6.31***	1.95	0.74
Male young adults = female young adults	0.16	1.3	23.09***
Male prime age adults = female prime age adults	0.03	27.8***	147.09***
Male elderly = female elderly	2.14	2.02	41.07***
Female share of household income * male schoolers = female share of household Income * female schoolers	0.79	1.02	0.30
Female share of household income * male young adults = female share of household income * female young adults	0.01	0.01	1.38
Female share of household income * male prime age adults = female share of household income * female prime age adults	1.92	0.15	0.17
Female share of household income * male elderly = female share of household income * female elderly	0.04	0.03	5.41**

Note: Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses). Male preschoolers are the excluded category.

Annex Table A5: Determinants of the composite index of women empowerment

Dependent variable: in (composite index of women empowerment)		
Variables	Coefficient	Robust standard errors
Ln (husband's education + 1)	0.018*	0.001
Ln (wife's education + 1)	0.072***	0.012
Ln (household asset index + 1)	0.048***	0.017
Ln (household status index + 1)	0.117***	0.033
Ln (strength of the wife's network of relatives)	0.009***	0.003
Participation in outside-home earning activities (1 if yes)	0.209***	0.022
Participation in within-home earning activities (1 if yes)	0.059***	0.020
If mother-in-law is staying with the family (1 if yes)	-0.208***	0.041
If father-in-law is staying with the family (1 if yes)	-0.052	0.093
If the woman participates in NGO activities	0.063***	0.022
If the woman has places other than the husband's home to stay for a long time (1 if yes)	0.019	0.021
If the wife's parents are richer now (1 if yes)	-0.018	0.022
Constant	0.727***	0.042
Number of observations	1000	
F-statistics	27.64***	
R-squared	0.2419	
F-statistics of restrictions		
Test wife's education = husband's education	9.44***	
Test household asset index = household status index	2.67*	
Test participation in outside-home earning activities = participation in within-home earning activities	23.02***	

Note: Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors.

Annex Table A6: Impacts of female empowerment on individual food security, individual good food share and individual monthly food expenditure

Dependent variable	Individual calorie adequacy ratio	Individual good food share	Ln individual food expenditure (monthly)
Variables	Coefficient	Coefficient	
Household calorie adequacy ratio, predicted	0.563*** (0.089)		
Household good food availability ratio, predicted		1.18*** (0.094)	
Ln (per capita household expenditure), predicted			0.221 (3.35)
[Ln (per capita household expenditure), predicted] ^{2}			0.004 (0.233)
Ln (individual age)	-0.110* (0.057)	-0.128*** (0.020)	0.421*** (0.078)
[Ln (individual age)] ^{2}	0.018* (0.009)	0.019*** (0.003)	-0.036*** (0.014)
Ln (individual activity level)	-0.728*** (0.021)	-0.027*** (0.005)	-0.007 (0.038)
Ln (household size)	0.024* (0.014)	0.001 (0.003)	0.124*** (0.027)
Household head's sex (male = 1)	0.018 (0.013)	-0.003 (0.003)	0.003 (0.002)
Location (urban = 1)	-0.027*** (0.008)	-0.004* (0.002)	0.127*** (0.015)
Individual age-sex dummy			
Male schoolers	0.190 (0.161)	-0.004 (0.056)	0.129 (0.234)
Male young adults	0.120 (0.160)	0.009 (0.057)	0.314 (0.243)
Male prime age adults	0.260* (0.156)	0.048 (0.056)	0.471** (0.231)
Male elderly	0.568** (0.284)	0.001 (0.062)	0.348 (0.375)
Female preschoolers	-0.129 (0.192)	-0.029 (0.067)	-0.165 (0.278)
Female schoolers	0.023 (0.155)	-0.012 (0.056)	-0.021 (0.242)
Female young adults	-0.007 (0.164)	0.026 (0.057)	-0.025 (0.257)
Female prime age adults	0.121 (0.157)	0.018 (0.056)	0.103 (0.231)
Female elderly	-0.088 (0.262)	0.013 (0.061)	-0.255 (0.361)
Bargaining power and interaction terms			
Ln (indicator of female status), fitted values	-0.114 (0.119)	-0.016 (0.046)	0.594*** (0.173)
Female status * female preschoolers	0.132 (0.167)	0.013 (0.057)	0.115 (0.239)
Female status * male schoolers	-0.058 (0.134)	0.019 (0.046)	-0.085 (0.198)
Female status * female schoolers	0.058 (0.130)	0.022 (0.046)	0.008 (0.206)
Female status * male young adults	0.024 (0.133)	0.013 (0.047)	-0.066 (0.203)
Female status * female young adults	0.138 (0.136)	-0.004 (0.046)	0.074 (0.216)
Female status * male prime age adults	-0.052 (0.127)	-0.016 (0.046)	-0.178 (0.189)
Female status * female prime age adults	0.057 (0.128)	-0.001 (0.045)	-0.112 (0.189)
Female status * male elderly	-0.268 (0.244)	0.013 (0.052)	-0.137 (0.325)
Female status * female elderly	0.254 (0.229)	-0.005 (0.051)	0.086 (0.309)
Constant	0.925*** (0.177)	0.204*** (0.059)	2.71 (12.0)
Number of observations	4678	4678	4678

continued ....

Dependent variable	Individual calorie adequacy ratio	Individual good food share	Ln individual food expenditure (monthly)
Variables	Coefficient	Coefficient	
F-statistics	56.48***	26.84***	72.82***
R-squared	0.2134	0.2011	0.3191
F-statistics of the restrictions			
Male schoolers = female schoolers	2.91*	0.16	0.76
Male young adults = female young adults	1.53	0.64	2.91*
Male prime age adults = female prime age adults	3.45*	5.05**	7.96***
Male elderly = female elderly	4.12**	0.11	2.09
Female status * male schoolers = female status * female schoolers	2.06	0.04	0.39
Female status * male young adults = female status * female young adults	1.70	0.91	0.67
Female status * male prime age adults = female status * female prime age adults	2.93*	1.76	0.36
Female status * male elderly = female status * female elderly	3.25*	0.28	0.35

Note: Statistical significance at 1, 5, and 10 per cent level are denoted by *, ** and *** respectively. Drawn inferences are based on robust standard errors (given in the parentheses). Male preschoolers are the excluded category.

Annex 2

Calculating individual calorie requirements

It is desirable that an individual should get the expended energy per unit of time (per, day for convenience) to maintain existing health. Broadly, total energy expenditure of an individual includes expenditure at rest and during physical activity. The values of these two components depend on individual-specific factors like age, sex, body weight and composition, physiologic state (for example, growth, pregnancy, lactation) and on some natural factors. Resting energy expenditure (REE) is the starting point in measuring calorie requirements and is defined as the energy expended by an individual at rest under thermally neutral conditions. Basal Metabolic Rate (BMR) is defined to be the REE soon after awakening in the morning measured at least 12 hours from the last meal. In practice the variation in measured REE and BMR is very low and in literatures these two terms are used interchangeably.

Generally, REE is the largest component of calorie requirements if physical activity is not too great. It depends largely on physical characteristics like weight, height, sex and age. In the literature REE is measured using several empirically derived equations. In this paper we have used the equations from the WHO (1985), which are given below.

Annex Table A7: Equations for predicting resting energy expenditure from body weight[a]

Sex and age range (years)	Equation to derive REE in Kcal/day	R[b]	SD[b]
Males			
0-3	(60.9 x wt[c]) - 54	0.97	53
3-10	(22.7 x wt) + 495	0.86	62
10-18	(17.5 x wt) + 651	0.90	100
18-30	(15.3 x wt) + 679	0.65	151
30-60	(11.6 x wt) + 879	0.60	164
>60	(13.5 x wt) + 487	0.79	148
Females			
0-3	(61.9 x wt) - 51	0.97	61
3-10	(22.5 x wt) + 499	0.85	63
10-18	(12.2 x wt) + 746	0.75	117
18-30	(14.7 x wt) + 496	0.72	121
30-60	(8.7 x wt) + 829	0.70	108
>60	(10.5 x wt) + 596	0.74	109

Notes:

[a] From WHO (1985). These equations were derived from BMR data.

[b] Correlation coefficient (R) of reported BMRs and predicted values, and standard deviation (SD) of the differences between actual and computed values.

[c] wt is weight of person in kilograms.

Source: Adapted from WTO (1985).

The equations in Annex Table A7 provide approximated values of REE that are widely accepted. This set of equations does not include height as this variable was found not to be statistically significant in determining REE.

Energy expenditure is largely influenced by the characteristics of physical activity, which can be of many sorts and of different intensities. Defining physical activity and its inclusion into the measurement of energy requirement is of immense importance as it is argued to be the second largest component of energy requirement (after rest). The traditional approach of defining physical activity by occupation categories is inadequate or not the closest approximation. This is because individuals perform different types of activities every day to fulfill the economic and social responsibilities and allocate time to maximize utility out of those activities. Different types of activity require different levels of energy expenditure and energy expenditure of a particular activity is an increasing function of time allocated to the activity. Thus, in measuring energy requirement one should incorporate not only activities but also the time allocation. As a result we have used a weighted average of activity factor where the categorization of activities and also the values of activity factor associated with each category are taken from NRC (1989) and the weights are the allocated time in each activity per day, which comes from the survey data. A total of 31 types of activities are considered in our study and they are then categorized into five categories namely resting, very light, light, moderate, and heavy according the intensity of energy expenditure as the names suggest. Table A1 is reproduced from NRC (1989) report with the activity types considered in each category in our study.

Annex Table A8: Approximate energy expenditure for various activities in relation to resting needs for males and females of average size

Activity category	Activity	Representative value for factor per unit of activity
Resting	Sleeping, eating, drinking	REE × 1.0
Very light	Office work, work in own business, looking after crops, looking after poultry and livestock, social and political activity, others	REE × 1.5
Light	Collecting firewood, fishing, masonary, carpentry, weaving, handicrafts, walking, transportation, work at school, shopping, cooking, domestic work, washing clothes and dishes, looking after the children and elderly, playing games, religious activity	REE × 2.5
Moderate	Ploughing, weeding, fetching water, riding bicycle, boating, harvesting crops, leveling crop lands, throwing fertilizers in the fields, non-mechanical irrigation	REE × 5.0
Heavy	Earth digging, brick-breaking, carrying loads, rickshaw-van pulling	REE × 7.0

Source: NRC (1989).

To make the time allocation representative an average of three days is taken for each individual. The weighted average of the activity factor is then used as multiple of REE to get to the approximate value of energy requirement.

Constructing the composite index of women's empowerment

The index is based on seven different indicators/indices.

(1) Earnings, savings and spending: we consider the following three questions,

1. Who takes the decision regarding the spending of women's earnings? If the woman takes independent or joint decisions she is given a value of 1 and 0 if otherwise.
2. Whether she keeps some money for her own security or personal spending. 1 for yes and 0 for no.
3. Whether the husband knows about this personal spending. 1 if the husband never knows and 0 otherwise.

(2) Ability to make purchases: we ask the woman *if she can buy some listed goods and services*. The list had 12 categories. For each kind of items, we ascribed 1 for always/sometimes and 0 if otherwise. All the answers were summed and then divided by 12. This index thus ranges from 0 to 1.

(3) Ability to take purchasing decision: regarding *the purchase of those 12 items* we inquired about *the decision taker*. For an independent (decision taken by the woman herself) or joint decision we give a 1 and a 0 if otherwise. In a similar fashion this index also lies between 0 and 1.

(4) Index of mobility: we categorize all the possible visiting places into 7 classes and *ask the married women if she has visited those places in recent times*. 1 is given for each yes and 0 for each no. The sum of all the responses is divided by 7. As a result we also have the mobility index in the '0 to 1' range.

(5) Occurrence of degrading and abusive incidents: we considered the following unexpected events:

1. Whether husband or other family members have taken money against the woman's will.
2. Whether husband or other family members have taken assets (land, jewellery, etc.) against the woman's will.
3. The woman was not allowed to meet her parents.
4. Threats of divorce.
5. Threats of remarriage.
6. Verbal abuse.
7. Physical abuse (beating).

For the non-occurrence of each type of incident we ascribe a 1, and a 0 if that event has taken place. Dividing the sum of all the answers by 7 we get an index that ranges from 0 to 1.

(6) Index of political awareness: to assess the woman's political awareness we ask the following:

1. Whether she knows the name of the local UP chairman (1 if yes and 0 otherwise).
2. Whether she knows the name of the local MP (1 if yes and 0 otherwise).
3. Whether she knows the name of the PM of the country (1 if yes and 0 otherwise).
4. Whether she has cast vote (1 if yes and 0 otherwise).
5. Whether she chose the candidate herself while casting vote (1 if yes and 0 otherwise).

This index, like the previous, are scaled between 0 and 1.

(7) Nutritional awareness: 10 questions were asked about nutrition and primary health care. If all the answers were correct the woman got 1. This index also ranges between 0 and 1.

Note: For all the seven indices described above, we took one value for each household. In the case of households having a second married woman, we took the average of the two women's indices.

The composite index of women empowerment: We sum all those 7 indices for each woman to obtain the corresponding value of the 'composite index of women empowerment'. This composite index is household specific and ranges from 0 to 7.

Indicators of a household's socioeconomic status

Household asset index: The index of household asset is constructed based on 32 different types of household belongings (goods and chattels).[27] We ascribe 1 for the presence of each item and 0 for its absence and thus the index will assume a value between 0 and 32 for each household.

Household status index: We construct another index to reflect the household's socioeconomic status based on 4 indicators – whether the household has a separate kitchen, substance (brick/cement/rod/tin/wood/tiles/leaves) used to build the roof, if 'pucca' latrine is used and whether supply/tube well water is the source of drinking water. The value of this index lies between 0 and 4.[28]

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[27] The goods are: radio, cassette player, camera, bicycle, motor cycle/scooter, motor car, refrigerator, washing machine, fan, oven (electric/gas), toaster, heater, television, VCR/VCP, dish antenna/decoder, cell phone, pressure lamp, sewing machine, tube well, wrist watch, wall clock, power tiller, tractor, threshing-machine, power pump, shallow tubewell, cattle, plough, insecticide spraying machine, generator, fishing materials (net, boat, trawler) and loom.

[28] A 'yes' answer related to three indicators was given a value of 1 each. In the materials used for roof, the use of brick, cement, and rod was given a value of 1, while for all other materials a value of 0 was assigned.