ELSEVIER
www.elsevier.com/locate/worlddev

CrossMark

World Development Vol. 61, pp. 11–52, 2014

http://dx.doi.org/10.1016/j.worlddev.2014.03.025

Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh?

ESHA SRABONI [a], HAZEL J. MALAPIT [b], AGNES R. QUISUMBING [b] and AKHTER U. AHMED [a,*]

[a] *International Food Policy Research Institute, Dhaka, Bangladesh*
[b] *International Food Policy Research Institute, DC, USA*

Summary. — Using a nationally representative survey from Bangladesh, we examine the relationship between women's empowerment in agriculture, measured using the Women's Empowerment in Agriculture Index, and per capita calorie availability, dietary diversity, and adult body mass index (BMI). Accounting for potential endogeneity of empowerment, we find that increases in women's empowerment are positively associated with calorie availability and dietary diversity at the household level. Overall, household wealth, education, and occupation are more important than women's empowerment as determinants of adult nutritional status, although negative impacts of group membership and credit on male BMI suggest that intrahousehold trade-offs may exist.

Key words — women's empowerment, gender parity, agriculture, food security, south Asia, Bangladesh

1. INTRODUCTION

While Bangladesh has experienced steady advances in food production through the adoption of agricultural technologies, chronic food insecurity remains a challenge. Similar to other countries in South Asia, there is a strong gender dimension to food insecurity and malnutrition in Bangladesh. In South Asia, the low status of women and gender gaps in health and education contribute to chronic child malnutrition (Smith, Ramakrishnan, Ndiaye, Haddad, & Martorell, 2003) and food insecurity (von Grebmer *et al.*, 2009), even as other determinants of food security, such as per capita incomes, have improved. Renewed interest in agriculture as an engine of inclusive growth and specifically in women's empowerment has highlighted the need to develop indicators for measuring women's empowerment, to examine its relationship to various food security outcomes, and to monitor the impact of interventions to empower women.

This paper presents how the recently developed Women's Empowerment in Agriculture Index (WEAI) (Alkire *et al.*, 2013) can be used to assess the extent of women's empowerment in agriculture, diagnose areas where gaps in empowerment exist, and examine the extent to which improvements in the underlying indicators in these areas can improve food security in rural Bangladesh. The WEAI is a new survey-based index that uses individual-level data collected from primary male and female respondents within the same households, and is similar in construction to the Alkire and Foster (2011) group of multidimensional poverty indices.

Although it was initially developed as a monitoring and evaluation tool for the US Government's Feed the Future programs, the WEAI has broader applicability as a diagnostic tool for policymakers, development organizations, and academics seeking to inform efforts to increase women's empowerment. The WEAI was developed and tested during 2011–12 using three country pilots in Bangladesh, Guatemala, and Uganda (Alkire *et al.*, 2013); this paper will represent the first time it is being calculated using a nationally representative survey.

Using nationally representative data from the 2012 Bangladesh Integrated Household Survey (BIHS) conducted by the International Food Policy Research Institute, this paper examines the relationship between women's empowerment in agriculture and three measures of food security in rural Bangladesh, per capita calorie availability, household dietary diversity, and adult body mass index (BMI). We use six measures of women's empowerment—the aggregate women's empowerment score, based on the five domains of empowerment in agriculture (5DE)—as well as four individual indicators derived by decomposing the 5DE to identify in which of the five domains disempowerment is most acute, and using the specific indicators that comprise those domains. Our sixth measure, women's empowerment relative to men, is reflected by another component of the WEAI, the gender parity gap. Because empowerment itself is endogenous, we use instrumental variables (IV) regression to examine the relationship between various measures of women's empowerment and measures of household food security.

Increases in women's empowerment scores are found to increase both calorie availability and household dietary diversity. Empowerment gaps for women in rural Bangladesh are found to be greatest in terms of leadership in the community and control and access to resources. Analyzing these two

* Funding for this research was provided by the United States Agency for International Development (USAID) for the Policy Research and Strategy Support Program (PRSSP) in Bangladesh and Women's Empowerment in Agriculture Index (WEAI) through USAID Grant Number: EEM-G-00-04-00013-00. We acknowledge additional support from the CGIAR Research Program on Policies, Institutions and Markets, led by IFPRI. We thank Suneetha Kadiyala for guidance on the measurement of dietary diversity, and Harold Alderman, John Hoddinott, and participants at IFPRI seminars, the first Conference on Global Food Security, and the sixth International Conference on Agricultural Statistics for helpful comments and suggestions. We thank the survey enumerators and other staff of Data Analysis and Technical Assistance Limited (DATA) for conducting the household surveys and assistance in data cleaning. We also thank the editor of *World Development* and two anonymous referees for insightful comments. Ginette Mignot and Jay Willis helped with final formatting of the document. All remaining errors and omissions are ours. Final revision accepted: March 30, 2014.

domains further in terms of their component indicators, we find that the number of groups in which women actively participate and women's greater control of assets are positively associated with both food security outcomes. Narrowing the gap in empowerment between men and women within households is also positively associated with calorie availability and household dietary diversity, consistent with the growing literature arguing that reducing intrahousehold gender inequality contributes positively to household welfare. Most of the indicators for women's empowerment do not have any significant impact on adult BMI, suggesting that other factors, such as household wealth, education, and occupation, are more important determinants of adult male and female nutritional status. However, women's group membership and decision-making concerning credit are negatively and significantly associated with adult male BMI, suggesting possible trade-offs within the household. The impacts of women's empowerment appear to vary by household wealth, as proxied by the size of owned land. Our results suggest that the positive effect of the different dimensions of female empowerment on food security outcomes is greater for smaller landowners, that is, for less well-off households, pointing to the potential positive redistributive effect of focusing women's empowerment efforts on poorer households.

2. BACKGROUND

(a) *Agriculture, women's empowerment, and food security*

Agriculture is closely linked to food security, by providing a source of food and nutrients, a broad-based source of income, and by directly influencing food prices (Arimond *et al.*, 2010). Women account for 43% of the agricultural labor force in developing countries (FAO, 2011a); yet considerable gender bias exists in the agricultural sector, both in terms of quantities of assets, agricultural inputs and resources that women control (see Agarwal, 1994 on land in South Asia; Deere, Oduro, Swaminathan, & Doss, 2013 on assets; and Peterman, Behrman, & Quisumbing, 2010 on nonland inputs), as well as returns to those inputs (Kilic, Palacios-Lopez, & Goldstein, 2013). Similar to the recognition of women's contribution to agriculture worldwide, women's role in Bangladeshi agriculture tends to be underappreciated, owing to the commonly held view that women are not involved in agricultural production, especially outside the homestead, because of cultural norms that value female seclusion and undervalue female labor (Kabeer, 1994; Rahman, 2000). Nevertheless, participation of women in the agricultural sector has increased over time (Asaduzzaman, 2010, citing Bangladesh Bureau of Statistics, various years). During 1999–2000 and 2005–06, the number of employed persons in agriculture increased from 19.99 to 22.93 million—about 15%. For male labor, there has been an absolute decrease of about 6%, while for females the number has increased from 3.76 to 7.71 million—that is, by more than 100%. As a result of such changes, the proportion of women in the agricultural labor force has increased from less than 20% to 33.6% of the total. This is indeed a phenomenal change, although it is not yet clear how much of this change resulted from a true secular increase as opposed to better measurement of women's participation.

Women in poor households, who are at greater risk of being food-insecure, are more likely to be involved in the agricultural sector, particularly as wage laborers, because women's earnings are important to their families' subsistence. Zaman (1995) provides evidence that the gender division of labor in agriculture is not as strictly demarcated as assumed, with women being involved in agricultural work both inside and outside the household. Rahman (2010) shows that female agricultural labor contributes significantly to productivity as well as technical efficiency, but finds, similar to Zaman (1995), that gender bias exists in the agricultural labor market. Remunerative employment of labor remains skewed in favor of men, since female labor is engaged only when the male labor supply is exhausted.

Women's ability to generate income in the agricultural sector is severely constrained by their limited use, ownership, and control of productive physical and human capital. Bangladeshi women are disadvantaged relative to men with respect to assets brought to marriage (Quisumbing & Maluccio, 2003), current productive assets (including land, livestock, and agricultural machinery) (Quisumbing, Roy, Njuki, Tanvin, & Waithanji, 2013), and human capital. Women lag behind in terms of education in Bangladesh—with more than one in three women having no schooling, compared to one in four men. A recent analysis also showed that lack of education in adult women in Bangladesh is a strong correlate of being "ultra-poor": 80% of adult women with no education live below half a dollar a day (Ahmed, Hill, Smith, Wiesmann, & Frankenberger, 2007).

The rationale for paying attention to gender inequality in agriculture is rooted in a body of empirical evidence that demonstrates the ways in which women are essential to improvements in household agricultural productivity, food security, and nutrition security. Considerable evidence exists that households do not act in a unitary manner when making decisions or allocating resources (Alderman, Chiappori, Haddad, Hoddinott, & Kanbur, 1995; Haddad, Hoddinott, & Alderman, 1997). This means that men and women within households do not *always* have the same preferences nor pool their resources. The nonpooling of agricultural resources within the household creates a gender gap in control of agricultural inputs, which has important implications for productivity. Several empirical studies have found that redistributing inputs between men and women in the household has the potential for increasing productivity (Kilic *et al.*, 2013; Peterman *et al.*, 2010; Udry, Hoddinott, Alderman, & Haddad, 1995). A growing body of empirical evidence suggests that increasing women's control over resources has positive effects on a number of important development outcomes. For *Côte d'Ivoire*, Hoddinott and Haddad (1995) and Duflo and Udry (2004) find that increasing women's share of cash income significantly increases the share of household budget allocated to food. Doss (2006) shows that, in Ghana, women's share of assets, particularly farmland, significantly increases budget shares on food expenditure.

Considerable evidence also suggests that mothers' greater control over resources improves child outcomes—in particular, nutrition and education (Hallman, 2003; Quisumbing, 2003; Quisumbing & Maluccio, 2003; Skoufias, 2005). Although much of the abovementioned evidence has emerged from observational studies, a systematic review of programs targeting transfers to women (Yoong, Rabinovich, & Diepeveen, 2012) has found that these improve children's well-being, especially in the form of investments in children's health and education.

The linkages between women's *empowerment* and food security have been more difficult to quantify owing to the difficulty of measuring empowerment. Despite these difficulties, there is evidence that *dis*empowerment in one of its most extreme forms—being a victim of intimate partner violence (IPV)—is associated with poor nutritional outcomes both for children

and their mothers. Ziaei, Naved, and Ekström (2012), using data from the 2007 Bangladesh Demographic and Health Survey (BDHS), investigate the association between women's exposure to IPV and their children's nutritional status. Of 2,042 women in the BDHS survey with at least one child under 5 years of age, 49.4% reported lifetime experience of physical partner violence, while 18.4% reported experience of sexual partner violence. They find that women were more likely to have a stunted child if they had lifetime experience of physical IPV or had been exposed to sexual IPV. A study based on a longitudinal dataset following up three sites in Bangladesh where agricultural technologies had been introduced found that experience of domestic abuse (particularly verbal abuse) had a significant negative impact on women's current BMI and on improvements in BMI over time (Quisumbing, Bhagowalia, Menon, & Soundararajan, 2009).

Current efforts to define and measure empowerment have drawn heavily on Kabeer's (1999) definition of empowerment as expanding people's ability to make strategic life choices, particularly in contexts in which this ability had been denied to them. In Kabeer's definition, the ability to exercise choice encompasses three dimensions: resources, agency, and achievements (well-being outcomes). The WEAI focuses on the "agency" aspect, which is far less studied than resources such as income, or achievements such as educational levels. Moreover, while nationally representative surveys such as some demographic and health surveys (DHS) include a range of questions about decisionmaking within the household, these are typically confined to the domestic sphere and do not encompass decisions in the productive and economic spheres, nor do the surveys have identical questions for men and women (Alkire *et al.*, 2013). The WEAI also departs from previous measures of women's empowerment in that it captures control over resources or agency within the agricultural sector, something which existing indices have not done.

(b) *Measuring women's empowerment using the WEAI*

The WEAI is an aggregate index, reported at the country or regional level, which is based on individual-level data on men and women within the same households. The WEAI is a weighted average of two sub-indexes: (1) the five domains of women's empowerment (5DE) and (2) gender parity (the Gender Parity Index, GPI).[1] The 5DE sub-index shows how empowered women are, capturing the roles and extent of women's engagement in the agricultural sector in five domains: (1) decisions over agricultural production, (2) access to and decisionmaking power over productive resources, (3) control over use of income, (4) leadership in the community, and (5) time use. Table 1 describes the five domains and their corresponding ten indicators. The 5DE assesses the degree to which women are empowered in these domains, and for those who are not empowered, the percentage of domains in which they are empowered. "Empowerment" within a domain means that the person has adequate achievements or has "achieved adequacy" for that domain (specific thresholds used to determine whether a person has adequate achievements will be discussed subsequently). Because the survey method goes beyond the traditional practice of interviewing only a household "head" (often a male) to interview both a principal male and principal female, 5DE measures can be computed for both the principal male and the principal female in a dual-adult household, although the 5DE component of the WEAI only includes women's 5DE. Computation of men's 5DE scores and their comparison to women's 5DE enables the comparison of the agricultural empowerment of men and women living in the same household. This comparison is embodied in the GPI (gender parity index), a relative inequality measure that reflects the inequality in 5DE profiles between the primary adult male and female in each household. The aggregate WEAI uses the mean GPI value of dual-adult households. GPI combines two key pieces of information: (1) the percentage of women who lack gender parity relative to their male-household counterparts and (2) the extent of the inequality in empowerment between those women who lack parity and the men with whom they live (see Alkire *et al.*, 2013 for details).

Both measures, taken together, make up the WEAI.[2] The aggregate index therefore shows the degree to which women are empowered in their households and communities (5DE)

Table 1. *The five domains of empowerment in the WEAI*

Domain	Indicator	Definition of indicator	Weight
Production	Input in productive decisions	Sole or joint decisionmaking over food and cash-crop farming, livestock, and fisheries	1/10
	Autonomy in production	Autonomy in agricultural production (e.g., what inputs to buy, crops to grow, what livestock to raise, etc.). Reflects the extent to which the respondent's motivation for decisionmaking reflects his/her values rather than a desire to please others or avoid harm.	1/10
Resources	Ownership of assets	Sole or joint ownership of major household assets	1/15
	Purchase, sale, or transfer of assets	Whether respondent participates in decision to buy, sell, or transfer his/her owned assets	1/15
	Access to and decisions on credit	Access to and participation in decisionmaking concerning credit	1/15
Income	Control over use of income	Sole or joint control over income and expenditures	1/5
Leadership	Group member	Whether respondent is an active member in at least one economic or social group (e.g., agricultural marketing, credit, water users' groups)	1/10
	Speaking in public	Whether the respondent is comfortable speaking in public concerning various issues such as intervening in a family dispute, ensure proper payment of wages for public work programs, etc.	1/10
Time	Workload	Allocation of time to productive and domestic tasks	1/10
	Leisure	Satisfaction with the available time for leisure activities	1/10

Source: Alkire *et al.* (2013).

and the degree of inequality between women and men in their households (GPI). Details regarding the construction and validation of the index can be found in Alkire *et al.* (2013). In this paper, we use individual measures of (women's) 5DE and its component indicators to investigate the relationship between women's empowerment in agriculture and food security; additionally, we examine the relationship between inequality in empowerment and food security in dual-adult households using the gender parity gap, a component of the GPI.

3. DATA, EMPIRICAL SPECIFICATIONS, AND VARIABLES

(a) *Data*

The Bangladesh Integrated Household Survey (BIHS) was designed and supervised by researchers at the International Food Policy Research Institute (IFPRI), including the authors of this paper, and conducted from December 2011 to March 2012. The BIHS sample is nationally representative of rural Bangladesh and representative of rural areas of each of the seven administrative divisions of the country. To estimate the total sample size of 5,503 households in 275 primary sampling units (PSUs), BIHS followed a stratified sampling design in two stages—selection of PSUs and selection of households within each PSU—using the sampling frame developed from the community series of the 2001 population census. In the first stage, a total sample of 275 PSUs were allocated among the seven strata (seven divisions) with probability proportional to the number of households in each stratum. Sampling weights were adjusted using the sampling frame of the 2011 population census.

The BIHS questionnaires include several modules that provide an integrated data platform to answer a variety of research questions, as well as separate questionnaires for self-identified primary male and female decisionmakers in sampled households. Our study relied primarily on information concerning household demographics, educational attainment, occupation and employment, food and nonfood consumption and expenditures, household-level agricultural production and livestock holding, household assets, housing and amenities, community infrastructure and facilities, individual anthropometric measurements, and a detailed module on the WEAI.

The BIHS sample consists of 1,608 nonfarm and 3,895 farm households; since the WEAI aims to measure agency in the agricultural sector, we restrict our analysis to farm households, including households relying on agricultural wage labor. The WEAI relies on information collected from both primary male and female adults in the household, and thus, our estimation samples depend on valid responses from these household members. For the household-level analysis using women's 5DE alone, we use data from the self-identified primary female adult. Of these data, 424 observations were dropped, because the primary female respondent was either unavailable on the day of the interview or did not respond to all of the WEAI survey questions. In addition, 192 observations were dropped because a female other than the primary female was interviewed, and six additional cases were dropped because of possible data entry errors in the demographic data. Our final estimation sample consists of 3,273 households. For the analysis that examines women's relative empowerment within the household, we restrict the analyses to households where both the primary male and female decisionmakers have been interviewed, reducing our sample size to 3,213 households.

For the individual-level analysis using women's 5DE, BMI values were obtained for 3,150 primary adult males and 3,263 primary adult females from farm households. For the analysis examining women's relative empowerment using the gender parity gap, the sample sizes for men and women are reduced to 3,094 and 3,203, respectively.

(b) *Empirical specification*

To examine the relationship between women's empowerment in agriculture and household food security, we estimate the following equation:

$$\mathbf{f} = \beta_0 + \beta_1\, empowerment + \beta_2\mathbf{x} + \beta_3\mathbf{h} + \beta_4\mathbf{c} + \varepsilon, \tag{1}$$

where $\mathbf{f}$ is a vector of food security outcomes, β_i are coefficients to be estimated, $\mathbf{x}$ is a vector of individual-level characteristics, $\mathbf{h}$ is a vector of household-level characteristics, $\mathbf{c}$ is a vector of community or village characteristics, and ε is an error term.

In addition to the base regression described in Eqn. (1), we also examine how the relationship between women's empowerment in agriculture and household food security varies by the size of cultivable land owned by the household. We therefore estimate the augmented equation:

$$\begin{aligned}\mathbf{f} = {} & \beta_0 + \beta_1\, empowerment + \beta_2 ln(landarea + 1) \\ & + \beta_3[empowerment \times \ln(landarea + 1)] + \beta_4\mathbf{x} \\ & + \beta_5\mathbf{h}_{\text{aug}} + \beta_6\mathbf{c} + v,\end{aligned} \tag{2}$$

where β_3 represents the interaction effect of empowerment and land area, $\mathbf{h}_{\text{aug}}$ is a vector of household-level characteristics excluding land, and v is an error term. [3]

We use two measures of women's empowerment in alternative specifications. In the first main specification, estimated for the full estimation sample, our measure of empowerment is the women's 5DE score; in the second main specification, estimated for a subsample of households in which we have both men's and women's empowerment scores, our measure of empowerment consists of the gender parity gap, computed by taking the difference between the men's and women's 5DE scores for households that do not have gender parity. [4] Because it is likely that women's empowerment within the household might be affected by the same factors affecting the availability of food and dietary diversity, we apply standard instrumental variables techniques to correct for potential endogeneity bias, using the ivreg2 procedure in Stata12 (Baum, Schaffer, & Stillman, 2010; StataCorp., 2011).

(c) *Outcome variables*

(i) *Per capita calorie availability*

A commonly used indicator for food security at the household level is calorie availability, constructed by converting quantities of food consumed into corresponding energy units. Food consumption data, covering around 300 food items, were collected at the household level. The data capture quantities consumed from market purchases, home production, and from other sources outside the house, e.g., relatives, government/nongovernment aid, or food received in exchange for labor. Agricultural seasonality is of concern when working with food consumption data, since lack of labor market activities during the lean season might affect household income, food expenditure, and consequently food consumption. The

survey period, however, does not coincide with any of the two lean seasons prevalent in Bangladesh, thus allaying concerns about seasonality. The 7-day data were converted to daily calorie equivalents and the resulting calorie values were divided by the household size to obtain per capita calorie availability values (Ahmed & Shams, 1994). [5]

(ii) *Household dietary diversity*

One of the criticisms of the use of calorie availability indicators is that they do not reflect the quality of foods available to households (Ruel, 2003). This is particularly relevant for developing countries where diets are heavily dependent on starchy staples, contain little animal products, and may be high in fats and sugars (Carletto, Zezza, & Banerjee, 2013). In recent years, household dietary diversity measures have gained importance as measures of household food security, especially as several studies have demonstrated a strong association between dietary diversity and household per capita consumption and daily caloric availability (Hatlôy *et al.*, 2000; Hoddinott & Yohannes, 2002). Household dietary diversity is defined as the count of food groups consumed using the 7-day recall household food consumption data. Food was grouped into 12 categories: cereals, white tubers and roots, vegetables, fruits, meat, eggs, fish and other seafood, legumes and nuts, milk and milk products, oils and fats, sweets, and spices, condiments, and beverages (FAO, 2011b); this measure has been validated as a measure of household food security and is being increasingly used.

(iii) *Adult BMI*

Per capita calorie availability only measures what is available at the household level, given household size, but not its intrahousehold distribution or utilization by individuals. It is not a sufficient indicator of food energy deficiency, which requires comparing calorie availability against the energy requirement of households, which, in turn, depends on the age and sex composition of households, and their individual height, weight, and activity levels (Carletto *et al.*, 2013). Moreover, measures of short-term nutritional status, such as BMI, also reflect current energy expenditure, health status, and access to health services and sanitation (UNICEF, 1990). Gender disparities in BMI can be affected by the intrahousehold distribution of food, work effort, and health inputs; for women, BMI is also affected by pregnancy and lactation status. In the absence of data on activity levels, we use BMI values to indicate food energy deficiency. BMI values were calculated for the primary adult male and female decisionmakers and analyzed separately for men and women.

(d) *Key independent variables*

(i) *Women's empowerment in agriculture index*

To measure women's empowerment in agriculture, we use the WEAI, computed using individual-level data collected from primary male and female respondents within the same households.

Table 1 presents the five domains, which comprise ten indicators. Each domain is weighted equally, as are each of the indicators within a domain. The 5DE sub-index is a measure of empowerment that shows the number of domains in which women are empowered. A woman is defined as empowered in 5DE if she has adequate achievements in four of the five domains or is empowered in some combination of the weighted indicators that reflect 80% total adequacy. The five domains of empowerment are defined as follows:

(ii) *Production*

This domain concerns decisions over agricultural production, and refers to sole or joint decisionmaking over food and cash-crop farming, livestock, and fisheries, as well as autonomy in agricultural production.

(iii) *Resources*

This domain concerns ownership, access to, and decisionmaking power over productive resources such as land, livestock, agricultural equipment, consumer durables, and credit.

(iv) *Income*

This domain concerns sole or joint control over the use of income and expenditures.

(v) *Leadership*

This domain concerns leadership in the community, here measured by membership in economic or social groups and comfort in speaking in public.

(vi) *Time*

This domain concerns the allocation of time to productive and domestic tasks and satisfaction with the available time for leisure activities.

A key innovation of the Index is that it identifies the domains in which women are disempowered as well as the relative degree of disempowerment. We use the diagnostic results on the WEAI, which describes the overall pattern of women's disempowerment across the five domains in rural Bangladesh, to guide our choice of empowerment indicators. We first identify the key domains that contribute the most to disempowerment, and then within each key domain, identify the indicators that contribute the most to disempowerment. We then construct a continuous measure of empowerment that draws on the individual-level data for the identified indicators.

Figure 1 shows that the *leadership* and *resources* domains contribute the most to women's disempowerment in rural Bangladesh, while Figure 2 shows the contribution of each domain indicator. *Group membership* emerges as the indicator that contributes most to disempowerment in the leadership

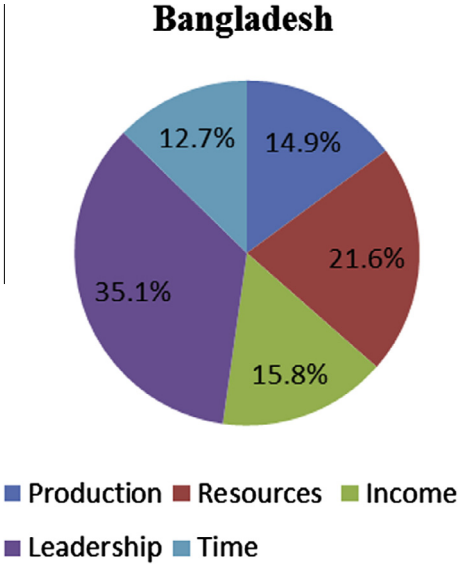

Figure 1. *Contribution of each of the five domains to the disempowerment of women. Source: Sraboni, Quisumbing, and Ahmed (2013).*

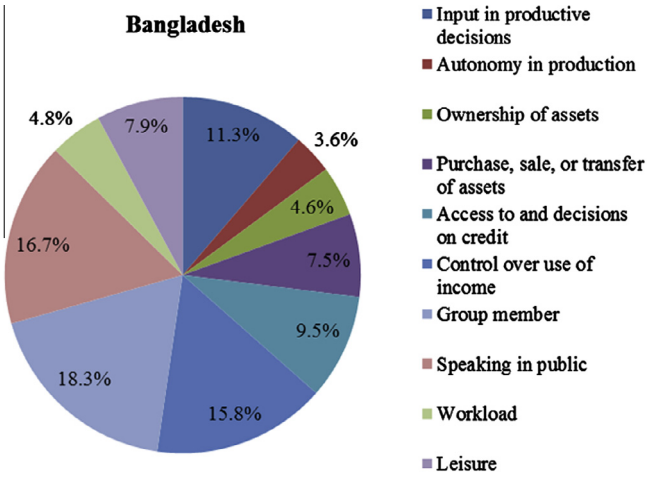

Figure 2. *Contribution of each of the 10 domain indicators to disempowerment of women. Source: Sraboni et al. (2013).*

domain and *access to and decisions on credit* as the most critical indicator for the resources domain. The credit indicator, however, may be problematic, since it is not clear whether nonborrowers are truly credit constrained (they may not avail of credit because they have sufficient liquidity). In light of this issue, we also analyze the two other indicators for the resources domain, namely, *asset ownership* and *rights over assets*. Based on this information, we use the following alternative measures of empowerment.

Model 1: Aggregate empowerment score of primary female respondent is the 5DE empowerment score of the female respondent in the household, which is the weighted average of her achievements in the ten indicators that comprise the five domains of empowerment in agriculture. This measure is increasing in empowerment, and ranges from zero to one.

Model 2: (Leadership domain, Group membership indicator) Number of groups in which woman is an active member is the total number of groups in which the female respondent reports being an active member.

Model 3: (Resources domain, Access to and decisions on credit indicator) Average number of decisions, concerning credit, taken by female is the number of credit decisions that the female respondent has made solely or jointly, averaged over the lending sources used. For each of the five possible lending sources non-government organization (NGO), informal, formal, friends/family, and rotating savings and credit associations (ROSCAs), the survey asks who made the decision to borrow and who made the decision on how to use the money/item borrowed.

Model 4: (Resources domain, Asset ownership indicator) Number of assets woman has sole/joint ownership of is the total number of asset types for which the female respondent reports sole or joint ownership.

Model 5: (Resources domain, Rights over assets indicator) Number of sole/joint decisions, concerning purchase/sale/transfer of assets, taken by woman is the total number of decisions made solely or jointly by the female respondent, summed over all asset types. For each asset type, the survey asks who can decide whether to sell, give away, mortgage/rent, and purchase the asset.

Considerable evidence exists in support of the need to pay attention to intrahousehold gender inequality for attaining development objectives (Alderman *et al.*, 1995; Haddad *et al.*, 1997; Quisumbing, 2003). Therefore, it is interesting to examine whether women's *relative* empowerment within the household is associated with household food security. The Gender Parity Index (GPI) is a composite index that reflects the percentage of women who have gender parity as well as the empowerment gap between men and women in households not having gender parity. Because we are interested in examining how differences between empowerment levels of men and women affect household food security outcomes, we use the gender parity gap component of the GPI as our measure of empowerment. Since we need both male and female scores to compute the gender parity gap, we use the smaller estimation sample of 3,213 households where both the primary male and female decisionmakers have been interviewed.

Model 6: Gender parity gap: According to Alkire *et al.* (2013), a household enjoys parity if the woman is empowered or her empowerment score is greater than or equal to that of the male in her household. Thus, the gender parity gap is zero if the household enjoys gender parity. Otherwise, the gap equals the difference in the male and female aggregate empowerment scores.

(e) *Instruments*

We use the difference in ages between the primary male and female decisionmakers, and number of types of informal credit sources in the village as instruments for all of the empowerment indicators. The survey collected information on whether the following types of informal credit sources are present in the community—moneylender within/outside village, shopkeepers who offer credit, agricultural input dealers who sell on credit, and large farmers/traders who buy crops at a fixed forward price. We do not include formal credit sources, because obtaining credit from these sources typically require collateral (which could be correlated with household wealth and could directly affect the outcomes being considered), nor NGOs, because obtaining credit from NGOs is membership-based. The existence of a large number of informal credit sources could be indicative of both greater social capital within the community, which could influence a woman's decision to actively participate in a group, as well as the size of the informal credit market. The availability of a large pool of funds could thus facilitate decisionmaking concerning credit, and accumulation of assets by the borrowers. The differences in ages can reflect differences in human capital between the primary female and her spouse, and therefore reflect relative bargaining strengths (Quisumbing & Hallman, 2005). [6]

We also instrument empowerment scores, the gender parity gap as well as group membership using information on the number of community activities the woman participated in during the previous year; a woman who is more active in the community is more likely to be an active participant in groups. The survey collected information on whether the woman has contributed money or time to the following community activities—building/maintenance of small wells or irrigation facilities, roads, development projects, local mosque or other religious structure, helping out other families with childcare, agricultural labor, or care of a patient—during the previous year. The difference in recall period implies that the decision to participate in the mentioned activities was already given (exogenous) prior to the current decision to join (or maintain membership in) a group.

An additional variable—whether the homestead land has been inherited by the woman, is used to instrument for both ownership of and rights over assets. Inherited assets have been previously used as a bargaining measure in the literature (Quisumbing 1994; Quisumbing & Maluccio, 2003). While inherited land is arguably endogenous, inherited

homestead land is much less likely to be correlated with the error term.

(f) *Other independent variables*

Our analysis controls for a number of household and community characteristics, as well as individual characteristics for the BMI regressions. Household characteristics include age, age-squared, and years of schooling of the household head,[7] household size, and proportion of males and females in various age groups (with males aged 60 and above as the excluded category). The occupation of the household head is accounted for using dummy variables for two types of primary occupation: farming and trading. We also include the price of rice as a control variable, since rice is the staple food in Bangladesh, accounting for a fifth of all spending of an average rural household, 35% of food expenditure, and 71% of total calorie intake (Ahmed *et al.*, 2013). The number of dairy cows owned by a household is expected to affect the food security outcomes through the pathway of production and consumption of milk and milk products, as well as household wealth. Three other variables are used as indicators of the socioeconomic status of the household: the amount, in decimals, of cultivable land owned by the household, a dummy for whether the household has access to electricity, and a dummy for whether it owns at least one tube well.[8] Taken together these socioeconomic characteristics represent the most important assets owned by rural households in Bangladesh. We also include diversity in food crop production (that is, the total number of food crops produced by the household) as a regressor; if households consume some of the food that they produce, then more diverse agricultural production is expected to increase dietary diversity at the household level. A change in total number of food crops produced may also alter calorie availability of producer households through explicit or implicit changes in household income. A household's crop production decisions may be affected by the same factors that influence its calorie availability and dietary diversity, which could lead to endogeneity bias in our analysis. We use the following instruments at the farm level to identify food crop production diversity: (1) whether or not the soil type is clay-loam, (2) whether or not the soil type is sandy-loam, and (3) the percentage of cropped land that is irrigated. Division dummies are included to control for location-specific effects. For the regressions with adult male and female BMI as dependent variables, we include the age and years of education of the primary male and female. For the primary female, we add two dummy variables indicating whether she is pregnant or lactating. Summary statistics of all the variables used are presented in Table 2.

4. RESULTS

(a) *Women's empowerment and food security*

Tables 3–8 present the ordinary least squares (OLS) and two-stage least squares (2SLS) regression results for the determinants of household food security and individual nutritional status. IV diagnostics are presented at the end of each table. First-stage results are available upon request. We first discuss results on calorie availability and dietary diversity, and then discuss results on adult BMI.

For the regressions involving per capita calorie availability and household dietary diversity (columns 1–4), the Anderson-Rubin and endogeneity test results imply that the endogenous variables are relevant and in fact, endogenous. The overidentification and under-identification test results confirm that the instruments are valid and the models identified. The Kleibergen-Paap *F*-statistics show that the null hypothesis for weak instruments is rejected at the 5% (Tables 3 and 6–8) and 10%-level thresholds (Table 4). However, the *F*-statistic in Table 5 fails to exceed the critical value of 4.79, which is associated with a bias relative to OLS of less than 30% (Stock & Yogo, 2005). This suggests that the instruments used for women's decisions on credit may be weak.

Columns 1 and 3 of Table 3 present the OLS coefficient estimates of the determinants of per capita calorie availability and household dietary diversity, respectively. These estimates show that the female empowerment score is highly significant and positively correlated with both these food security indicators at the household level. In columns 2 and 4, after instrumenting for both potentially endogenous variables (empowerment and food crop production), the estimates show a similar pattern, with the IV estimates being larger than the OLS estimates. These results, together with the good performance of the instruments in general, suggest that household diet diversity and per capita calorie availability increase if the primary female decisionmaker is more empowered; the larger IV coefficients suggest that neglecting endogeneity of empowerment may underestimate the impact of increasing women's empowerment on these food security outcomes.

Moving on to the individual indicators, in Table 4 we find that women's group membership is positively and significantly correlated with the calorie availability measures and dietary diversity. This implies that increasing the number of groups in which women actively participate has a positive impact on household food security outcomes. In Table 5, the OLS coefficient estimates (columns 1 and 3) for women's decisionmaking concerning credit are insignificant, but IV estimates emerge as positive and significant, suggesting that women's decisionmaking concerning credit is significant and positively correlated with the food security outcomes (columns 2 and 4). Since the weak-identification test results suggest that the instruments used for this particular model are weak, we take these results with caution. An underlying problem with using decisions on credit as an indicator of empowerment in this context is that wealthier people may not need to avail of credit (because they can self-finance) and that many microfinance activities are targeted to poorer women in Bangladesh.

The OLS and IV coefficient estimates of women's ownership of assets (presented in Table 6) and rights over assets (Table 7) are significantly positive, implying that female ownership of and control over major household assets has a role to play in improving household food security. Previous work in Bangladesh has demonstrated that greater resource control by women is associated with improved child health (Hallman, 2003); evaluations of the long-term impact of agricultural interventions have similarly showed that interventions targeted to women's groups have increased women's assets and improved nutritional status of women and girls (Kumar & Quisumbing, 2010).

Table 8 presents the regression results for the gender parity gap and food security outcomes. The OLS and IV coefficient estimates of the gender parity gap are significant and negative, implying that a reduction in the gap is associated with an increase in calorie availability and household dietary diversity. Reducing the gender gap in empowerment or improving women's relative empowerment is associated with greater food security at the household level, consistent with the existing literature on female bargaining power within the household and household welfare outcomes.

In most of the IV models, the effect of number of food crops produced by household on calorie availability at the

Table 2. *Summary statistics*

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Dependent variables					
Per capita calorie availability	3,273	2,487	688	979	7,115
Per adult equivalent calorie availability	3,273	3,185	813	1,186	9,530
Household dietary diversity	3,273	9.54	1.58	4	12
Body mass index (BMI) of primary male respondent	3,150	20.13	2.74	12.65	32.79
Body mass index (BMI) of primary female respondent	3,263	20.75	3.36	12.94	34.69
Empowerment variables					
Empowerment score of woman	3,273	0.67	0.23	0.07	1
Number of groups woman is an active member of	3,273	0.33	0.49	0	3
Average number of decisions over credit	3,273	0.96	0.98	0	2
Number of assets woman has self/joint ownership of	3,273	1.96	1.50	0	10
Number of self/joint decisions over purchase, sale, or transfer of assets made by woman	3,273	11.90	9.76	0	48
Gender parity gap	3,213	0.17	0.20	0	0.89
Other controls					
Age (in years) of household head	3,273	45.26	13.39	20	95
Age-squared of household head	3,273	2,228	1,303	400	9,025
Years of education of household head	3,273	2.97	3.82	0	16
Age (in years) of primary male respondent	3,150	45.27	13.42	20	95
Age-squared of primary male respondent	3,150	2,230	1,307	400	9,025
Years of education of primary male respondent	3,150	2.99	3.84	0	16
Age (in years) of primary female respondent	3,263	37.21	11.70	18	80
Age-squared of primary female respondent	3,263	1,522	949	324	6,400
Years of education of primary female respondent	3,263	2.93	3.42	0	16
Female respondent is pregnant (= 1, 0 otherwise)	3,263	0.04	0.18	0	1
Female respondent is lactating (= 1, 0 otherwise)	3,263	0.18	0.39	0	1
Household head is farmer (= 1, 0 otherwise)	3,273	0.31	0.46	0	1
Household head is trader (= 1, 0 otherwise)	3,273	0.08	0.27	0	1
Household size	3,273	4.36	1.57	2	17
Proportion of males 0–4 years old	3,273	0.05	0.10	0	0.6
Proportion of males 5–10 years old	3,273	0.07	0.12	0	0.6
Proportion of males 11–18 years old	3,273	0.07	0.12	0	0.67
Proportion of males 19–59 years old	3,273	0.25	0.14	0	0.75
Proportion of females 0–4 years old	3,273	0.05	0.10	0	0.6
Proportion of females 5–10 years old	3,273	0.07	0.12	0	0.5
Proportion of females 11–18 years old	3,273	0.07	0.12	0	0.6
Proportion of females 19–59 years old	3,273	0.28	0.12	0	0.75
Proportion of females 60 years and older	3,273	0.04	0.10	0	0.67
Number of food crops produced by household	3,273	1.27	1.42	0	11
Number of dairy cows owned	3,273	0.74	1.20	0	9
Price of rice (in taka)	3,273	29.90	3.38	20	50
Ln (owned cultivable land + 1)	3,273	0.70	1.55	0	6.98
Access to electricity (= 1, 0 otherwise)	3,273	0.44	0.50	0	1
Owns hand tube well (= 1, 0 otherwise)	3,273	0.25	0.43	0	1
Division dummy 1	3,273	0.06	0.23	0	1
Division dummy 2	3,273	0.10	0.29	0	1
Division dummy 3	3,273	0.29	0.45	0	1
Division dummy 4	3,273	0.14	0.35	0	1
Division dummy 5	3,273	0.20	0.40	0	1
Division dummy 6	3,273	0.16	0.37	0	1
Instruments					
Age difference (male–female)	3,273	8.08	4.60	−15	40
Types of informal credit sources in village	3,273	2.36	1.50	0	5
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)	3,273	0.46	0.50	0	1
Number of community activities woman has participated in during the previous year	3,273	0.86	1.18	0	7
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)	3,273	0.03	0.18	0	1
Clay-loam soil (= 1, 0 if otherwise)	3,273	0.28	0.45	0	1
Sandy-loam soil (= 1, 0 if otherwise)	3,273	0.18	0.38	0	1
% of land irrigated by household	3,273	46.26	42.29	0	100

Source: IFPRI Bangladesh Integrated Household Survey, 2011–12.

Table 3. *Model 1: Women's empowerment score, household food security, and individual nutritional status outcomes*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Empowerment score of woman	235.364***	891.858***	0.493***	1.938***	−0.119	−0.447	−0.256	0.021
	(47.705)	(172.793)	(0.120)	(0.411)	(0.212)	(0.775)	(0.264)	(0.885)
Age (in years) of household head	14.282**	9.929	−0.010	−0.023				
	(6.178)	(6.644)	(0.015)	(0.016)				
Age-squared of household head	−0.110	−0.067	0.000	0.000				
	(0.067)	(0.072)	(0.000)	(0.000)				
Years of education of household head	8.639***	8.514**	0.074***	0.072***				
	(3.284)	(3.347)	(0.007)	(0.008)				
Age (in years) of member					0.059**	0.061**	0.238***	0.239***
					(0.030)	(0.031)	(0.035)	(0.036)
Age-squared of member					−0.001**	−0.001**	−0.003***	−0.003***
					(0.000)	(0.000)	(0.000)	(0.000)
Years of education of member					0.118***	0.118***	0.119***	0.119***
					(0.015)	(0.015)	(0.021)	(0.021)
Pregnant (= 1, 0 otherwise)							1.105***	1.123***
							(0.286)	(0.286)
Lactating (= 1, 0 otherwise)							−0.861***	−0.850***
							(0.184)	(0.185)
Household head is farmer (= 1, 0 otherwise)	79.132***	95.092***	0.220***	0.174**	0.137	0.123	−0.040	0.077
	(26.165)	(34.737)	(0.064)	(0.081)	(0.122)	(0.148)	(0.143)	(0.180)
Household head is trader (= 1, 0 otherwise)	39.311	15.330	0.547***	0.514***	0.977***	0.992***	0.452*	0.419*
	(38.856)	(40.629)	(0.097)	(0.100)	(0.213)	(0.214)	(0.246)	(0.247)
Household size	−75.922***	−71.063***	0.078***	0.081***	0.073*	0.069*	0.035	0.046
	(8.606)	(9.149)	(0.020)	(0.022)	(0.040)	(0.042)	(0.047)	(0.048)
Proportion of males 0–4 years old	−1,533.389***	−1,564.817***	0.396	0.400	0.020	0.045	0.181	0.056
	(199.816)	(208.895)	(0.473)	(0.489)	(0.868)	(0.871)	(1.002)	(1.016)
Proportion of males 5–10 years old	−960.172***	−1,021.892***	0.379	0.284	0.605	0.636	1.050	0.971
	(187.744)	(195.191)	(0.421)	(0.436)	(0.806)	(0.808)	(0.921)	(0.929)
Proportion of males 11–18 years old	−301.962	−363.127*	−0.151	−0.275	0.215	0.244	1.518*	1.486*
	(185.377)	(192.144)	(0.414)	(0.428)	(0.792)	(0.791)	(0.895)	(0.898)
Proportion of males 19–59 years old	165.236	163.044	0.542*	0.534	1.220*	1.216*	1.854***	1.860***
	(153.994)	(158.439)	(0.314)	(0.326)	(0.659)	(0.656)	(0.676)	(0.674)
Proportion of females 0–4 years old	−1,604.705***	−1,596.603***	0.495	0.599	0.137	0.141	0.705	0.579
	(198.528)	(206.674)	(0.474)	(0.490)	(0.864)	(0.868)	(1.015)	(1.018)
Proportion of females 5–10 years old	−813.647***	−892.625***	0.573	0.425	0.964	1.005	0.610	0.546
	(192.091)	(198.954)	(0.424)	(0.438)	(0.833)	(0.837)	(0.925)	(0.936)
Proportion of females 11–18 years old	−153.315	−260.023	0.498	0.267	0.273	0.328	1.637*	1.590*
	(199.495)	(205.349)	(0.432)	(0.450)	(0.822)	(0.823)	(0.948)	(0.961)
Proportion of females 19–59 years old	30.101	−22.283	0.944*	0.855*	1.121	1.140	1.787	1.747
	(226.492)	(232.903)	(0.501)	(0.519)	(1.012)	(1.011)	(1.098)	(1.095)
Proportion of females 60 years and older	−319.497	−357.407	0.300	0.254	1.040	1.055	2.269*	2.210*
	(250.737)	(257.477)	(0.519)	(0.539)	(1.095)	(1.096)	(1.228)	(1.228)
Number of food crops produced by household	36.259***	24.510	0.075***	0.142**	−0.086**	−0.071	0.040	−0.087
	(9.009)	(23.556)	(0.020)	(0.057)	(0.038)	(0.102)	(0.047)	(0.126)
Number of dairy cows owned	49.536***	44.001***	0.126***	0.095***	0.078*	0.080*	0.035	0.058
	(10.399)	(11.409)	(0.024)	(0.026)	(0.044)	(0.048)	(0.057)	(0.060)
Price of rice (in taka)	−4.194	−1.502	0.021**	0.027***	0.059***	0.057***	0.043**	0.044**
	(3.952)	(4.083)	(0.009)	(0.010)	(0.018)	(0.018)	(0.022)	(0.022)
Ln (owned cultivable land + 1)	28.398***	29.720***	0.038**	0.042**	0.154***	0.153***	0.132***	0.132***
	(8.488)	(8.678)	(0.017)	(0.018)	(0.039)	(0.039)	(0.044)	(0.044)
Owns hand tube well (= 1, 0 otherwise)	100.024***	45.094	0.286***	0.143**	0.044	0.068	0.089	0.095
	(26.863)	(29.281)	(0.063)	(0.070)	(0.122)	(0.135)	(0.146)	(0.160)
Access to electricity (= 1, 0 otherwise)	10.708	−14.117	0.411***	0.355***	0.512***	0.525***	0.626***	0.620***
	(22.838)	(24.523)	(0.056)	(0.060)	(0.105)	(0.108)	(0.127)	(0.129)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2,691.208***	2,339.944***	7.291***	6.537***	15.248***	15.434***	11.971***	11.822***
	(219.368)	(243.215)	(0.530)	(0.587)	(1.015)	(1.097)	(1.179)	(1.213)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	41.928	38.481	26.628	25.084	12.722	12.404	15.078	15.007
Adjusted R^2	0.275	0.230	0.175	0.130	0.113	0.112	0.106	0.103

(*continued on next page*)

Table 3—*continued*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Hansen J p, Ho: instruments valid		0.470		0.640		0.311		0.192
Under ID test p, Ho: underidentified		0.000		0.000		0.000		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		41.798		41.798		39.627		40.325
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.456		0.352
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.449		0.345
Endogeneity test p, Ho: exogenous		0.000		0.000		0.925		0.582
First stage Adjusted R^2 (Empowerment score of woman)		0.180		0.180		0.181		0.183
First stage Adjusted R^2 (Number of food crops produced by household)		0.314		0.314		0.310		0.313

Source: Estimated by authors using data from the IFPRI Bangladesh Integrated Household Survey, 2011–12.
Note: Estimates from base regression without interaction with land. Robust standard errors are in parentheses.
$^{***}p < 0.01$.
$^{**}p < 0.05$.
$^{*}p < 0.1$.

household level is insignificant, but a strong and significant positive association between crop diversity and dietary diversity is evident; the more food crops the households produce, the higher their dietary diversity. The number of dairy cows owned has a significant positive impact on both household food energy availability and household dietary diversity in all models. Rice price is not significantly associated with household level food energy availability, but is strongly and positively associated with the household-level dietary diversity. The latter finding is similar to that of Rashid, Smith, and Rahman (2011), who argue that households may respond to an increase in rice price by partially shifting consumption away from rice to other food items, which results in an increase in dietary diversity. Owned cultivable land is strongly associated with both household food energy availability and household dietary diversity in all models; larger areas of cultivable land may increase household-level calorie availability and dietary diversity both through an income or wealth effect, as well as by making available a larger stock of productive assets. However, the other two income-related variables—ownership of hand tube well and access to electricity—appear to significantly influence household-level food energy availability and dietary diversity only in certain models.

Consistent with the existing literature on human capital and household food security, the education of the household head has a positive and significant relationship with both calorie availability and dietary diversity. Having a household head whose primary occupation is farming significantly increases both calorie availability and dietary diversity in most of the regression models. The positive relationship between farming as the main occupation with both calorie availability and dietary diversity is consistent with our other result that diversity in agricultural production increases dietary diversity at the household level. Having a household head who is primarily involved in trade improves only dietary diversity, not calorie availability.

Household size has a significant negative impact on per capita calorie availability in all the regressions, but has a positive and significant correlation with diet diversity. Since a household member may have access to food from a variety of sources (home production, purchased outside the house, received in exchange for labor, etc.), a larger household size may simply be a reflection of the greater variety in food consumption patterns as a result of having more people living in the household. Coefficients on demographic categories indicate that household demographic composition significantly affects calorie availability across different specifications of the empowerment variable, but only a few demographic categories significantly affect dietary diversity. In the (preferred) IV specification, households with a larger proportion of females between 19 and 59 years of age have more diverse diets; these coefficients are weakly significant in the specifications using the overall empowerment score and asset-based empowerment indicators.

For regressions involving male and female BMI, we fail to reject the exogeneity of women's empowerment and household crop production in the adult male and female BMI equations (columns 6 and 8); hence the OLS results (columns 5 and 7) are our preferred estimates for this sample.

Most of the indicators for women's empowerment do not have any significant impact on adult male (column 5 of Tables 3 and 6–8) and adult female BMI (column 7 of Tables 3–8), suggesting that other factors, such as household wealth, education, and occupation (discussed below), are more important determinants of adult male and female nutritional status. However, women's group membership and decisionmaking concerning credit are negatively and significantly associated with adult male BMI (column 5 of Tables 4 and 5). Taken together with our findings on calorie availability and dietary diversity, these results suggest that adults in households where the primary female has larger social networks and greater access to credit may have increased energy requirements beyond that which is provided by the increased access to food. The insignificant impacts on females and significant and negative impact on males may result from higher demands on male labor, resulting in higher activity levels and therefore greater energy deficiencies for men. Our findings on credit may also be reflecting poverty, given that credit is typically targeted to women in poor households. These hypotheses deserve further investigation in future work. We find that the number of food crops produced by the household has a strongly significant

Table 4. *Model 2: Women's group membership, household food security, and individual nutritional status outcomes*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Number of groups woman is an active member of	39.109*	813.559***	0.109*	1.673***	−0.264**	−0.134	0.032	0.501
	(22.939)	(186.928)	(0.057)	(0.424)	(0.103)	(0.664)	(0.125)	(0.753)
Age (in years) of household head	15.426**	6.450	−0.008	−0.029*				
	(6.125)	(7.423)	(0.015)	(0.017)				
Age-squared of household head	−0.120*	−0.016	0.000	0.000*				
	(0.066)	(0.081)	(0.000)	(0.000)				
Years of education of household head	8.837***	11.529***	0.074***	0.078***				
	(3.304)	(3.922)	(0.007)	(0.009)				
Age (in years) of member					0.062**	0.060*	0.235***	0.231***
					(0.030)	(0.031)	(0.035)	(0.037)
Age-squared of member					−0.001**	−0.001**	−0.003***	−0.003***
					(0.000)	(0.000)	(0.000)	(0.000)
Years of education of member					0.117***	0.117***	0.118***	0.119***
					(0.015)	(0.015)	(0.021)	(0.021)
Pregnant (= 1, 0 otherwise)							1.105***	1.123***
							(0.285)	(0.284)
Lactating (= 1, 0 otherwise)							−0.856***	−0.853***
							(0.184)	(0.184)
Household head is farmer (= 1, 0 otherwise)	80.475***	201.120***	0.226***	0.387***	0.102	0.113	−0.030	0.166
	(26.353)	(51.229)	(0.064)	(0.114)	(0.122)	(0.193)	(0.144)	(0.234)
Household head is trader (= 1, 0 otherwise)	45.881	10.528	0.559***	0.509***	0.983***	0.980***	0.442*	0.395
	(39.175)	(50.801)	(0.097)	(0.115)	(0.212)	(0.214)	(0.246)	(0.249)
Household size	−77.840***	−82.949***	0.073***	0.056**	0.075*	0.074*	0.037	0.046
	(8.671)	(10.772)	(0.020)	(0.023)	(0.040)	(0.041)	(0.047)	(0.047)
Proportion of males 0–4 years old	−1,528.809***	−1,643.825***	0.402	0.245	0.053	0.042	0.137	−0.098
	(199.730)	(234.459)	(0.473)	(0.531)	(0.865)	(0.874)	(1.002)	(1.043)
Proportion of males 5–10 years old	−943.952***	−1,051.360***	0.410	0.234	0.633	0.619	1.007	0.839
	(187.720)	(220.073)	(0.421)	(0.477)	(0.802)	(0.809)	(0.921)	(0.950)
Proportion of males 11–18 years old	−289.250	−469.103**	−0.131	−0.483	0.274	0.243	1.479*	1.332
	(185.171)	(215.354)	(0.414)	(0.468)	(0.789)	(0.806)	(0.895)	(0.932)
Proportion of males 19–59 years old	164.890	141.817	0.540*	0.491	1.227*	1.226*	1.839***	1.792***
	(153.762)	(171.874)	(0.314)	(0.354)	(0.655)	(0.655)	(0.676)	(0.685)
Proportion of females 0–4 years old	−1,606.313***	−1,560.295***	0.494	0.674	0.124	0.141	0.685	0.521
	(198.999)	(234.269)	(0.474)	(0.525)	(0.860)	(0.864)	(1.015)	(1.024)
Proportion of females 5–10 years old	−791.767***	−913.201***	0.615	0.396	0.992	0.976	0.563	0.415
	(191.789)	(220.747)	(0.424)	(0.475)	(0.830)	(0.836)	(0.924)	(0.953)
Proportion of females 11–18 years old	−129.198	−408.405*	0.539	−0.021	0.355	0.307	1.572*	1.364
	(199.970)	(232.738)	(0.432)	(0.505)	(0.820)	(0.846)	(0.948)	(1.018)
Proportion of females 19–59 years old	45.373	−17.950	0.974*	0.873	1.134	1.129	1.760	1.666
	(226.539)	(255.454)	(0.500)	(0.549)	(1.009)	(1.008)	(1.097)	(1.104)
Proportion of females 60 years and older	−310.409	−390.661	0.316	0.193	1.074	1.061	2.240*	2.095*
	(250.924)	(283.066)	(0.518)	(0.575)	(1.092)	(1.099)	(1.228)	(1.251)
Number of food crops produced by household	38.339***	18.129	0.079***	0.133**	−0.086**	−0.078	0.037	−0.109
	(9.092)	(27.980)	(0.020)	(0.064)	(0.038)	(0.104)	(0.047)	(0.128)
Number of dairy cows owned	52.596***	69.454***	0.132***	0.147***	0.072*	0.073	0.034	0.071
	(10.426)	(14.079)	(0.024)	(0.031)	(0.044)	(0.050)	(0.057)	(0.064)
Price of rice (in taka)	−4.851	1.351	0.020**	0.033***	0.057***	0.058***	0.045**	0.048**
	(3.975)	(4.827)	(0.010)	(0.011)	(0.018)	(0.019)	(0.022)	(0.022)
Ln (owned cultivable land + 1)	28.612***	42.641***	0.038**	0.069***	0.149***	0.152***	0.134***	0.142***
	(8.513)	(10.334)	(0.017)	(0.021)	(0.039)	(0.040)	(0.044)	(0.047)
Owns hand tube well (= 1, 0 otherwise)	115.792***	32.833	0.316***	0.126	0.064	0.047	0.064	0.046
	(26.784)	(35.942)	(0.063)	(0.080)	(0.120)	(0.137)	(0.147)	(0.160)
Access to electricity (= 1, 0 otherwise)	18.498	−3.726	0.427***	0.381***	0.517***	0.512***	0.617***	0.607***
	(22.946)	(27.953)	(0.056)	(0.065)	(0.104)	(0.107)	(0.127)	(0.128)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2,818.102***	2,841.667***	7.558***	7.625***	15.178***	15.180***	11.868***	11.926***
	(220.021)	(256.485)	(0.529)	(0.592)	(1.004)	(1.000)	(1.180)	(1.188)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	40.377	29.168	25.837	21.037	13.151	12.488	15.092	14.952
Adjusted R^2	0.270	−0.017	0.171	−0.052	0.115	0.114	0.105	0.098

(*continued on next page*)

Table 4—*continued*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Hansen J p, Ho: instruments valid		0.247		0.914		0.151		0.137
Under ID test p, Ho: underidentified		0.000		0.000		0.000		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		9.545		9.545		9.059		9.782
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.296		0.255
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.289		0.249
Endogeneity test p, Ho: exogenous		0.000		0.000		0.900		0.524
First stage Adjusted R^2 (Number of groups woman is an active member of)		0.106		0.106		0.108		0.106
First stage Adjusted R^2 (Number of food crops produced by household)		0.321		0.321		0.317		0.320

Source: Estimated by authors using data from the IFPRI Bangladesh Integrated Household Survey, 2011–12.
Note: Estimates from base regression without interaction with land. Robust standard errors are in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

negative association with adult male BMI in all of the models, possibly because growing more crops increases the intensity of labor inputs in the field, which is primarily a male domain. Rice price is strongly and positively associated with male and female BMI in all models, possibly working through two pathways. First, an increase in the rice price would increase the income of net sellers of rice (who would typically be farming households), hence BMI of household members is expected to improve. Second, an increase in the rice price may also induce a shift toward higher quality diets, possibly from staple to protein-based diets.

Household wealth indicators such as owned cultivable land and access to electricity are strongly and positively associated with both male and female BMI in all models; however, the number of dairy cows has a positive and significant impact on adult male BMI only. Dairying is very intensive in female labor (Quisumbing *et al.*, 2013), although we do not find any significant impact on female BMI of dairy cow ownership.

The education of the primary male and female also has significant and positive impact on their BMI. Primary males and females also have higher BMIs in households where the primary male (household head) is engaged in trading, possibly because trading is less physically strenuous than farming. Household size is significantly and positively associated with male BMI in most of the models. Pregnancy and lactation status significantly affect women's BMI, with pregnant women having significantly higher BMI, but with lactating women having significantly *lower* BMIs. The latter finding highlights the biological demands of lactation, and indicates that lactating women are a nutritionally vulnerable group in the Bangladeshi context.

(b) *Household wealth and the impact of women's empowerment on food security*

There is suggestive evidence from India (Eswaran, Ramaswami, & Wadhwa, 2013) that the relationship between women's empowerment and status (as determined by caste and wealth) may not be positive. Using time allocation data, they show that women's market work relative to males is lower in the higher castes, suggesting that greater family status may result in lower autonomy for women. Because land is the most important asset for rural Bangladeshi households, we examine how the relationship between women's empowerment in agriculture and household food security varies by the size of owned cultivable land. As shown in Eqn. (2) (Section 3b), we estimate the interaction effect of empowerment and land area, with selected regression results presented in Table 9. The IV diagnostics for the regressions involving calorie availability and dietary diversity (Models 1, 2, 4, and 6) show that while the results of the Anderson Rubin, overidentification, and underidentification tests deteriorate to some extent, the endogenous variables are still relevant, the null hypotheses of exogeneity can be rejected, the instruments remain valid, and the models are identified. However, for Models 3 and 5, we fail to reject the null that the model is under-identified; the weak-identification test results for Models 3, 4, and 5 suggest that our instruments are weak. For the regressions involving male and female BMI, we fail to reject the exogeneity of women's empowerment and household crop production in the adult male and female BMI equations; hence the OLS results (columns 5 and 7) are taken to be valid for this sample. Given the weak performance of the 2SLS estimates in Models 3, 4, and 5 in the regressions with interactions (compared to the base regression), we treat the results of the augmented regressions with the appropriate caveats, and focus on the discussion of the interaction terms rather than the main effects, for which the impacts are qualitatively similar to the base regressions.

The interactions of the women's empowerment indicators with the size of owned land are significant only in some of the models, and these results should also be taken with caution, given the performance of the instruments. Calorie availability tends to decrease in larger landowner households where women own more assets (column 2 of Model 4, Table 9) and diet diversity decreases in larger landowner households where women take more decisions concerning assets (column 4 of Model 5, Table 9). [9] For households owning more land, women who are involved in a greater number of groups and make more decisions on credit tend to have lower BMI (column 7 of Models 2 and 3). With the appropriate caveats, these results appear to indicate that the positive effect of the different dimensions of female empowerment on food security outcomes is greater for smaller landowners, that is, for less well-off households. While these results are broadly consistent with the findings of Eswaran *et al.*

Table 5. *Model 3: Women's decisions on credit, household food security, and individual nutritional status outcomes*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Average number of decisions over credit	−0.127	806.335**	−0.020	0.940*	−0.135***	−0.580	−0.059	−0.882
	(11.102)	(313.472)	(0.028)	(0.543)	(0.051)	(0.771)	(0.061)	(0.991)
Age (in years) of household head	15.914***	−17.073	−0.006	−0.049*				
	(6.135)	(16.396)	(0.015)	(0.028)				
Age-squared of household head	−0.126*	0.224	0.000	0.001*				
	(0.066)	(0.175)	(0.000)	(0.000)				
Years of education of household head	8.713***	17.340***	0.073***	0.082***				
	(3.304)	(6.538)	(0.007)	(0.011)				
Age (in years) of member					0.064**	0.082*	0.238***	0.280***
					(0.030)	(0.045)	(0.035)	(0.060)
Age-squared of member					−0.001**	−0.001**	−0.003***	−0.004***
					(0.000)	(0.000)	(0.000)	(0.001)
Years of education of member					0.116***	0.111***	0.117***	0.115***
					(0.015)	(0.017)	(0.021)	(0.022)
Pregnant (= 1, 0 otherwise)							1.099***	1.017***
							(0.286)	(0.328)
Lactating (= 1, 0 otherwise)							−0.853***	−0.814***
							(0.184)	(0.194)
Household head is farmer (= 1, 0 otherwise)	75.134***	307.092***	0.207***	0.380*	0.108	−0.042	−0.048	−0.209
	(26.390)	(112.967)	(0.064)	(0.195)	(0.122)	(0.287)	(0.143)	(0.371)
Household head is trader (= 1, 0 otherwise)	47.475	15.810	0.564***	0.552***	0.974***	0.994***	0.445*	0.455*
	(39.196)	(68.466)	(0.098)	(0.116)	(0.212)	(0.214)	(0.246)	(0.257)
Household size	−77.518***	−58.839***	0.074***	0.087***	0.070*	0.055	0.036	0.020
	(8.636)	(16.989)	(0.020)	(0.028)	(0.040)	(0.049)	(0.046)	(0.057)
Proportion of males 0–4 years old	−1,523.630***	−2,048.095***	0.428	−0.103	0.095	0.415	0.186	0.729
	(199.666)	(390.761)	(0.474)	(0.666)	(0.870)	(1.029)	(1.001)	(1.297)
Proportion of males 5–10 years old	−938.865***	−1,282.772***	0.432	0.074	0.646	0.846	1.048	1.494
	(187.610)	(329.839)	(0.422)	(0.553)	(0.806)	(0.882)	(0.920)	(1.127)
Proportion of males 11–18 years old	−280.204	−735.363**	−0.095	−0.622	0.291	0.588	1.528*	2.076*
	(185.283)	(339.529)	(0.415)	(0.579)	(0.793)	(0.940)	(0.894)	(1.135)
Proportion of males 19–59 years old	166.093	99.133	0.545*	0.462	1.228*	1.254*	1.859***	2.085***
	(153.762)	(230.437)	(0.314)	(0.376)	(0.658)	(0.663)	(0.676)	(0.744)
Proportion of females 0–4 years old	−1,609.422***	−1,903.357***	0.491	0.250	0.178	0.366	0.712	1.026
	(198.590)	(348.876)	(0.474)	(0.612)	(0.864)	(0.924)	(1.013)	(1.178)
Proportion of females 5–10 years old	−785.832***	−1,086.839***	0.639	0.313	1.003	1.197	0.600	0.997
	(191.973)	(332.238)	(0.426)	(0.553)	(0.834)	(0.895)	(0.924)	(1.081)
Proportion of females 11–18 years old	−115.074	−477.554	0.588	0.160	0.317	0.535	1.620*	2.092*
	(199.732)	(336.649)	(0.432)	(0.568)	(0.825)	(0.900)	(0.945)	(1.134)
Proportion of females 19–59 years old	48.339	−76.428	0.985**	0.870	1.134	1.217	1.781	1.997*
	(226.709)	(354.347)	(0.501)	(0.592)	(1.011)	(1.027)	(1.098)	(1.176)
Proportion of females 60 years and older	−306.680	−560.668	0.332	0.078	1.088	1.291	2.277*	2.694*
	(251.198)	(391.181)	(0.519)	(0.643)	(1.095)	(1.155)	(1.227)	(1.405)
Number of food crops produced by household	38.471***	−37.308	0.080***	0.108	−0.085**	−0.021	0.038	0.022
	(9.088)	(54.556)	(0.020)	(0.094)	(0.038)	(0.133)	(0.047)	(0.173)
Number of dairy cows owned	51.920***	91.177***	0.130***	0.153***	0.072*	0.045	0.031	0.010
	(10.443)	(24.800)	(0.024)	(0.043)	(0.044)	(0.064)	(0.057)	(0.083)
Price of rice (in taka)	−5.169	6.870	0.019**	0.033**	0.057***	0.051**	0.043**	0.031
	(3.988)	(7.605)	(0.009)	(0.014)	(0.018)	(0.021)	(0.022)	(0.026)
Ln (owned cultivable land + 1)	27.889***	18.896	0.037**	0.028	0.156***	0.161***	0.134***	0.138***
	(8.524)	(13.731)	(0.017)	(0.022)	(0.039)	(0.040)	(0.044)	(0.045)
Owns hand tube well (= 1, 0 otherwise)	120.209***	30.360	0.331***	0.196**	0.054	0.105	0.075	0.185
	(26.698)	(53.824)	(0.063)	(0.090)	(0.121)	(0.158)	(0.146)	(0.183)
Access to electricity (= 1, 0 otherwise)	19.639	−37.329	0.431***	0.362***	0.520***	0.561***	0.622***	0.679***
	(22.978)	(44.644)	(0.056)	(0.078)	(0.104)	(0.128)	(0.127)	(0.146)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2,816.747***	2,679.870***	7.557***	7.419***	15.210***	15.309***	11.863***	11.880***
	(220.321)	(354.557)	(0.529)	(0.627)	(1.006)	(1.035)	(1.181)	(1.232)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	40.253	14.729	25.562	17.980	12.860	11.896	15.076	14.149
Adjusted R^2	0.269	−1.001	0.170	−0.168	0.115	0.090	0.106	0.051

(*continued on next page*)

Table 4—*continued*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Hansen J p, Ho: instruments valid		0.592		0.397		0.244		0.263
Under ID test p, Ho: underidentified		0.031		0.031		0.012		0.032
Weak ID test stat (Kleibergen-Paap rk Wald F)		2.134		2.134		2.594		2.125
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.356		0.314
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.349		0.307
Endogeneity test p, Ho: exogenous		0.000		0.001		0.848		0.320
First stage Adjusted R^2 (Average number of decisions over credit)		0.059		0.059		0.063		0.057
First stage Adjusted R^2 (Number of food crops produced by household)		0.320		0.320		0.317		0.319

Source: Estimated by authors using data from the IFPRI Bangladesh Integrated Household Survey, 2011–12.
Note: Estimates from base regression without interaction with land. Robust standard errors are in parentheses.
$^{***}p < 0.01$.
$^{**}p < 0.05$.
$^{*}p < 0.1$.

Table 6. *Model 4: Women's ownership of assets, household food security, and individual nutritional status outcomes*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Number of assets woman has self/joint ownership of	33.263***	146.085***	0.104***	0.178**	0.032	−0.069	0.051	−0.137
	(8.323)	(33.343)	(0.019)	(0.078)	(0.036)	(0.148)	(0.043)	(0.173)
Age (in years) of household head	14.621**	10.146	−0.011	−0.018				
	(6.161)	(6.614)	(0.014)	(0.015)				
Age-squared of household head	−0.113*	−0.068	0.000	0.000				
	(0.067)	(0.072)	(0.000)	(0.000)				
Years of education of household head	7.654**	4.012	0.070***	0.066***				
	(3.257)	(3.452)	(0.007)	(0.008)				
Age (in years) of member					0.057*	0.060**	0.232***	0.248***
					(0.030)	(0.030)	(0.035)	(0.037)
Age-squared of member					−0.001**	−0.001**	−0.003***	−0.003***
					(0.000)	(0.000)	(0.000)	(0.000)
Years of education of member					0.117***	0.120***	0.114***	0.128***
					(0.015)	(0.016)	(0.021)	(0.024)
Pregnant (= 1, 0 otherwise)							1.103***	1.126***
							(0.286)	(0.287)
Lactating (= 1, 0 otherwise)							−0.849***	−0.870***
							(0.184)	(0.186)
Household head is farmer (= 1, 0 otherwise)	76.609***	78.643**	0.216***	0.115	0.139	0.136	−0.031	0.052
	(26.218)	(34.327)	(0.064)	(0.078)	(0.122)	(0.144)	(0.143)	(0.175)
Household head is trader (= 1, 0 otherwise)	39.113	11.481	0.538***	0.545***	0.962***	0.995***	0.433*	0.451*
	(38.802)	(41.059)	(0.097)	(0.099)	(0.213)	(0.220)	(0.246)	(0.249)
Household size	−75.261***	−67.855***	0.081***	0.078***	0.076*	0.069	0.041	0.036
	(8.512)	(9.154)	(0.020)	(0.021)	(0.040)	(0.043)	(0.046)	(0.050)
Proportion of males 0–4 years old	−1,519.595***	−1,503.062***	0.429	0.532	0.025	−0.005	0.121	0.138
	(199.323)	(208.246)	(0.473)	(0.479)	(0.868)	(0.873)	(1.003)	(1.011)
Proportion of males 5–10 years old	−950.629***	−988.932***	0.387	0.413	0.595	0.599	0.982	1.067
	(187.730)	(196.402)	(0.422)	(0.430)	(0.804)	(0.807)	(0.921)	(0.931)
Proportion of males 11–18 years old	−306.015*	−392.922**	−0.187	−0.230	0.191	0.239	1.440	1.620*
	(185.826)	(195.517)	(0.414)	(0.425)	(0.790)	(0.794)	(0.896)	(0.910)
Proportion of males 19–59 years old	162.392	149.777	0.532*	0.520	1.228*	1.211*	1.825***	1.907***
	(153.699)	(158.473)	(0.314)	(0.320)	(0.659)	(0.658)	(0.675)	(0.679)
Proportion of females 0–4 years old	−1,621.661***	−1,660.018***	0.447	0.530	0.137	0.152	0.641	0.719
	(198.185)	(207.263)	(0.474)	(0.482)	(0.863)	(0.869)	(1.016)	(1.039)
Proportion of females 5–10 years old	−802.075***	−856.122***	0.581	0.577	0.945	0.966	0.536	0.648
	(192.398)	(200.614)	(0.425)	(0.433)	(0.831)	(0.836)	(0.925)	(0.935)

(*continued on next page*)

Table 6—*continued*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Proportion of females 11–18 years old	−158.353	−304.838	0.443	0.351	0.224	0.317	1.511	1.795*
	(200.579)	(210.733)	(0.432)	(0.451)	(0.820)	(0.827)	(0.949)	(0.981)
Proportion of females 19–59 years old	18.455	−81.933	0.889*	0.856*	1.108	1.135	1.712	1.892*
	(227.380)	(239.440)	(0.502)	(0.519)	(1.010)	(1.013)	(1.100)	(1.113)
Proportion of females 60 years and older	−343.769	−468.114*	0.211	0.176	1.025	1.066	2.182*	2.389*
	(250.994)	(261.353)	(0.520)	(0.539)	(1.094)	(1.098)	(1.231)	(1.256)
Number of food crops produced by household	35.492***	28.672	0.070***	0.183***	−0.090**	−0.076	0.033	−0.058
	(9.097)	(23.999)	(0.020)	(0.056)	(0.038)	(0.102)	(0.047)	(0.123)
Number of dairy cows owned	48.602***	36.671***	0.120***	0.089***	0.073*	0.084*	0.028	0.068
	(10.464)	(12.087)	(0.024)	(0.026)	(0.044)	(0.049)	(0.057)	(0.061)
Price of rice (in taka)	−4.833	−3.687	0.020**	0.021**	0.060***	0.058***	0.045**	0.042**
	(3.957)	(4.061)	(0.009)	(0.010)	(0.018)	(0.018)	(0.022)	(0.021)
Ln (owned cultivable land + 1)	27.584***	26.615***	0.035**	0.037**	0.154***	0.154***	0.133***	0.132***
	(8.533)	(8.890)	(0.017)	(0.017)	(0.039)	(0.039)	(0.044)	(0.044)
Owns hand tube well (= 1, 0 otherwise)	110.866***	78.456***	0.299***	0.250***	0.025	0.052	0.053	0.131
	(26.577)	(28.379)	(0.062)	(0.064)	(0.121)	(0.127)	(0.146)	(0.155)
Access to electricity (= 1, 0 otherwise)	12.291	−12.634	0.407***	0.389***	0.502***	0.520***	0.609***	0.644***
	(22.890)	(25.116)	(0.056)	(0.059)	(0.105)	(0.108)	(0.127)	(0.130)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2,799.797***	2,743.056***	7.501***	7.488***	15.147***	15.254***	11.872***	11.805***
	(218.773)	(226.553)	(0.528)	(0.535)	(1.006)	(1.017)	(1.180)	(1.177)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	41.121	37.357	27.427	24.975	12.792	12.437	15.119	14.884
Adjusted R^2	0.274	0.218	0.179	0.166	0.113	0.110	0.106	0.098
Hansen J p, Ho: instruments valid		0.574		0.518		0.277		0.343
Under ID test p, Ho: under-identified		0.000		0.000		0.000		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		32.199		32.199		32.288		30.094
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, p-value		0.000		0.000		0.415		0.425
A-R Wald Chi^2 test, p-value		0.000		0.000		0.407		0.418
Endogeneity test p, Ho: exogenous		0.001		0.013		0.755		0.206
First stage Adjusted R^2 (Number of assets woman has self/joint ownership of)		0.128		0.128		0.132		0.135
First stage Adjusted R^2 (Number of food crops produced by household)		0.320		0.320		0.316		0.319

Source: Estimated by authors using data from the IFPRI Bangladesh Integrated Household Survey, 2011–12.
Note: Estimates from base regression without interaction with land. Robust standard errors are in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

(2013), they also point to the potential positive redistributive effect of focusing women's empowerment efforts on poorer households.

(c) *Magnitudes of women's empowerment effects*

Table 10 presents the elasticities of per capita calorie availability, household dietary diversity, and adult BMI with respect to the empowerment indicators and three household characteristics—number of food crops produced by household, years of education of household head, and area of cultivable land owned by household. Although the endogeneity tests lead to the rejection of the null hypothesis that the empowerment variables are exogenous, the IV diagnostics lead us to doubt the validity of our 2SLS estimates for some of the measures of empowerment.[10] Moreover, although the empowerment indicators emerged as significant in the 2SLS base regressions, because the elasticities computed from the 2SLS specification use predicted values of both the dependent and explanatory variables, the standard errors of the IV elasticities are quite large. These large standard errors lead to the inability to estimate elasticities precisely using the IV specification, and lead one to accept the null hypotheses that these elasticity estimates are insignificant, even if they are larger in magnitude than the OLS estimates. We therefore base our discussion of the elasticity estimates mostly on the OLS results, treating them as a lower bound, given the imprecision of the IV elasticity estimates. We find that the magnitude of the impact on calorie availability (column 1) and dietary diversity (column 3) of the overall empowerment score is the highest—a 10% increase in the empowerment score leads to a 6.3% increase in calorie availability and a 3.5% increase in dietary diversity in the OLS regressions. After controlling for the potential endogeneity

Table 7. *Model 5: Women's rights over assets, household food security, and individual nutritional status outcomes*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Number of self/joint decisions over purchase, sale, or transfer of assets made by woman	5.737***	19.637***	0.018***	0.016	−0.005	0.002	0.006	0.002
	(1.243)	(5.135)	(0.003)	(0.013)	(0.006)	(0.023)	(0.007)	(0.028)
Age (in years) of household head	13.646**	8.675	−0.014	−0.017				
	(6.124)	(6.473)	(0.015)	(0.015)				
Age-squared of household head	−0.104	−0.056	0.000	0.000				
	(0.066)	(0.070)	(0.000)	(0.000)				
Years of education of household head	7.625**	5.217	0.070***	0.069***				
	(3.255)	(3.368)	(0.007)	(0.008)				
Age (in years) of member					0.060**	0.058*	0.232***	0.238***
					(0.030)	(0.031)	(0.035)	(0.038)
Age-squared of member					−0.001**	−0.001**	−0.003***	−0.003***
					(0.000)	(0.000)	(0.000)	(0.000)
Years of education of member					0.119***	0.117***	0.115***	0.118***
					(0.015)	(0.015)	(0.021)	(0.023)
Pregnant (= 1, 0 otherwise)							1.109***	1.125***
							(0.285)	(0.286)
Lactating (= 1, 0 otherwise)							−0.850***	−0.848***
							(0.184)	(0.187)
Household head is farmer (= 1, 0 otherwise)	71.321***	75.632**	0.200***	0.102	0.144	0.146	−0.038	0.082
	(26.184)	(34.346)	(0.064)	(0.078)	(0.121)	(0.145)	(0.142)	(0.175)
Household head is trader (= 1, 0 otherwise)	34.877	0.964	0.525***	0.554***	0.985***	0.966***	0.431*	0.413
	(39.204)	(43.539)	(0.096)	(0.101)	(0.214)	(0.225)	(0.247)	(0.254)
Household size	−74.161***	−64.884***	0.084***	0.075***	0.070*	0.075*	0.041	0.048
	(8.566)	(9.564)	(0.020)	(0.022)	(0.040)	(0.045)	(0.046)	(0.051)
Proportion of males 0–4 years old	−1,546.846***	−1,615.209***	0.346	0.441	0.031	−0.001	0.102	0.037
	(199.041)	(206.383)	(0.471)	(0.479)	(0.868)	(0.878)	(1.002)	(1.036)
Proportion of males 5–10 years old	−971.520***	−1,057.285***	0.324	0.382	0.618	0.583	0.974	0.955
	(187.126)	(194.103)	(0.419)	(0.430)	(0.806)	(0.818)	(0.921)	(0.942)
Proportion of males 11–18 years old	−325.653*	−437.470**	−0.245	−0.219	0.239	0.194	1.437	1.469
	(185.415)	(194.681)	(0.412)	(0.428)	(0.792)	(0.806)	(0.895)	(0.922)
Proportion of males 19–59 years old	166.953	169.525	0.546*	0.542*	1.214*	1.224*	1.839***	1.860***
	(153.243)	(154.577)	(0.313)	(0.315)	(0.660)	(0.655)	(0.675)	(0.673)
Proportion of females 0–4 years old	−1,630.065***	−1,694.354***	0.422	0.532	0.153	0.125	0.650	0.560
	(197.888)	(205.187)	(0.473)	(0.483)	(0.864)	(0.873)	(1.014)	(1.038)
Proportion of females 5–10 years old	−821.326***	−911.444***	0.523	0.564	0.978	0.939	0.530	0.532
	(191.731)	(197.929)	(0.422)	(0.435)	(0.833)	(0.842)	(0.922)	(0.944)
Proportion of females 11–18 years old	−155.518	−253.923	0.455	0.470	0.281	0.244	1.542	1.578
	(199.050)	(203.938)	(0.429)	(0.443)	(0.821)	(0.825)	(0.946)	(0.962)
Proportion of females 19–59 years old	16.339	−65.496	0.885*	0.925*	1.129	1.108	1.729	1.734
	(226.667)	(234.410)	(0.498)	(0.512)	(1.013)	(1.011)	(1.097)	(1.104)
Proportion of females 60 years and older	−340.188	−427.584*	0.224	0.279	1.052	1.026	2.203*	2.193*
	(250.662)	(257.228)	(0.518)	(0.530)	(1.096)	(1.098)	(1.227)	(1.245)
Number of food crops produced by household	34.134***	8.077	0.066***	0.181***	−0.083**	−0.098	0.033	−0.096
	(9.093)	(27.137)	(0.020)	(0.063)	(0.038)	(0.116)	(0.048)	(0.140)
Number of dairy cows owned	47.587***	40.221***	0.117***	0.096***	0.081*	0.078	0.028	0.058
	(10.465)	(11.727)	(0.024)	(0.026)	(0.044)	(0.048)	(0.057)	(0.061)
Price of rice (in taka)	−4.737	−3.757	0.020**	0.021**	0.059***	0.060***	0.045**	0.044**
	(3.969)	(4.057)	(0.009)	(0.010)	(0.018)	(0.018)	(0.022)	(0.021)
Ln (owned cultivable land + 1)	26.100***	21.487**	0.031*	0.034*	0.155***	0.153***	0.132***	0.131***
	(8.498)	(8.830)	(0.017)	(0.018)	(0.039)	(0.039)	(0.044)	(0.045)
Owns hand tube well (= 1, 0 otherwise)	117.479***	114.594***	0.320***	0.294***	0.036	0.036	0.065	0.097
	(26.503)	(27.182)	(0.062)	(0.063)	(0.121)	(0.122)	(0.146)	(0.149)
Access to electricity (= 1, 0 otherwise)	12.156	−5.785	0.407***	0.408***	0.514***	0.506***	0.611***	0.618***
	(22.890)	(24.534)	(0.056)	(0.059)	(0.104)	(0.108)	(0.127)	(0.129)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2,822.341***	2,832.715***	7.571***	7.593***	15.188***	15.178***	11.890***	11.841***
	(219.334)	(222.547)	(0.528)	(0.530)	(1.007)	(0.999)	(1.179)	(1.178)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	41.058	37.590	28.025	25.513	12.761	12.490	15.086	15.011
Adjusted R^2	0.275	0.240	0.181	0.172	0.113	0.112	0.106	0.103

(*continued on next page*)

Table 7—*continued*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Hansen J p, Ho: instruments valid		0.061		0.131		0.251		0.259
Under ID test p, Ho: underidentified		0.000		0.000		0.000		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		23.334		23.334		23.340		21.822
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.415		0.425
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.407		0.418
Endogeneity test p, Ho: exogenous		0.012		0.070		0.941		0.386
First stage Adjusted R^2 (Number of self/joint decisions over purchase, sale, or transfer of assets made by woman)		0.181		0.181		0.190		0.188
First stage Adjusted R^2 (Number of food crops produced by household)		0.320		0.320		0.316		0.319

Source: Estimated by authors using data from the IFPRI Bangladesh Integrated Household Survey, 2011–12.
Note: Estimates from base regression without interaction with land. Robust standard errors are in parentheses.
$^{***}p < 0.01$.
$^{**}p < 0.05$.
$^{*}p < 0.1$.

Table 8. *Model 6: Gender parity gap, household food security, and individual nutritional status outcomes*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Gender parity gap (= 0 if woman enjoys gender parity, "gap" if not)	−163.834***	−1,282.089***	−0.401***	−2.583***	0.220	0.785	0.318	0.252
	(52.646)	(256.600)	(0.133)	(0.601)	(0.241)	(1.110)	(0.301)	(1.242)
Age (in years) of household head	15.976**	9.845	−0.009	−0.025				
	(6.217)	(7.016)	(0.015)	(0.016)				
Age-squared of household head	−0.126*	−0.066	0.000	0.000				
	(0.067)	(0.076)	(0.000)	(0.000)				
Years of education of household head	9.238***	10.081***	0.074***	0.074***				
	(3.330)	(3.523)	(0.007)	(0.008)				
Age (in years) of member					0.056*	0.059*	0.238***	0.240***
					(0.030)	(0.031)	(0.036)	(0.037)
Age-squared of member					−0.001**	−0.001**	−0.003***	−0.003***
					(0.000)	(0.000)	(0.000)	(0.000)
Years of education of member					0.119***	0.118***	0.116***	0.117***
					(0.015)	(0.015)	(0.021)	(0.021)
Pregnant (= 1, 0 otherwise)							1.159***	1.178***
							(0.294)	(0.295)
Lactating (= 1, 0 otherwise)							−0.890***	−0.884***
							(0.184)	(0.184)
Household head is farmer (= 1, 0 otherwise)	74.163***	84.660**	0.223***	0.151*	0.130	0.110	−0.038	0.056
	(26.352)	(35.405)	(0.064)	(0.082)	(0.122)	(0.146)	(0.144)	(0.177)
Household head is trader (= 1, 0 otherwise)	43.092	4.451	0.556***	0.505***	0.940***	0.967***	0.488*	0.464*
	(39.325)	(42.673)	(0.099)	(0.103)	(0.213)	(0.216)	(0.251)	(0.253)
Household size	−76.559***	−68.532***	0.073***	0.080***	0.063	0.057	0.038	0.047
	(8.692)	(9.552)	(0.020)	(0.023)	(0.041)	(0.043)	(0.047)	(0.050)
Proportion of males 0–4 years old	−1,544.764***	−1,594.009***	0.474	0.468	−0.168	−0.123	0.146	0.059
	(204.887)	(224.046)	(0.477)	(0.506)	(0.877)	(0.883)	(1.017)	(1.030)
Proportion of males 5–10 years old	−967.151***	−1,043.160***	0.439	0.343	0.488	0.531	1.195	1.147
	(191.741)	(206.927)	(0.422)	(0.452)	(0.812)	(0.815)	(0.935)	(0.943)
Proportion of males 11–18 years old	−328.485*	−425.453**	−0.121	−0.292	0.011	0.057	1.566*	1.553*
	(190.186)	(205.314)	(0.418)	(0.443)	(0.802)	(0.804)	(0.909)	(0.915)
Proportion of males 19–59 years old	142.865	135.830	0.590*	0.579*	1.176*	1.171*	1.886***	1.893***
	(157.756)	(168.143)	(0.316)	(0.336)	(0.666)	(0.665)	(0.688)	(0.686)
Proportion of females 0–4 years old	−1,613.382***	−1,597.564***	0.525	0.662	0.013	0.026	0.617	0.517
	(203.070)	(220.178)	(0.479)	(0.506)	(0.874)	(0.880)	(1.027)	(1.029)

(*continued on next page*)

Table 8—*continued*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Proportion of females 5–10 years old	−839.164***	−969.284***	0.582	0.363	0.869	0.935	0.697	0.663
	(197.619)	(213.360)	(0.429)	(0.459)	(0.843)	(0.851)	(0.942)	(0.959)
Proportion of females 11–18 years old	−149.120	−289.433	0.553	0.291	0.237	0.304	1.522	1.511
	(204.730)	(217.506)	(0.436)	(0.467)	(0.831)	(0.833)	(0.962)	(0.977)
Proportion of females 19–59 years old	8.155	−80.391	0.983*	0.846	0.928	0.964	1.823	1.797
	(231.876)	(248.583)	(0.506)	(0.541)	(1.017)	(1.017)	(1.112)	(1.111)
Proportion of females 60 years and older	−357.547	−435.890	0.310	0.206	0.781	0.814	2.409*	2.367*
	(256.315)	(273.060)	(0.523)	(0.561)	(1.099)	(1.100)	(1.244)	(1.248)
Number of food crops produced by household	36.659***	40.145*	0.080***	0.195***	−0.080**	−0.062	0.040	−0.067
	(9.105)	(23.874)	(0.020)	(0.057)	(0.038)	(0.100)	(0.048)	(0.122)
Number of dairy cows owned	50.519***	44.513***	0.128***	0.095***	0.073*	0.073	0.039	0.060
	(10.434)	(11.663)	(0.024)	(0.026)	(0.044)	(0.048)	(0.058)	(0.060)
Price of rice (in taka)	−3.700	−0.469	0.021**	0.028***	0.059***	0.057***	0.044**	0.044**
	(3.868)	(4.191)	(0.009)	(0.010)	(0.018)	(0.018)	(0.022)	(0.022)
Ln (owned cultivable land + 1)	29.223***	35.044***	0.038**	0.051***	0.154***	0.151***	0.134***	0.133***
	(8.609)	(9.058)	(0.017)	(0.019)	(0.039)	(0.039)	(0.045)	(0.045)
Owns hand tube well (= 1, 0 otherwise)	110.282***	46.695	0.307***	0.157**	0.046	0.073	0.062	0.083
	(26.994)	(30.367)	(0.063)	(0.071)	(0.122)	(0.134)	(0.147)	(0.159)
Access to electricity (= 1, 0 otherwise)	12.421	−13.203	0.408***	0.357***	0.519***	0.532***	0.632***	0.632***
	(23.142)	(25.453)	(0.057)	(0.061)	(0.105)	(0.108)	(0.127)	(0.129)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2,821.997***	3,085.689***	7.585***	8.115***	15.336***	15.220***	11.699***	11.699***
	(222.972)	(245.743)	(0.535)	(0.585)	(1.016)	(1.036)	(1.212)	(1.269)
Observations	3,213	3,213	3,213	3,213	3,094	3,094	3,203	3,203
F	40.077	34.102	26.200	23.094	12.467	12.048	15.215	15.136
Adjusted R^2	0.270	0.170	0.173	0.091	0.111	0.110	0.107	0.106
Hansen J p, Ho: instruments valid		0.553		0.423		0.425		0.255
Under ID test p, Ho: underidentified		0.000		0.000		0.000		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		27.216		27.216		25.550		25.764
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.566		0.446
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.559		0.439
Endogeneity test p, Ho: exogenous		0.000		0.000		0.860		0.646
First stage Adjusted R^2 (Gender parity gap)		0.121		0.121		0.118		0.121
First stage Adjusted R^2 (Number of food crops produced by household)		0.314		0.314		0.310		0.313

Source: Estimated by authors using data from the IFPRI Bangladesh Integrated Household Survey, 2011–12.
Note: Estimates from base regression without interaction with land. Robust standard errors are in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

of empowerment and crop production diversity, the magnitudes are even higher; a 10% increase in the empowerment score leads to a 24% increase in calorie availability (column 2) and a 13.6% increase in dietary diversity (column 4), although as mentioned above, these elasticities are imprecisely estimated. Among the component indicators, the largest elasticities are with respect to women's rights over assets (0.027 for calorie availability and 0.022 for diet diversity) and women's ownership of assets (0.026 for calorie availability and 0.021 for diet diversity) for the OLS estimates. [11] We also find that most of the empowerment indicators have larger effects on calorie availability and dietary diversity than the selected household variables, for both OLS and IV estimates. For example, based on the OLS estimates, we find that a 10% increase in the assets owned by the woman has an effect of increasing calorie availability by 2.6%. However, the same proportional increase in the number of food crops, years of education of household head, and area of land owned lead to respective increases of 1.8%, 0.09%, and 0.11% in calorie availability. The relative magnitudes of empowerment elasticities compared to household characteristics are similar for the IV elasticities.

The magnitudes of the effects of the empowerment indicators on adult BMI are relatively smaller than the effects on the other food security outcomes; the OLS elasticities range from 0.001 (effect of number of groups women is active in on female BMI) to 0.008 (effect of overall empowerment on female BMI). For both OLS and IV estimates, we also find that the impacts of various indicators of empowerment on BMI are relatively smaller than that of other household characteristics.

Table 9. *Estimates from household food security and individual nutrition status regressions with land interactions*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Model 1: Women's empowerment score								
Empowerment score of woman	236.420***	878.890***	0.575***	2.244***	−0.222	−0.432	−0.253	−0.577
	(50.699)	(184.769)	(0.131)	(0.460)	(0.225)	(0.841)	(0.282)	(0.948)
Ln (owned cultivable land + 1)	29.371	−3.467	0.113**	0.181	0.059	−0.082	0.136	−0.494
	(23.518)	(75.926)	(0.050)	(0.150)	(0.104)	(0.312)	(0.131)	(0.385)
Empowerment score of woman × Ln (owned cultivable land + 1)	−1.438	49.081	−0.112	−0.206	0.140	0.349	−0.005	0.926
	(31.270)	(112.493)	(0.068)	(0.219)	(0.141)	(0.460)	(0.180)	(0.564)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	40.566	37.049	25.761	24.237	12.348	12.153	14.587	14.472
Adjusted R^2	0.274	0.225	0.176	0.122	0.113	0.112	0.105	0.093
Hansen J p, Ho: instruments valid		0.231		0.446		0.526		0.630
Under ID test p, Ho: underidentified		0.000		0.000		0.000		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		20.703		20.703		19.911		19.682
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.643		0.562
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.633		0.551
Endogeneity test p, Ho: exogenous		0.000		0.000		0.962		0.192
Model 2: Women's group membership								
Number of groups woman is an active member of	48.466**	692.446***	0.162***	1.719***	−0.301***	−0.320	0.173	−0.262
	(24.499)	(170.405)	(0.063)	(0.433)	(0.109)	(0.645)	(0.132)	(0.758)
Ln (owned cultivable land + 1)	32.219***	32.722	0.059***	0.092*	0.135***	0.111	0.189***	−0.042
	(9.388)	(27.536)	(0.018)	(0.053)	(0.044)	(0.104)	(0.049)	(0.127)
Number of groups woman is an active member of × Ln (owned cultivable land + 1)	−15.431	34.626	−0.088**	−0.101	0.061	0.165	−0.232**	0.756
	(18.423)	(119.194)	(0.038)	(0.214)	(0.077)	(0.407)	(0.091)	(0.519)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	39.023	30.405	25.014	20.564	12.741	12.188	14.875	13.992
Adjusted R^2	0.270	0.050	0.173	−0.045	0.115	0.114	0.107	0.063
Hansen J p, Ho: instruments valid		0.108		0.368		0.313		0.473
Under ID test p, Ho: underidentified		0.000		0.000		0.000		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		5.229		5.229		4.380		5.327
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.497		0.407
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.485		0.394
Endogeneity test p, Ho: exogenous		0.000		0.000		0.992		0.117
Model 3: Women's decisions on credit								
Average number of decisions over credit	4.529	705.155***	−0.006	0.659	−0.112**	−0.655	0.005	−1.139
	(11.728)	(253.810)	(0.031)	(0.462)	(0.053)	(0.718)	(0.066)	(0.945)
Ln (owned cultivable land + 1)	33.918***	152.357*	0.056**	0.155	0.185***	0.289	0.217***	−0.003
	(12.219)	(88.380)	(0.023)	(0.132)	(0.052)	(0.376)	(0.062)	(0.400)
Average number of decisions over credit × Ln (owned cultivable land + 1)	−6.854	−149.154	−0.022	−0.139	−0.034	−0.143	−0.094**	0.160
	(8.167)	(97.669)	(0.016)	(0.147)	(0.037)	(0.411)	(0.043)	(0.445)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	39.136	18.759	24.735	21.297	12.426	10.937	14.740	13.267
Adjusted R^2	0.269	−0.539	0.171	0.030	0.115	0.065	0.107	0.019
Hansen J p, Ho: instruments valid		0.334		0.032		0.415		0.533
Under ID test p, Ho: underidentified		0.269		0.269		0.452		0.190
Weak ID test stat (Kleibergen-Paap rk Wald F)		1.000		1.000		0.794		1.135
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.516		0.501
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.506		0.490
Endogeneity test p, Ho: exogenous		0.000		0.029		0.878		0.279
Model 4: Women's ownership of assets								
Number of assets woman has self/joint ownership of	38.631***	174.917***	0.118***	0.231***	0.042	−0.012	0.066	−0.141
	(9.214)	(35.279)	(0.021)	(0.083)	(0.039)	(0.154)	(0.047)	(0.183)
Ln (owned cultivable land + 1)	42.827***	156.687**	0.074***	0.164	0.181***	0.311	0.175**	−0.037
	(13.099)	(76.327)	(0.029)	(0.112)	(0.065)	(0.254)	(0.073)	(0.333)
Number of assets woman has self/joint ownership of × Ln (owned cultivable land + 1)	−6.962	−59.385*	−0.018*	−0.058	−0.013	−0.075	−0.019	0.078
	(4.683)	(33.890)	(0.010)	(0.050)	(0.024)	(0.118)	(0.028)	(0.150)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263

(*continued on next page*)

Table 9—*continued*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
F	39.678	34.728	26.469	24.045	12.349	11.876	14.717	14.383
Adjusted R^2	0.274	0.201	0.180	0.164	0.113	0.107	0.106	0.096
Hansen J p, Ho: instruments valid		0.703		0.243		0.465		0.580
Under ID test p, Ho: underidentified		0.010		0.010		0.008		0.013
Weak ID test stat (Kleibergen-Paap rk Wald F)		2.085		2.085		2.261		2.052
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.001		0.623		0.656
A-R Wald Chi^2 test, *p*-value		0.000		0.001		0.612		0.646
Endogeneity test p, Ho: exogenous		0.000		0.059		0.899		0.274
Model 5: Women's rights over assets								
Number of self/joint decisions over purchase, sale, or transfer of assets made by woman	6.045*** (1.337)	23.091*** (5.225)	0.019*** (0.003)	0.027** (0.013)	−0.007 (0.006)	0.012 (0.023)	0.004 (0.007)	0.009 (0.028)
Ln (owned cultivable land + 1)	30.912** (12.666)	126.288 (78.503)	0.061** (0.027)	0.334* (0.184)	0.128** (0.060)	0.481* (0.284)	0.088 (0.068)	0.226 (0.405)
Number of self/joint decisions over purchase, sale, or transfer of assets made by woman × Ln (owned cultivable land + 1)	−0.351 (0.789)	−7.580 (5.522)	−0.002 (0.001)	−0.022* (0.013)	0.002 (0.004)	−0.024 (0.020)	0.003 (0.004)	−0.007 (0.029)
Observations	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263
F	39.768	35.436	27.011	22.323	12.319	11.515	14.612	14.541
Adjusted R^2	0.275	0.223	0.181	0.131	0.113	0.088	0.106	0.100
Hansen J p, Ho: instruments valid		0.165		0.316		0.583		0.474
Under ID test p, Ho: underidentified		0.238		0.238		0.134		0.234
Weak ID test stat (Kleibergen-Paap rk Wald F)		1.156		1.156		1.376		1.164
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.001		0.623		0.656
A-R Wald Chi^2 test, *p*-value		0.000		0.001		0.612		0.646
Endogeneity test p, Ho: exogenous		0.006		0.086		0.633		0.553
Model 6: Women's gender parity gap								
Gender parity gap (= 0 if woman enjoys gender parity, "gap" if not)	−161.629*** (54.641)	−1,335.018*** (281.034)	−0.380*** (0.145)	−2.855*** (0.694)	0.342 (0.258)	0.876 (1.227)	0.268 (0.321)	1.200 (1.361)
Ln (owned cultivable land + 1)	29.784*** (10.399)	37.863 (28.102)	0.044** (0.022)	0.040 (0.054)	0.186*** (0.050)	0.252** (0.114)	0.121** (0.058)	0.366*** (0.136)
Gender parity (= 0 if woman enjoys gender parity, "gap" if not) × Ln (owned cultivable land + 1)	−3.094 (37.327)	−14.139 (144.634)	−0.030 (0.076)	0.068 (0.296)	−0.174 (0.154)	−0.541 (0.576)	0.071 (0.211)	−1.285* (0.718)
Observations	3,213	3,213	3,213	3,213	3,094	3,094	3,203	3,203
F	38.725	32.434	25.290	22.113	12.065	11.746	14.718	14.468
Adjusted R^2	0.270	0.158	0.173	0.077	0.111	0.109	0.107	0.090
Hansen J p, Ho: instruments valid		0.473		0.213		0.607		0.770
Under ID test p, Ho: underidentified		0.000		0.000		0.000		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		11.450		11.450		10.940		10.691
Anderson-Rubin, Ho: endogvars irrelevant								
A-R Wald test, *p*-value		0.000		0.000		0.689		0.640
A-R Wald Chi^2 test, *p*-value		0.000		0.000		0.679		0.629
Endogeneity test p, Ho: exogenous		0.000		0.000		0.890		0.147

Source: Estimated by authors using data from the IFPRI Bangladesh Integrated Household Survey, 2011–12.
Note: Robust standard errors are in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Although the results of the elasticities analysis point to the importance of women's empowerment in general, and women's asset ownership in particular, for improving household food security, they do not yield conclusive evidence that prioritizing women's empowerment alone should take precedence over improving other determinants of food security. The magnitudes of the elasticity estimates, even where significant, are small. Moreover, one must recognize the limitations of elasticity analyses in general, because elasticities isolate the effects of a single variable, whereas food security is determined by the interaction of many variables, not just women's empowerment. This analysis also does not indicate, in practice, how increases in these underlying variables are to be achieved. Because our elasticity estimates were computed at the sample means, they may not be indicative of differential responses across the empowerment

Table 10. *Elasticities of calorie availability, dietary diversity, and adult BMI with respect to empowerment indicators and other household characteristics*

Variable	Per capita calorie availability		Household dietary diversity		Male BMI		Female BMI	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (8)	2SLS (9)
Empowerment score of woman	0.063***	0.240	0.035***	0.136	−0.004	−0.015	−0.008	0.001
	(0.013)	(224.877)	(0.008)	(139.752)	(0.007)	(125.432)	(0.009)	(138.552)
Number of groups woman is an active member of	0.005*	0.107	0.004*	0.058	−0.004**	−0.002	0.001	0.008
	(0.003)	(118.956)	(0.002)	(70.462)	(0.002)	(52.659)	(0.002)	(57.681)
Average number of decisions over credit	−0.000	0.310	−0.002	0.094	−0.006***	−0.028	−0.003	−0.041
	(0.004)	(584.159)	(0.003)	(264.171)	(0.002)	(179.205)	(0.003)	(221.669)
Number of assets woman has self/joint ownership of	0.026***	0.115	0.021***	0.037	0.003	−0.007	0.005	−0.013
	(0.007)	(126.640)	(0.004)	(77.334)	(0.003)	(68.572)	(0.004)	(78.939)
Number of self/joint decisions over purchase, sale, or transfer of assets made by woman	0.027***	0.094	0.022***	0.020	−0.003	0.001	0.004	0.001
	(0.006)	(118.856)	(0.004)	(75.924)	(0.003)	(64.359)	(0.004)	(77.964)
Gender parity (= 0 if woman enjoys gender parity, "gap" if not)	−0.011***	−0.086	−0.007***	−0.045	0.002	0.007	0.003	0.002
	(0.004)	(83.338)	(0.002)	(51.081)	(0.002)	(45.363)	(0.002)	(48.585)
Range of elasticity estimates for other household characteristics								
Number of food crops produced by household	0.017***–0.020***	−0.019–0.021	0.009***–0.011***	(0.018–0.026)	−0.006**–0.005**	−0.006–0.001	0.002–0.003	−0.007–0.001
	(0.005)	(134.99–58.31)	(0.003)	(35.957–60.373)	(0.002)	(31.487–36.018)	(0.003)	(37.044–51.617)
Years of education of household head	0.009***–0.011***	0.005–0.021	0.022***–0.023***	0.021–0.026	0.017***–0.018***	0.017–0.018	0.016***–0.017***	0.016–0.018
	(0.004)	(19.39–36.018)	(0.002)	(11.434–16.385)	(0.002)	(10.652–12.662)	(0.003)	(14.342–16.210)
Area of cultivable land owned by household (in decimals)	0.010***–0.012***	0.008–0.017	0.003*–0.004**	0.003–0.007	0.007***–0.008***	0.008	0.006***	0.006–0.007
	(0.003)	(16.887–26.744)	(0.002)	(8.864–11.183)	(0.002)	(9.369–9.762)	(0.002)	(10.255–10.844)
Observations*	3,273	3,273	3,273	3,273	3,150	3,150	3,263	3,263

Source: Estimated by authors using data from the IFPRI Bangladesh Integrated Household Survey, 2011–12.
Note: Calculated from base regressions without land interactions, and evaluated at the mean. Robust standard errors are in parentheses. For analyses involving the gender parity variable, the number of observations is reduced to 3,213 for calorie availability and household dietary diversity, 3,094 for male BMI, and 3,203 for female BMI.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

or wealth distribution. This can be explored in future work.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This paper has demonstrated that the recently developed WEAI can be used not only to assess the extent of women's empowerment in agriculture, but also to identify areas where the gaps in empowerment are greatest. By decomposing the WEAI into its component domains and indicators, we have identified that the domains of leadership in the community and control of resources are the most promising areas for policy intervention. Our analysis has also highlighted the importance of increasing the number of groups in which women actively participate and increasing women's control of assets. To what extent are the strategic and programmatic priorities of government and civil society aligned with closing empowerment gaps, specifically in these areas of greatest disempowerment? Because the NGO sector has emerged as an important alternative delivery channel for social services, and provides complementary avenues for poor women to access basic services alongside state-run services (Nazneen, Hossain, & Sultan, 2011), we consider both government and civil society initiatives in answering this question.

These empowerment gaps must be taken in the context of the country's impressive gains in women's health and girls' education relative to comparator countries in the past two decades (Nazneen *et al.*, 2011), with rapid reduction in fertility rates, infant and child mortality, and maternal mortality, and the closing of the gender gap in primary and secondary enrollment. Women's economic and social advancement are also stated goals of public policy, falling under the purview of the Ministry of Women and Children Affairs (MOWCA). In assessing progress in implementing the government's policy commitments to gender equality, the MOWCA (2010) found that the greatest emphasis of government ministries was on improving the gender balance of staff and working conditions of women. However, less than a third of the ministries (14 out of 47 responding to a questionnaire) identified economic advancement as a programmatic area, and within this area, women's economic participation in the labor force was emphasized, not increasing control over assets or income derived from economic activities. Protection of legal rights focused on birth registration, eliminating child labor, and combating early marriage and dowry-related violence, not on equal rights to own assets. The only program that explicitly mentioned strengthening women's rights to assets was a program of the Ministry of Land that leased out *khash* (government-owned) land to wives and husbands on an equal rights basis in the Model Village and Cluster Village Project (MOWCA, 2010, p. 42).

With regard to leadership in the community, despite the two top political leaders being women, Bangladeshi women in general have fared far less well with respect to participation in national politics than women in comparator countries (Nazneen *et al.*, 2011, p. 12). The established political parties have tended to focus on conventional and uncontroversial women's issues such as maternal healthcare, girl's education, political participation, violence against women in the public sphere, and certain forms of domestic violence such as dowry-related violence (Nazneen *et al.*, 2011, p. 24). Policy documents and pronouncements on strengthening women's leadership in the community are quite vague, although MOWCA (2011, authors' translation) mentions the role of District Women Affairs Officers and Upazilla Women Affairs Officers in implementing programs undertaken for the development of women in the economic advancement ministries, as well as a move to organize women into self-sustained groups at the village and union levels, with the possibility of registering these groups as formal organizations under different government organizations.

Donor policy documents do not highlight women's participation in mass party politics as a route to women's empowerment, but make greater reference to working with civil society as a route to strengthening women's voice at the local levels (Nazneen *et al.*, 2011). Nevertheless, civil society efforts need a supportive policy environment to be effective, and often work against deep-seated economic and social barriers to women's empowerment. While NGOs have been active in increasing their membership base among poor rural women, women with more bargaining power within their households (owing to greater schooling or assets brought to marriage) are more likely to participate in NGOs (Quisumbing, 2009). Group-based efforts have often been unable to reach the ultra-poor, because many group-based activities, such as those in microfinance, require a minimum level of resources for participation, such as funds for the compulsory savings requirements.

Long-seated systems of property rights that favor men in terms of inheritance, and the difficulty that women face in accumulating assets that they can control, need to be addressed so that women can build up their control of assets. This suggests that reforms of inheritance and property rights law more broadly, and specific interventions to increase women's control of assets, would be important parts of the policy agenda to reduce gender inequality. These could include targeted asset transfers to poor women (similar to those implemented by BRAC through its Targeting the Ultra Poor [TUP] Program) as well as efforts to improve women's access to financial instruments (both savings and credit) so they can accumulate assets. However, even if assets are transferred to women, a recent impact evaluation of BRAC's TUP program shows that there is no guarantee that they will retain control of the transferred assets or other assets acquired from incomes generated from the transferred assets (Das *et al.*, 2013). While the National Women's Development Policy formulated by the Ministry of Women and Children Affairs aims to "ensure full control of women of the property earned through own labor, inheritance, debt, land and market management" (MOWCA, 2011, authors' translation), it does not offer specific pronouncements about efforts to reform property law to improve gender equity. Our finding that not only absolute empowerment, but the relative empowerment of women within households, also positively affects household food security provides additional support for policies to narrow the gender gap in Bangladesh.

Our results also highlight the importance of investing in the agricultural sector as a whole to increase production diversity. The BIHS results show that about 77% of the total cropped area in Bangladesh is under rice cultivation, implying very little crop diversity (Ahmed *et al.*, 2013). Significant advances in agricultural research have focused mainly on rice. Our findings call for increased investment in agricultural research to enhance productivity of nonrice food crops such as pulses, vegetables, and fruits. The positive impacts of tube-well ownership and access to electricity also suggest that investments in complementary infrastructure will be important to

increase household-level food energy availability and dietary diversity. Lastly, continued investments in schooling, particularly of women and girls, will be important not only to increase food security, but also to narrow the gender gap in human capital.

NOTES

1. This description draws from Alkire *et al.* (2013).

2. The WEAI is a weighted sum of the 5DE and GPI with weights 0.9 and 0.1, respectively.

3. We add the integer 1 to the land area variable to avoid losing observations for households that do not own land but are involved in agriculture, such as cultivators who rent in land or agricultural wage laborers.

4. As discussed below, the gender parity gap is equal to zero if the women's score is equal to or exceeds the man's 5DE score.

5. Alternatively, calorie availability can be expressed in terms of per adult equivalents. Results for both per capita and per adult equivalent calorie availability are qualitatively similar, hence we focus our discussion on the per capita indicator. Results for per adult equivalent calorie availability are available upon request.

6. For households where information on the woman's spouse was not available (in female-headed households—where the male spouse is a migrant, or the female is widowed/separated), we considered the age difference to be zero.

7. The household head is the self-identified primary decisionmaker (in most cases, male) in the sample household.

8. 100 decimals = 1 acre.

9. However, both of these regressions have weak instruments, and the model is underidentified in the diet diversity regression with land interactions.

10. For Models 2 and 3 (group membership and credit decisions, respectively), instruments are weak in the calorie availability and diet diversity regressions; in Model 5 (women's rights over assets), the Hansen J test rejects the null hypothesis that instruments are valid in the calorie availability regression.

11. For the 2SLS elasticities, the largest are with respect to credit, however, the instruments are weak.

REFERENCES

Agarwal, B. (1994). *A field of one's own: Gender and land rights in South Asia*. Cambridge: Cambridge University Press.

Ahmed, A. U., Hill, R. V., Smith, L. C., Wiesmann, D. M., & Frankenberger, T. (2007). The World's most deprived: Characteristics and causes of extreme poverty and hunger. *2020 vision for food, agriculture, and the environment discussion paper 43*.

Ahmed, A. U., Ahmad, K., Chou, V., Hernandez, R., Menon, P., Naeem, F., *et al.* (2013). *The status of food security in the Feed the Future Zone and other regions of Bangladesh: Results from the 2011–2012 Bangladesh Integrated Household Survey*. Project report submitted to the U.S. Agency for International Development. International Food Policy Research Institute, Dhaka. Available from: http://ebrary.ifpri.org/cdm/singleitem/collection/p15738coll2/id/127518/rec/2.

Ahmed, A. U., & Shams, Y. (1994). Demand elasticities in rural Bangladesh: An application of the AIDS Model. *The Bangladesh Development Studies, 22*(1).

Alderman, H., Chiappori, P. A., Haddad, L., Hoddinott, J., & Kanbur, R. (1995). Unitary versus collective models of the household: Is it time to shift the burden of proof?. *The World Bank Research Observer, 10*(1), 1–19.

Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A. R., Seymour, G., & Vaz, A. (2013). The Women's Empowerment in Agriculture Index. *World Development, 52*, 71–91.

Alkire, S., & Foster, J. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics, 95*(7), 476–487.

Arimond, M., Hawkes, C., Ruel, M. T., Sifri, Z., Berti, P. R., Leroy, J. L., *et al.* (2010). Agricultural interventions and nutrition: Lessons from the past and new evidence. In B. Thompson, & L. Amoroso (Eds.), *Combating micronutrient deficiencies: Food-based approaches* (pp. 41–75). Rome: Food and Agriculture Organization of the United Nations and CAB International.

Asaduzzaman, M. (2010). The next agricultural transition in Bangladesh: Which transition, why, and how. In *Conference on "Understanding the Next Generation in Asia"* (Vol. 23). Bangkok.

Baum, C. F., Schaffer, M. E., & Stillman, S. (2010). ivreg2: Stata module for extended instrumental variables/2SLS, GMM and AC/HAC, LIML and k-class regression. Available from http://ideas.repec.org/c/boc/bocode/s425401.html.

Carletto, C., Zezza, A., & Banerjee, R. (2013). Towards better measurement of household food security: Harmonizing indicators and the role of household surveys. *Global Food Security, 2*(1), 30–40.

Das, N., Yasmin, R., Ara, J., Kamruzzaman, M., Davis, P., Behrman, J. A., *et al.* (2013). *How do intrahousehold dynamics change when assets are transferred to women? Evidence from BRAC's challenging the frontiers of poverty reduction—Targeting the ultra-poor program in Bangladesh*. Washington, DC: International Food Policy Research Institute.

Deere, C. D., Oduro, A. D., Swaminathan, H., & Doss, C. (2013). Property rights and the gender distribution of wealth in Ecuador, Ghana, and India. *Journal of Economic Inequality, 11*(2), 249–265.

Doss, C. (2006). The effects of intrahousehold property ownership on expenditure patterns in Ghana. *Journal of African Economies, 15*(1), 149–180.

Duflo, E., & Udry, C. (2004). *Intrahousehold resource allocation in Cote d'Ivoire: Social norms, separate accounts, and consumption choices*. No. w10498. Cambridge, MA: National Bureau of Economic Research.

Eswaran, M., Ramaswami, B., & Wadhwa, W. (2013). Status, caste, and the time allocation of women in rural India. *Economic Development and Cultural Change, 61*(2), 311–333.

FAO (Food and Agriculture Organization of the United Nations) (2011a). *The state of food and agriculture 2010–2011. Women in agriculture: Closing the gender gap for development*. Rome.

FAO (Food and Agriculture Organization of the United Nations) (2011b). *Guidelines for measuring household and individual dietary diversity*. Rome.

Haddad, L., Hoddinott, J., & Alderman, H. (1997). *Intrahousehold resource allocation in developing countries: Models, methods, and policy*. Baltimore, MD: Johns Hopkins University Press for the International Food Policy Research Institute.

Hallman, K. (2003). Mother-father resources, marriage payments, and girl–boy health in rural Bangladesh. In A. R. Quisumbing (Ed.), *Household decisions, gender, and development: A synthesis of recent*

research (pp. 115–120). Baltimore, MD: Johns Hopkins University Press for the International Food Policy Research Institute.
Hatlôy, A., Hallund, J., Diarra, M. M., & Oshaug, A. (2000). Food variety, socioeconomic status, and nutritional status in urban and rural areas in Koutiala (Mali). *Public Health Nutrition, 3*, 57–65.
Hoddinott, J., & Yohannes, Y. (2002). Dietary diversity as a food security indicator. *Food consumption and nutrition division discussion paper no. 136*. Washington, DC: International Food Policy Research Institute.
Hoddinott, J., & Haddad, L. (1995). Does female income share influence household expenditures? Evidence from Côte d'Ivoire. *Oxford Bulletin of Economics and Statistics, 57*(1), 77–96.
Kabeer, N. (1999). Resources, agency, achievements: Reflections on the measurement of women's empowerment. *Development and change, 30*(3), 435–464.
Kabeer, N. (1994). Women's labor in the Bangladesh garment industry: Choices and constraints. In C. Fawzi El-Solh, & J. Mabro (Eds.), *Muslim women's choices. Religious belief and social reality* (pp. 164–183). Oxford, UK: Berg Publishers.
Kilic, T., Palacios-Lopez, A., & Goldstein, M. (2013). Caught in a productivity trap: A distributional perspective on gender differences in Malawian agriculture. *World Bank policy research working paper 6381*. Washington, DC: World Bank.
Kumar, N., & Quisumbing, A. R. (2010). *Does social capital build women's assets?: The long-term impacts of group-based and individual dissemination of agricultural technology in Bangladesh*. Washington, DC: International Food Policy Research Institute.
MOWCA (Ministry of Women and Children Affairs) (2010). *Gender equality in Bangladesh: Progress and road ahead*. Dhaka, Bangladesh: Ministry of Women and Children Affairs, Government of Bangladesh, March.
MOWCA (Ministry of Women and Children Affairs) (2011). *National women development policy 2011 (in Bengali)*. Dhaka, Bangladesh: Ministry of Women and Children Affairs, Government of Bangladesh. Available from http://www.mowca.gov.bd/?p=436.
Nazneen, S., Hossain, N., & Sultan, M. (2011). National discourses on women's empowerment in Bangladesh: Continuities and change. *IDS working paper 368*. Brighton, UK: Institute of Development Studies.
Peterman, A., Behrman, J., & Quisumbing, A. (2010). A review of empirical evidence on gender differences in nonland agricultural inputs, technology, and services in developing countries. *Discussion paper no. 975*. Washington, DC: International Food Policy Research Institute.
Quisumbing, A. R. (1994). Intergenerational transfers in Philippine rice villages: Gender differences in traditional inheritance customs. *Journal of Development Economics, 43*(2), 167–195.
Quisumbing, A. R. (2003). *Household decisions, gender, and development: A synthesis of recent research*. Washington, DC: International Food Policy Research Institute.
Quisumbing, A. R. (2009). Beyond the Bari: Gender, groups, and social relations in rural Bangladesh. *CAPRi working paper no. 96*. Washington, DC: International Food Policy Research Institute.
Quisumbing, A. R., Bhagowalia, P., Menon, P., & Soundararajan, V. (2009). *Understanding the dynamics of gender-nutrition linkages in Bangladesh: Evidence from nationally representative and panel data sets*. Unpublished manuscript, June 30, 2009. International Food Policy Research Institute.
Quisumbing, A., Roy, S., Njuki, J., Tanvin, K., & Waithanji, E. (2013). Can dairy value chain projects change gender norms in rural Bangladesh? Impacts on assets, gender norms, and time use. *Discussion paper no. 1311*. Washington, DC: International Food Policy Research Institute.
Quisumbing, A. R., & Hallman, K. (2005). Marriage in transition: Evidence on age, education, and assets from six developing countries. In C. B. Lloyd, J. R. Behrman, N. P. Stromquist, & B. Cohen (Eds.), *The changing transitions to adulthood in developing countries: Selected studies, panel on transitions to adulthood in developing countries* (pp. 200–269). Washington, DC: Committee on Population, Division of Behavioral and Social Sciences and Education, National Academies Press.
Quisumbing, A. R., & Maluccio, J. A. (2003). Resources at marriage and intrahousehold allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa. *Oxford Bulletin of Economics and Statistics, 65*(3), 283–327.
Rahman, S. (2000). Women's employment in Bangladesh agriculture: Composition, determinants, and scope. *Journal of Rural Studies, 16*(4), 497–507.
Rahman, S. (2010). Women's labor contribution to productivity and efficiency in agriculture: Empirical evidence from Bangladesh. *Journal of Agricultural Economics, 61*(2), 318–342.
Rashid, D. A., Smith, L. C., & Rahman, T. (2011). Determinants of dietary quality: Evidence from Bangladesh. *World Development, 39*(12), 2221–2231.
Ruel, M. T. (2003). Operationalizing dietary diversity: A review of measurement issues and research priorities. *Journal of Nutrition, 133*, 3911S–3926S.
Skoufias, E. (2005). PROGRESA and its impacts on the welfare of rural households in Mexico. *Food consumption and nutrition division discussion paper no. 139*. Washington, DC: International Food Policy Research Institute.
Smith, L. C., Ramakrishnan, U., Ndiaye, A., Haddad, L., & Martorell, R. (2003). The importance of women's status for child nutrition in developing countries. International Food Policy Research Institute (IFPRI) research report abstract 131. *Food & Nutrition Bulletin, 24*(3), 287–288.
Sraboni, E., Quisumbing, A. R., & Ahmed, A. U. (2013). *The women's empowerment in agriculture index: Results from the 2011–2012 Bangladesh integrated household survey*. Project report submitted to the U.S. Agency for International Development. Dhaka: International Food Policy Research Institute. Available from http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/127504.
StataCorp. (2011). *Stata statistical software: Release 12*. College Station, TX: StataCorp LP.
Stock, J. H., & Yogo, M. (2005). Testing for weak instruments in linear IV regression. In D. W. K. Andrew, & J. H. Stock (Eds.), *Identification and inference for econometric models: Essays in honor of Thomas Rothenberg* (pp. 80–108). New York: Cambridge University Press.
Udry, C., Hoddinott, J., Alderman, H., & Haddad, L. (1995). Gender differentials in farm productivity: Implications for household efficiency and agricultural policy. *Food Policy, 20*(5), 407–423.
UNICEF (United Nations Children's Fund) (1990). *Strategy for improved nutrition of women and children in developing countries*. New York: UNICEF.
von Grebmer, K., Nestorova, B., Quisumbing, A. R., Fertziger, R., Fritschel, H., Pandya-Lorch, R., *et al.* (2009). *2009 Global hunger index: The challenge of hunger: Focus on financial crisis and gender inequality*. Bonn/Washington, DC/Republic of Ireland: Deutsche Welthungerhilfe (German AgroAction), International Food Policy Research Institute, and Concern Worldwide.
Yoong, J., Rabinovich, L., & Diepeveen, S. (2012). The impact of economic resource transfers to women versus men: A systematic review. *Technical report*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.
Zaman, H. (1995). Patterns of activity and use of time in rural Bangladesh: Class, gender, and seasonal variations. *The Journal of Developing Areas, 29*(3), 371–388.
Ziaei, S., Naved, R. T., & Ekström, E. C. (2012). Women's exposure to intimate partner violence and child malnutrition: Findings from demographic and health surveys in Bangladesh. *Maternal & Child Nutrition*. http://dx.doi.org/10.1111/j.1740-8709.2012.00432.x.

APPENDIX A

(see Tables 11–17j)

Table 11. *Model 1: Women's empowerment score and per adult equivalent calorie availability*

Variable	Per adult equivalent calorie availability	
	OLS (1)	2SLS (2)
Empowerment score of woman	288.921***	1,100.588***
	(62.155)	(222.549)
Age (in years) of household head	15.973*	10.402
	(8.263)	(8.878)
Age-squared of household head	−0.125	−0.070
	(0.091)	(0.098)
Years of education of household head	10.697**	10.458**
	(4.301)	(4.359)
Household head is farmer (= 1, 0 otherwise)	113.970***	128.657***
	(34.050)	(44.806)
Household head is trader (= 1, 0 otherwise)	59.686	31.296
	(49.750)	(51.950)
Household size	−96.703***	−91.121***
	(11.207)	(11.835)
Proportion of males 0–4 years old	−944.962***	−979.262***
	(262.404)	(273.466)
Proportion of males 5–10 years old	−957.435***	−1,031.235***
	(245.035)	(254.336)
Proportion of males 11–18 years old	−1,067.528***	−1,142.455***
	(239.740)	(248.049)
Proportion of males 19–59 years old	−1,333.262***	−1,336.144***
	(201.741)	(207.133)
Proportion of females 0–4 years old	−962.667***	−947.325***
	(261.802)	(271.576)
Proportion of females 5–10 years old	−502.199**	−598.276**
	(251.845)	(259.839)
Proportion of females 11–18 years old	−401.619	−533.342**
	(258.228)	(265.836)
Proportion of females 19–59 years old	−647.129**	−710.284**
	(293.254)	(301.181)
Proportion of females 60 years and older	−22.718	−67.253
	(328.560)	(336.961)
Number of food crops produced by household	46.953***	38.191
	(11.552)	(30.280)
Number of dairy cows owned	61.363***	53.355***
	(13.387)	(14.755)
Price of rice (in taka)	−4.741	−1.389
	(5.073)	(5.225)
Ln (owned cultivable land + 1)	37.980***	39.720***
	(10.885)	(11.116)
Owns hand tube well (= 1, 0 otherwise)	119.506***	50.227
	(34.431)	(37.775)
Access to electricity (= 1, 0 otherwise)	11.354	−19.400
	(29.507)	(31.497)
Division level fixed-effects	Yes	Yes
Constant	4,008.168***	3,575.073***
	(282.009)	(309.563)
Observations	3,273	3,273
F	18.594	17.909
Adjusted R^2	0.187	0.142
Hansen J p, Ho: instruments valid		0.249
Under ID test p, Ho: underidentified		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		41.798
Anderson-Rubin, Ho: endogvars irrelevant		
A-R Wald test, *p*-value		0.000
A-R Wald Chi^2 test, *p*-value		0.000
Endogeneity test p, Ho: exogenous		0.000

Table 12. *Model 2: Women's group membership and per adult equivalent calorie availability*

Variable	Per adult equivalent calorie availability	
	OLS (1)	2SLS (2)
Number of groups woman is an active member of	39.995	1,011.372***
	(29.832)	(239.083)
Age (in years) of household head	17.476**	6.028
	(8.199)	(9.824)
Age-squared of household head	−0.139	−0.006
	(0.090)	(0.108)
Years of education of household head	10.914**	14.206***
	(4.328)	(5.048)
Household head is farmer (= 1, 0 otherwise)	114.530***	260.786***
	(34.264)	(65.482)
Household head is trader (= 1, 0 otherwise)	68.076	24.998
	(50.070)	(64.499)
Household size	−98.990***	−105.826***
	(11.299)	(13.857)
Proportion of males 0–4 years old	−938.293***	−1,077.981***
	(262.295)	(304.382)
Proportion of males 5–10 years old	−936.492***	−1,068.694***
	(244.923)	(284.688)
Proportion of males 11–18 years old	−1,050.085***	−1,274.973***
	(239.413)	(276.602)
Proportion of males 19–59 years old	−1,333.443***	−1,362.555***
	(201.426)	(223.404)
Proportion of females 0–4 years old	−965.285***	−902.220***
	(262.363)	(305.169)
Proportion of females 5–10 years old	−474.134*	−624.870**
	(251.455)	(286.003)
Proportion of females 11–18 years old	−369.131	−719.129**
	(258.595)	(299.521)
Proportion of females 19–59 years old	−627.778**	−705.585**
	(293.271)	(328.111)
Proportion of females 60 years and older	−10.805	−109.119
	(328.635)	(366.097)
Number of food crops produced by household	49.533***	29.971
	(11.670)	(35.764)
Number of dairy cows owned	64.982***	84.957***
	(13.406)	(18.058)
Price of rice (in taka)	−5.612	2.191
	(5.090)	(6.175)
Ln (owned cultivable land + 1)	38.095***	55.796***
	(10.908)	(13.124)
Owns hand tube well (= 1, 0 otherwise)	139.763***	34.338
	(34.287)	(46.058)
Access to electricity (= 1, 0 otherwise)	21.148	−6.788
	(29.657)	(35.679)
Division level fixed-effects	Yes	Yes
Constant	4,163.654***	4,194.413***
	(282.543)	(328.194)
Observations	3,273	3,273
F	17.885	14.486
Adjusted R^2	0.182	−0.114
Hansen J p, Ho: instruments valid		0.139
Under ID test p, Ho: underidentified		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		9.545
Anderson-Rubin, Ho: endogvars irrelevant		
A-R Wald test, *p*-value		0.000
A-R Wald Chi^2 test, *p*-value		0.000
Endogeneity test p, Ho: exogenous		0.000

Table 13. *Model 3: Women's decisions on credit and per adult equivalent calorie availability*

Variable	Per adult equivalent calorie availability	
	OLS (1)	2SLS (2)
Average number of decisions over credit	0.708	1,027.521**
	(14.402)	(401.662)
Age (in years) of household head	17.939**	−24.216
	(8.202)	(21.245)
Age-squared of household head	−0.144	0.303
	(0.090)	(0.228)
Years of education of household head	10.796**	21.710***
	(4.324)	(8.372)
Household head is farmer (= 1, 0 otherwise)	109.252***	400.431***
	(34.336)	(144.593)
Household head is trader (= 1, 0 otherwise)	69.687	30.409
	(50.073)	(87.412)
Household size	−98.647***	−75.215***
	(11.264)	(21.770)
Proportion of males 0–4 years old	−933.490***	−1,597.502***
	(262.141)	(502.692)
Proportion of males 5–10 years old	−931.620***	−1,367.426***
	(244.755)	(424.807)
Proportion of males 11–18 years old	−1,041.299***	−1,620.248***
	(239.507)	(435.997)
Proportion of males 19–59 years old	−1,332.285***	−1,417.681***
	(201.405)	(298.223)
Proportion of females 0–4 years old	−968.710***	−1,338.570***
	(261.872)	(449.904)
Proportion of females 5–10 years old	−468.360*	−850.318**
	(251.659)	(427.095)
Proportion of females 11–18 years old	−355.061	−816.413*
	(258.314)	(431.648)
Proportion of females 19–59 years old	−624.856**	−782.386*
	(293.418)	(455.422)
Proportion of females 60 years and older	−7.230	−328.691
	(329.027)	(503.181)
Number of food crops produced by household	49.655***	−42.081
	(11.666)	(69.803)
Number of dairy cows owned	64.319***	113.342***
	(13.431)	(31.803)
Price of rice (in taka) Ln (owned cultivable land + 1)	−5.925	9.424
	(5.105)	(9.679)
	37.347***	25.983
Owns hand tube well (= 1, 0 otherwise)	(10.925)	(17.453)
	144.172***	28.648
	(34.116)	(68.800)
Access to electricity (= 1, 0 otherwise)	22.255	−50.329
	(29.700)	(57.135)
Division level fixed-effects	Yes	Yes
Constant	4,162.139***	3,988.850***
	(282.790)	(453.473)
Observations	3,273	3,273
F	17.874	7.937
Adjusted R^2	0.182	−1.168
Hansen J p, Ho: instruments valid		0.493
Under ID test p, Ho: underidentified		0.031
Weak ID test stat (Kleibergen-Paap rk Wald F)		2.134
Anderson-Rubin, Ho: endogvars irrelevant		
A-R Wald test, *p*-value		0.000
A-R Wald Chi^2 test, *p*-value		0.000
Endogeneity test p, Ho: exogenous		0.000

Table 14. *Model 4: Women's ownership of assets and per adult equivalent calorie availability*

Variable	Per adult equivalent calorie availability	
	OLS (1)	2SLS (2)
Number of assets woman has self/joint ownership of	41.559***	189.051***
	(10.811)	(43.130)
Age (in years) of household head	16.361**	10.372
	(8.237)	(8.877)
Age-squared of household head	−0.128	−0.068
	(0.090)	(0.098)
Years of education of household head	9.465**	4.642
	(4.262)	(4.513)
Household head is farmer (= 1, 0 otherwise)	110.904***	109.862**
	(34.140)	(44.649)
Household head is trader (= 1, 0 otherwise)	59.261	24.061
	(49.588)	(52.467)
Household size	−95.842***	−86.472***
	(11.103)	(11.908)
Proportion of males 0–4 years old	−927.938***	−902.982***
	(261.784)	(273.512)
Proportion of males 5–10 years old	−945.977***	−994.210***
	(245.026)	(256.835)
Proportion of males 11–18 years old	−1,073.065***	−1,186.169***
	(240.366)	(253.339)
Proportion of males 19–59 years old	−1,336.835***	−1,353.452***
	(201.381)	(207.939)
Proportion of females 0–4 years old	−983.747***	−1,029.984***
	(261.416)	(273.230)
Proportion of females 5–10 years old	−488.348*	−557.852**
	(252.290)	(263.186)
Proportion of females 11–18 years old	−408.746	−600.095**
	(259.543)	(273.361)
Proportion of females 19–59 years old	−662.078**	−792.133**
	(294.508)	(311.385)
Proportion of females 60 years and older	−53.322	−214.165
	(328.772)	(342.280)
Number of food crops produced by household	45.946***	41.259
	(11.666)	(31.116)
Number of dairy cows owned	60.145***	43.693***
	(13.469)	(15.651)
Price of rice (in taka)	−5.519	−4.002
	(5.076)	(5.223)
Ln (owned cultivable land + 1)	36.975***	35.785***
	(10.943)	(11.411)
Owns hand tube well (= 1, 0 otherwise)	132.612***	89.240**
	(34.057)	(36.527)
Access to electricity (= 1, 0 otherwise)	13.137	−19.493
	(29.650)	(32.515)
Division level fixed-effects	Yes	Yes
Constant	4,141.097***	4,067.797***
	(281.072)	(291.438)
Observations	3,273	3,273
F	18.424	17.421
Adjusted R^2	0.187	0.124
Hansen J p, Ho: instruments valid		0.421
Under ID test p, Ho: underidentified		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		32.199
Anderson-Rubin, Ho: endogvars irrelevant		
A-R Wald test, *p*-value		0.000
A-R Wald Chi^2 test, *p*-value		0.000
Endogeneity test p, Ho: exogenous		0.000

Table 15. *Model 5: Women's rights over assets and per adult equivalent calorie availability*

Variable	Per adult equivalent calorie availability	
	OLS (1)	2SLS (2)
Number of self/joint decisions over purchase, sale, or transfer of assets made by woman	7.245***	26.026***
	(1.608)	(6.667)
Age (in years) of household head	15.113*	8.269
	(8.191)	(8.694)
Age-squared of household head	−0.117	−0.051
	(0.089)	(0.094)
Years of education of household head	9.414**	6.104
	(4.268)	(4.426)
Household head is farmer (= 1, 0 otherwise)	104.247***	106.703**
	(34.096)	(44.759)
Household head is trader (= 1, 0 otherwise)	53.798	8.818
	(50.043)	(55.687)
Household size	−94.423***	−82.172***
	(11.174)	(12.416)
Proportion of males 0–4 years old	−962.297***	−1,051.624***
	(261.313)	(270.905)
Proportion of males 5–10 years old	−972.516***	−1,086.723***
	(244.233)	(254.127)
Proportion of males 11–18 years old	−1,098.210***	−1,248.829***
	(239.742)	(252.617)
Proportion of males 19–59 years old	−1,331.124***	−1,327.763***
	(200.761)	(202.752)
Proportion of females 0–4 years old	−994.523***	−1,077.834***
	(261.021)	(270.702)
Proportion of females 5–10 years old	−512.876**	−633.592**
	(251.372)	(259.736)
Proportion of females 11–18 years old	−405.747	−538.571**
	(257.536)	(264.839)
Proportion of females 19–59 years old	−665.151**	−774.648**
	(293.402)	(304.696)
Proportion of females 60 years and older	−49.298	−165.824
	(328.333)	(337.034)
Number of food crops produced by household	44.191***	12.833
	(11.655)	(35.275)
Number of dairy cows owned	58.818***	48.088***
	(13.489)	(15.226)
Price of rice (in taka)	−5.392	−4.052
	(5.089)	(5.222)
Ln (owned cultivable land + 1)	35.097***	28.933**
	(10.901)	(11.316)
Owns hand tube well (= 1, 0 otherwise)	140.838***	136.027***
	(33.882)	(34.870)
Access to electricity (= 1, 0 otherwise)	12.868	−11.414
	(29.650)	(31.788)
Division level fixed-effects	Yes	Yes
Constant	4,169.338***	4,184.153***
	(281.672)	(286.914)
Observations	3,273	3,273
F	18.554	17.749
Adjusted R^2	0.188	0.146
Hansen J p, Ho: instruments valid		0.054
Under ID test p, Ho: underidentified		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		23.334
Anderson-Rubin, Ho: endogvars irrelevant		
A-R Wald test, p-value		0.000
A-R Wald Chi^2 test, p-value		0.000
Endogeneity test p, Ho: exogenous		0.005

Table 16. *Model 6: Gender parity gap and per adult equivalent calorie availability*

Variable	Per adult equivalent calorie availability	
	OLS (1)	2SLS (2)
Gender parity gap (= 0 if woman enjoys gender parity, "gap" if not)	−202.163***	−1,587.689***
	(68.626)	(329.406)
Age (in years) of household head	18.249**	10.480
	(8.307)	(9.346)
Age-squared of household head	−0.146	−0.070
	(0.091)	(0.102)
Years of education of household head	11.402***	12.369***
	(4.361)	(4.573)
Household head is farmer (= 1, 0 otherwise)	107.653***	116.313**
	(34.280)	(45.683)
Household head is trader (= 1, 0 otherwise)	64.289	17.530
	(50.398)	(54.370)
Household size	−97.454***	−87.890***
	(11.309)	(12.293)
Proportion of males 0–4 years old	−961.321***	−1,018.070***
	(268.684)	(291.725)
Proportion of males 5–10 years old	−971.213***	−1,062.934***
	(250.239)	(268.999)
Proportion of males 11–18 years old	−1,108.721***	−1,227.982***
	(246.051)	(264.550)
Proportion of males 19–59 years old	−1,367.198***	−1,375.799***
	(206.764)	(219.447)
Proportion of females 0–4 years old	−976.129***	−951.576***
	(267.593)	(288.082)
Proportion of females 5–10 years old	−539.342**	−698.911**
	(258.994)	(277.511)
Proportion of females 11–18 years old	−402.919	−576.229**
	(264.948)	(281.013)
Proportion of females 19–59 years old	−680.802**	−788.806**
	(300.308)	(320.529)
Proportion of females 60 years and older	−79.224	−173.984
	(335.533)	(356.074)
Number of food crops produced by household	47.283***	56.670*
	(11.679)	(30.744)
Number of dairy cows owned	62.398***	53.946***
	(13.419)	(15.051)
Price of rice (in taka)	−4.416	−0.389
	(5.015)	(5.387)
Ln (owned cultivable land + 1)	39.148***	46.439***
	(11.037)	(11.624)
Owns hand tube well (= 1, 0 otherwise)	132.292***	52.323
	(34.554)	(39.078)
Access to electricity (= 1, 0 otherwise)	12.989	−18.801
	(29.910)	(32.642)
Division level fixed-effects	Yes	Yes
Constant	4,178.484***	4,505.917***
	(286.784)	(316.963)
Observations	3,213	3,213
F	17.751	16.173
Adjusted R^2	0.184	0.082
Hansen J p, Ho: instruments valid		0.291
Under ID test p, Ho: underidentified		0.000
Weak ID test stat (Kleibergen-Paap rk Wald F)		27.216
Anderson-Rubin, Ho: endogvars irrelevant		
A-R Wald test, *p*-value		0.000
A-R Wald Chi^2 test, *p*-value		0.000
Endogeneity test p, Ho: exogenous		0.000

Table 17a. *First Stage regressions (for models without interactions)*

	Table 3: Per capita calorie availability and household dietary diversity	
	Endogenous variable: empowerment score of woman	Endogenous variable: number of food crops produced by household
	coef/se	coef/se
Age (in years) of household head	0.008***	0.025**
	(0.002)	(0.011)
Age-squared of household head	−0.000***	−0.000***
	(0.000)	(0.000)
Years of education of household head	0.000	0.010
	(0.001)	(0.008)
Household head is farmer (= 1, 0 otherwise)	−0.025***	0.508***
	(0.010)	(0.064)
Household head is trader (= 1, 0 otherwise)	0.025*	−0.189***
	(0.014)	(0.066)
Household size	−0.009***	0.062***
	(0.003)	(0.021)
Proportion of males 0–4 years old	0.110	−0.698*
	(0.072)	(0.411)
Proportion of males 5–10 years old	0.138**	−0.539
	(0.064)	(0.382)
Proportion of males 11–18 years old	0.119*	−0.277
	(0.061)	(0.367)
Proportion of males 19–59 years old	0.031	−0.076
	(0.048)	(0.272)
Proportion of females 0–4 years old	0.045	−0.875**
	(0.069)	(0.390)
Proportion of females 5–10 years old	0.175***	−0.335
	(0.064)	(0.383)
Proportion of females 11–18 years old	0.199***	−0.063
	(0.065)	(0.391)
Proportion of females 19–59 years old	0.121	−0.181
	(0.074)	(0.435)
Proportion of females 60 years and older	0.099	−0.237
	(0.079)	(0.470)
Ln (owned cultivable land + 1)	−0.002	0.011
	(0.003)	(0.019)
Access to electricity (= 1, 0 otherwise)	0.023***	−0.036
	(0.008)	(0.050)
Price of rice (in taka)	−0.003*	0.003
	(0.001)	(0.007)
Division level fixed-effects	Yes	Yes
Number of dairy cows owned	0.011***	0.138***
	(0.003)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.065***	0.195***
	(0.010)	(0.054)
Age difference (male–female)	−0.003***	0.004
	(0.001)	(0.005)
Types of informal credit sources in village	0.025***	0.037***
	(0.003)	(0.014)
Whether female has participated in any community activity	0.102***	0.039
during the previous year (= 1, 0 if otherwise)	(0.008)	(0.046)
Clay-loam soil (= 1, 0 if otherwise)	−0.006	0.395***
	(0.010)	(0.061)
Sandy-loam soil (= 1, 0 if otherwise)	−0.031***	0.537***
	(0.012)	(0.071)
% of land irrigated by household	0.001***	0.010***
	(0.000)	(0.001)
Number of community activities woman has participated in during the previous year		
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)		
Constant	0.345***	−0.655
	(0.081)	(0.444)
Observations	3,273	3,213
F	23.598	50.101
Adjusted R^2	0.180	0.314

Table 17b. *First Stage regressions (for models without interactions)*

	Table 4: Per capita calorie availability and household dietary diversity	
	Endogenous variable: number of groups woman is an active member of coef/se	Endogenous variable: number of food crops produced by household coef/se
Age (in years) of household head	0.013***	0.024**
	(0.004)	(0.011)
Age-squared of household head	−0.000***	−0.000**
	(0.000)	(0.000)
Years of education of household head	−0.003	0.009
	(0.003)	(0.007)
Household head is farmer (= 1, 0 otherwise)	−0.151***	0.514***
	(0.021)	(0.064)
Household head is trader (= 1, 0 otherwise)	0.031	−0.193***
	(0.037)	(0.064)
Household size	0.006	0.061***
	(0.007)	(0.021)
Proportion of males 0–4 years old	0.197	−0.682*
	(0.150)	(0.400)
Proportion of males 5–10 years old	0.164	−0.532
	(0.134)	(0.373)
Proportion of males 11–18 years old	0.242*	−0.269
	(0.126)	(0.358)
Proportion of males 19–59 years old	0.045	−0.061
	(0.096)	(0.264)
Proportion of females 0–4 years old	−0.021	−0.858**
	(0.145)	(0.381)
Proportion of females 5–10 years old	0.192	−0.323
	(0.136)	(0.373)
Proportion of females 11–18 years old	0.377***	−0.051
	(0.135)	(0.382)
Proportion of females 19–59 years old	0.101	−0.177
	(0.154)	(0.426)
Proportion of females 60 years and older	0.102	−0.234
	(0.168)	(0.459)
Ln (owned cultivable land + 1)	−0.020***	0.009
	(0.006)	(0.018)
Access to electricity (= 1, 0 otherwise)	0.012	−0.035
	(0.019)	(0.049)
Price of rice (in taka)	−0.006**	0.003
	(0.003)	(0.007)
Division level fixed-effects	Yes	Yes
Number of dairy cows owned	−0.018**	0.138***
	(0.008)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.072***	0.186***
	(0.022)	(0.054)
Age difference (male–female)	−0.004**	0.004
	(0.002)	(0.005)
Types of informal credit sources in village	0.018***	0.035**
	(0.007)	(0.014)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)		
Clay-loam soil (= 1, 0 if otherwise)	−0.020	0.406***
	(0.023)	(0.060)
Sandy-loam soil (= 1, 0 if otherwise)	−0.024	0.548***
	(0.026)	(0.071)
% of land irrigated by household	0.001***	0.010***
	(0.000)	(0.001)
Number of community activities woman has participated in during the previous year	0.059***	0.032
	(0.009)	(0.022)
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)		
Constant	−0.174	−0.621
	(0.174)	(0.432)
Observations	3,273	3,273
F	13.821	51.137
Adjusted R^2	0.106	0.321

Table 17c. *First Stage regressions (for models without interactions)*

	Table 5: Per capita calorie availability and household dietary diversity	
	Endogenous variable: average number of decisions over credit coef/se	Endogenous variable: number of food crops produced by household coef/se
Age (in years) of household head	0.044***	0.024**
	(0.010)	(0.011)
Age-squared of household head	−0.000***	−0.000**
	(0.000)	(0.000)
Years of education of household head	−0.010**	0.009
	(0.005)	(0.008)
Household head is farmer (= 1, 0 otherwise)	−0.252***	0.514***
	(0.042)	(0.064)
Household head is trader (= 1, 0 otherwise)	0.010	−0.190***
	(0.069)	(0.065)
Household size	−0.020	0.061***
	(0.014)	(0.021)
Proportion of males 0–4 years old	0.625*	−0.689*
	(0.320)	(0.399)
Proportion of males 5–10 years old	0.421	−0.529
	(0.289)	(0.373)
Proportion of males 11–18 years old	0.553**	−0.266
	(0.276)	(0.358)
Proportion of males 19–59 years old	0.078	−0.067
	(0.213)	(0.263)
Proportion of females 0–4 years old	0.324	−0.868**
	(0.311)	(0.380)
Proportion of females 5–10 years old	0.369	−0.328
	(0.293)	(0.372)
Proportion of females 11–18 years old	0.468	−0.041
	(0.291)	(0.381)
Proportion of females 19–59 years old	0.161	−0.178
	(0.327)	(0.425)
Proportion of females 60 years and older	0.312	−0.240
	(0.351)	(0.459)
Ln (owned cultivable land + 1)	0.013	0.010
	(0.012)	(0.018)
Access to electricity (= 1, 0 otherwise)	0.063*	−0.032
	(0.037)	(0.049)
Price of rice (in taka)	−0.013**	0.003
	(0.006)	(0.007)
Division level fixed-effects	Yes	Yes
Number of dairy cows owned	−0.037**	0.138***
	(0.016)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.133***	0.205***
	(0.043)	(0.054)
Age difference (male–female)	−0.002	0.004
	(0.004)	(0.005)
Types of informal credit sources in village	0.046***	0.040***
	(0.013)	(0.014)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)		
Clay-loam soil (= 1, 0 if otherwise)	0.071	0.402***
	(0.045)	(0.060)
Sandy-loam soil (= 1, 0 if otherwise)	0.048	0.545***
	(0.051)	(0.071)
% of land irrigated by household	0.001*	0.010***
	(0.000)	(0.001)
Number of community activities woman has participated in during the previous year		
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)		
Constant	−0.080	−0.621
	(0.346)	(0.432)
Observations	3,273	3,273
F	8.188	51.785
Adjusted R^2	0.059	0.320

Table 17d. *First Stage regressions (for models without interactions)*

	Table 6: Per capita calorie availability and household dietary diversity	
	Endogenous variable: number of assets woman has self/joint ownership of coef/se	Endogenous variable: number of food crops produced by household coef/se
Age (in years) of household head	0.047***	0.024**
	(0.014)	(0.011)
Age-squared of household head	−0.000***	−0.000**
	(0.000)	(0.000)
Years of education of household head	0.032***	0.009
	(0.008)	(0.008)
Household head is farmer (= 1, 0 otherwise)	−0.047	0.514***
	(0.066)	(0.064)
Household head is trader (= 1, 0 otherwise)	0.164	−0.190***
	(0.106)	(0.065)
Household size	−0.077***	0.061***
	(0.028)	(0.021)
Proportion of males 0–4 years old	0.087	−0.689*
	(0.485)	(0.399)
Proportion of males 5–10 years old	0.606	−0.529
	(0.451)	(0.373)
Proportion of males 11–18 years old	0.855**	−0.266
	(0.429)	(0.358)
Proportion of males 19–59 years old	0.144	−0.068
	(0.328)	(0.263)
Proportion of females 0–4 years old	0.572	−0.868**
	(0.491)	(0.380)
Proportion of females 5–10 years old	0.654	−0.329
	(0.449)	(0.372)
Proportion of females 11–18 years old	1.457***	−0.041
	(0.459)	(0.381)
Proportion of females 19–59 years old	1.032*	−0.178
	(0.550)	(0.425)
Proportion of females 60 years and older	1.200**	−0.240
	(0.589)	(0.459)
Ln (owned cultivable land + 1)	0.016	0.010
	(0.019)	(0.018)
Access to electricity (= 1, 0 otherwise)	0.185***	−0.032
	(0.056)	(0.049)
Price of rice (in taka)	0.001	0.003
	(0.009)	(0.007)
Division level fixed-effects	Yes	Yes
Number of dairy cows owned	0.115***	0.138***
	(0.026)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.308***	0.204***
	(0.068)	(0.054)
Age difference (male–female)	−0.017**	0.004
	(0.007)	(0.005)
Types of informal credit sources in village	0.247***	0.040***
	(0.018)	(0.014)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)		
Clay-loam soil (= 1, 0 if otherwise)	0.082	0.402***
	(0.068)	(0.060)
Sandy-loam soil (= 1, 0 if otherwise)	−0.042	0.545***
	(0.075)	(0.071)
% of land irrigated by household	0.002**	0.010***
	(0.001)	(0.001)
Number of community activities woman has participated in during the previous year		
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)	0.388**	−0.007
	(0.162)	(0.093)
Constant	−0.699	−0.621
	(0.548)	(0.433)
Observations	3,273	3,273
F	16.033	50.174
Adjusted R^2	0.128	0.320

Table 17e. *First Stage regressions (for models without interactions)*

	Table 7: Per capita calorie availability and household dietary diversity	
	Endogenous variable: number of self/joint decisions over purchase, sale, or transfer of assets made by woman coef/se	Endogenous variable: number of food crops produced by household coef/se
Age (in years) of household head	0.431***	0.024**
	(0.087)	(0.011)
Age-squared of household head	−0.004***	−0.000**
	(0.001)	(0.000)
Years of education of household head	0.167***	0.009
	(0.051)	(0.008)
Household head is farmer (= 1, 0 otherwise)	0.348	0.514***
	(0.434)	(0.064)
Household head is trader (= 1, 0 otherwise)	1.624**	−0.190***
	(0.660)	(0.065)
Household size	−0.613***	0.061***
	(0.146)	(0.021)
Proportion of males 0–4 years old	4.709	−0.689*
	(2.914)	(0.399)
Proportion of males 5–10 years old	6.588**	−0.529
	(2.749)	(0.373)
Proportion of males 11–18 years old	7.819***	−0.266
	(2.690)	(0.358)
Proportion of males 19–59 years old	−0.171	−0.068
	(1.996)	(0.263)
Proportion of females 0–4 years old	4.625	−0.868**
	(2.864)	(0.380)
Proportion of females 5–10 years old	6.719**	−0.329
	(2.683)	(0.372)
Proportion of females 11–18 years old	7.599***	−0.041
	(2.756)	(0.381)
Proportion of females 19–59 years old	6.320*	−0.178
	(3.228)	(0.425)
Proportion of females 60 years and older	6.966**	−0.240
	(3.518)	(0.459)
Ln (owned cultivable land + 1)	0.390***	0.010
	(0.128)	(0.018)
Access to electricity (= 1, 0 otherwise)	1.285***	−0.032
	(0.351)	(0.049)
Price of rice (in taka)	−0.005	0.003
	(0.056)	(0.007)
Division level fixed-effects	Yes	Yes
Number of dairy cows owned	0.766***	0.138***
	(0.169)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.939**	0.204***
	(0.397)	(0.054)
Age difference (male–female)	−0.051	0.004
	(0.043)	(0.005)
Types of informal credit sources in village	1.571***	0.040***
	(0.122)	(0.014)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)		
Clay-loam soil (= 1, 0 if otherwise)	1.668***	0.402***
	(0.430)	(0.060)
Sandy-loam soil (= 1, 0 if otherwise)	3.036***	0.545***
	(0.518)	(0.071)
% of land irrigated by household	0.010**	0.010***
	(0.004)	(0.001)
Number of community activities woman has participated in during the previous year		
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)	2.791***	−0.007
	(1.006)	(0.093)
Constant	−8.626***	−0.621
	(3.226)	(0.433)
Observations	3,273	3,273
F	18.802	50.174
Adjusted R^2	0.181	0.320

Table 17f. *First Stage regressions (for models without interactions)*

	Table 8: Per capita calorie availability and household dietary diversity	
	Endogenous variable gender parity gap (= 0 if woman enjoys gender parity, "gap" if not) coef/se	Endogenous variable: number of food crops produced by household coef/se
Age (in years) of household head	−0.006***	0.025**
	(0.002)	(0.011)
Age-squared of household head	0.000**	−0.000***
	(0.000)	(0.000)
Years of education of household head	0.001	0.010
	(0.001)	(0.008)
Household head is farmer (= 1, 0 otherwise)	0.019**	0.508***
	(0.008)	(0.064)
Household head is trader (= 1, 0 otherwise)	−0.028**	−0.189***
	(0.012)	(0.066)
Household size	0.009***	0.062***
	(0.003)	(0.021)
Proportion of males 0–4 years old	−0.102	−0.698*
	(0.066)	(0.411)
Proportion of males 5–10 years old	−0.114**	−0.539
	(0.058)	(0.382)
Proportion of males 11–18 years old	−0.114**	−0.277
	(0.055)	(0.367)
Proportion of males 19–59 years old	−0.029	−0.076
	(0.043)	(0.272)
Proportion of females 0–4 years old	−0.040	−0.875**
	(0.064)	(0.390)
Proportion of females 5–10 years old	−0.164***	−0.335
	(0.058)	(0.383)
Proportion of females 11–18 years old	−0.156***	−0.063
	(0.058)	(0.391)
Proportion of females 19–59 years old	−0.116*	−0.181
	(0.066)	(0.435)
Proportion of females 60 years and older	−0.105	−0.237
	(0.070)	(0.470)
Ln (owned cultivable land + 1)	0.005**	0.011
	(0.002)	(0.019)
Access to electricity (= 1, 0 otherwise)	−0.013*	−0.036
	(0.007)	(0.050)
Price of rice (in taka)	0.002	0.003
	(0.001)	(0.007)
Division level fixed-effects	Yes	Yes
Number of dairy cows owned	−0.005*	0.138***
	(0.003)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	−0.042***	0.195***
	(0.008)	(0.054)
Age difference (male–female)	0.002**	0.004
	(0.001)	(0.005)
Types of informal credit sources in village	−0.021***	0.037***
	(0.003)	(0.014)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)	−0.059***	0.039
	(0.007)	(0.046)
Clay-loam soil (= 1, 0 if otherwise)	0.009	0.395***
	(0.009)	(0.061)
Sandy-loam soil (= 1, 0 if otherwise)	0.039***	0.537***
	(0.011)	(0.071)
% of land irrigated by household	−0.000***	0.010***
	(0.000)	(0.001)
Number of community activities woman has participated in during the previous year		
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)		
Constant	0.377***	−0.655
	(0.076)	(0.444)
Observations	3,213	3,213
F	12.367	50.101
Adjusted R^2	0.121	0.314

Table 17g. *First stage regressions*

	Table 3: Male BMI		Table 4: Male BMI		Table 5: Male BMI	
	First stage regression results					
	Endogenous variable: empowerment score of woman	Endogenous variable: number of food crops produced by household	Endogenous variable: number of groups woman is an active member of	Endogenous variable: number of food crops produced by household	Endogenous variable: average number of decisions over credit	Endogenous variable: number of food crops produced by household
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Age (in years) of member	0.008***	0.024**	0.014***	0.023**	0.045***	0.023**
	(0.002)	(0.011)	(0.004)	(0.011)	(0.010)	(0.011)
Age-squared of member	−0.000***	−0.000**	−0.000***	−0.000**	−0.000***	−0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of education of member	0.000	0.010	−0.003	0.010	−0.010**	0.010
	(0.001)	(0.008)	(0.003)	(0.008)	(0.005)	(0.008)
Household head is farmer (= 1, 0 otherwise)	−0.023**	0.495***	−0.155***	0.502***	−0.262***	0.502***
	(0.010)	(0.065)	(0.021)	(0.065)	(0.042)	(0.065)
Household head is trader (= 1, 0 otherwise)	0.028*	−0.192***	0.031	−0.196***	0.003	−0.193***
	(0.015)	(0.068)	(0.038)	(0.066)	(0.070)	(0.066)
Household size	−0.009***	0.068***	0.003	0.067***	−0.027*	0.066***
	(0.003)	(0.022)	(0.007)	(0.022)	(0.014)	(0.022)
Proportion of males 0–4 years old	0.111	−0.835*	0.233	−0.812*	0.674**	−0.819*
	(0.073)	(0.434)	(0.154)	(0.426)	(0.330)	(0.425)
Proportion of males 5–10 years old	0.122*	−0.631	0.199	−0.617	0.435	−0.617
	(0.065)	(0.401)	(0.138)	(0.396)	(0.299)	(0.395)
Proportion of males 11–18 years old	0.104*	−0.348	0.285**	−0.336	0.656**	−0.334
	(0.062)	(0.388)	(0.131)	(0.381)	(0.285)	(0.381)
Proportion of males 19–59 years old	0.018	−0.163	0.050	−0.144	0.051	−0.152
	(0.049)	(0.287)	(0.100)	(0.281)	(0.221)	(0.280)
Proportion of females 0–4 years old	0.036	−1.005**	0.018	−0.981**	0.354	−0.990**
	(0.071)	(0.411)	(0.150)	(0.403)	(0.320)	(0.402)
Proportion of females 5–10 years old	0.165**	−0.451	0.215	−0.434	0.425	−0.440
	(0.066)	(0.401)	(0.140)	(0.394)	(0.302)	(0.393)
Proportion of females 11–18 years old	0.195***	−0.143	0.421***	−0.124	0.517*	−0.116
	(0.067)	(0.412)	(0.139)	(0.405)	(0.300)	(0.405)
Proportion of females 19–59 years old	0.092	−0.245	0.120	−0.235	0.192	−0.238
	(0.077)	(0.470)	(0.161)	(0.464)	(0.343)	(0.463)
Proportion of females 60 years and older	0.081	−0.397	0.169	−0.387	0.414	−0.393
	(0.082)	(0.493)	(0.177)	(0.485)	(0.366)	(0.485)
Ln (owned cultivable land + 1)	−0.002	0.017	−0.019***	0.014	0.015	0.016
	(0.003)	(0.019)	(0.006)	(0.019)	(0.012)	(0.019)
Access to electricity (= 1, 0 otherwise)	0.025***	−0.050	0.019	−0.048	0.080**	−0.045
	(0.008)	(0.051)	(0.019)	(0.051)	(0.038)	(0.050)
Price of rice (in taka)	−0.003**	0.004	−0.007**	0.004	−0.012**	0.004
	(0.001)	(0.007)	(0.003)	(0.007)	(0.006)	(0.007)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of dairy cows owned	0.012***	0.139***	−0.019**	0.139***	−0.039**	0.140***
	(0.003)	(0.029)	(0.008)	(0.029)	(0.016)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.062***	0.195***	0.075***	0.187***	0.147***	0.204***
	(0.010)	(0.056)	(0.023)	(0.055)	(0.044)	(0.055)
Age difference (male–female)	−0.002*	0.003	−0.006**	0.003	−0.007	0.003
	(0.001)	(0.006)	(0.002)	(0.006)	(0.005)	(0.006)
Types of informal credit sources in village	0.025***	0.039***	0.020***	0.036**	0.047***	0.040***
	(0.003)	(0.015)	(0.007)	(0.015)	(0.013)	(0.015)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)	0.103***	0.035				
	(0.008)	(0.047)				
Clay-loam soil (= 1, 0 if otherwise)	−0.005	0.388***	−0.015	0.399***	0.078*	0.395***
	(0.010)	(0.062)	(0.024)	(0.061)	(0.046)	(0.062)
Sandy-loam soil (= 1, 0 if otherwise)	−0.030***	0.530***	−0.024	0.541***	0.041	0.538***
	(0.012)	(0.072)	(0.026)	(0.072)	(0.052)	(0.072)

(*continued on next page*)

Table 17g—*continued*

	Table 3: Male BMI		Table 4: Male BMI First stage regression results		Table 5: Male BMI	
	Endogenous variable: empowerment score of woman coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: number of groups woman is an active member of coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: average number of decisions over credit coef/se	Endogenous variable: number of food crops produced by household coef/se
% of land irrigated by household	0.001***	0.010***	0.001***	0.010***	0.001*	0.010***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Number of community activities woman has participated in during the previous year			0.055***	0.030		
			(0.009)	(0.022)		
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)						
Constant	0.365***	−0.569	−0.184	−0.540	−0.048	−0.538
	(0.084)	(0.465)	(0.180)	(0.456)	(0.356)	(0.456)
Observations	3,150	3,094	3,150	3,150	3,150	3,150
F	22.910	49.278	13.134	50.233	8.539	50.666
Adjusted R^2	0.181	0.310	0.108	0.317	0.063	0.317

Table 17h. *First stage regressions*

	Table 6: Male BMI		Table 7: Male BMI First-stage regression results		Table 8: Male BMI	
	Endogenous variable: number of assets woman has self/joint ownership of coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: number of self/joint decisions over purchase, sale, or transfer of assets made by woman coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: gender parity gap (= 0 if woman enjoys gender parity, "gap" if not) coef/se	Endogenous variable: number of food crops produced by household coef/se
Age (in years) of member	0.041***	0.023**	0.440***	0.023**	−0.006***	0.024**
	(0.014)	(0.011)	(0.089)	(0.011)	(0.002)	(0.011)
Age-squared of member	−0.000***	−0.000**	−0.004***	−0.000**	0.000**	−0.000**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Years of education of member	0.032***	0.010	0.166***	0.010	0.001	0.010
	(0.008)	(0.008)	(0.051)	(0.008)	(0.001)	(0.008)
Household head is farmer (= 1, 0 otherwise)	−0.003	0.502***	0.512	0.502***	0.016*	0.495***
	(0.066)	(0.065)	(0.437)	(0.065)	(0.009)	(0.065)
Household head is trader (= 1, 0 otherwise)	0.212**	−0.193***	1.755***	−0.193***	−0.031***	−0.192***
	(0.106)	(0.066)	(0.665)	(0.066)	(0.012)	(0.068)
Household size	−0.065**	0.066***	−0.624***	0.066***	0.009***	0.068***
	(0.028)	(0.022)	(0.149)	(0.022)	(0.003)	(0.022)
Proportion of males 0–4 years old	−0.315	−0.819*	3.089	−0.819*	−0.099	−0.835*
	(0.483)	(0.425)	(2.986)	(0.425)	(0.069)	(0.434)
Proportion of males 5–10 years old	0.129	−0.617	4.592*	−0.617	−0.095	−0.631
	(0.443)	(0.395)	(2.789)	(0.395)	(0.061)	(0.401)
Proportion of males 11–18 years old	0.478	−0.334	5.937**	−0.334	−0.098*	−0.348
	(0.425)	(0.381)	(2.753)	(0.381)	(0.058)	(0.388)
Proportion of males 19–59 years old	−0.138	−0.151	−1.493	−0.151	−0.013	−0.163
	(0.324)	(0.280)	(2.037)	(0.280)	(0.045)	(0.287)
Proportion of females 0–4 years old	0.125	−0.990**	2.746	−0.990**	−0.031	−1.005**
	(0.490)	(0.402)	(2.921)	(0.402)	(0.066)	(0.411)

(*continued on next page*)

Table 17h—*continued*

	Table 6: Male BMI		Table 7: Male BMI First-stage regression results		Table 8: Male BMI	
	Endogenous variable: number of assets woman has self/joint ownership of	Endogenous variable: number of food crops produced by household	Endogenous variable: number of self/joint decisions over purchase, sale, or transfer of assets made by woman	Endogenous variable: number of food crops produced by household	Endogenous variable: gender parity gap (= 0 if woman enjoys gender parity, "gap" if not)	Endogenous variable: number of food crops produced by household
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Proportion of females 5–10 years old	0.236	−0.440	4.997*	−0.440	−0.145**	−0.451
	(0.444)	(0.393)	(2.740)	(0.393)	(0.061)	(0.401)
Proportion of females 11–18 years old	0.949**	−0.116	5.302*	−0.116	−0.138**	−0.143
	(0.450)	(0.405)	(2.800)	(0.405)	(0.061)	(0.412)
Proportion of females 19–59 years old	0.320	−0.238	2.930	−0.238	−0.086	−0.245
	(0.540)	(0.463)	(3.331)	(0.463)	(0.071)	(0.470)
Proportion of females 60 years and older	0.521	−0.393	4.186	−0.393	−0.078	−0.397
	(0.573)	(0.485)	(3.593)	(0.485)	(0.075)	(0.493)
Ln (owned cultivable land + 1)	0.003	0.016	0.374***	0.016	0.005**	0.017
	(0.019)	(0.019)	(0.130)	(0.019)	(0.002)	(0.019)
Access to electricity (= 1, 0 otherwise)	0.163***	−0.045	1.206***	−0.045	−0.013*	−0.050
	(0.056)	(0.050)	(0.357)	(0.050)	(0.008)	(0.051)
Price of rice (in taka)	−0.003	0.004	−0.028	0.004	0.002	0.004
	(0.009)	(0.007)	(0.057)	(0.007)	(0.001)	(0.007)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of dairy cows owned	0.125***	0.140***	0.825***	0.140***	−0.006**	0.139***
	(0.026)	(0.029)	(0.171)	(0.029)	(0.003)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.303***	0.204***	0.781*	0.204***	−0.041***	0.195***
	(0.068)	(0.055)	(0.402)	(0.055)	(0.008)	(0.056)
Age difference (male–female)	0.005	0.003	0.026	0.003	0.001	0.003
	(0.007)	(0.006)	(0.045)	(0.006)	(0.001)	(0.006)
Types of informal credit sources in village	0.251***	0.040***	1.615***	0.040***	−0.021***	0.039***
	(0.017)	(0.015)	(0.124)	(0.015)	(0.003)	(0.015)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)					−0.060***	0.035
					(0.007)	(0.047)
Clay-loam soil (= 1, 0 if otherwise)	0.106	0.395***	1.830***	0.395***	0.008	0.388***
	(0.068)	(0.062)	(0.438)	(0.062)	(0.009)	(0.062)
Sandy-loam soil (= 1, 0 if otherwise)	−0.028	0.538***	3.035***	0.538***	0.038***	0.530***
	(0.075)	(0.072)	(0.523)	(0.072)	(0.011)	(0.072)
% of land irrigated by household	0.002**	0.010***	0.009**	0.010***	−0.000***	0.010***
	(0.001)	(0.001)	(0.004)	(0.001)	(0.000)	(0.001)
Number of community activities woman has participated in during the previous year						
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)	0.348**	0.000	2.652***	0.000		
	(0.161)	(0.096)	(1.028)	(0.096)		
Constant	−0.151	−0.538	−6.428*	−0.538	0.355***	−0.569
	(0.541)	(0.457)	(3.289)	(0.457)	(0.079)	(0.465)
Observations	3,150	3,150	3,150	3,150	3,094	3,094
F	16.150	49.106	19.040	49.106	11.649	49.278
Adjusted R^2	0.132	0.316	0.190	0.316	0.118	0.310

Table 17i. *First stage regressions*

	Table 3: Female BMI		Table 4: Female BMI First stage regression results		Table 5: Female BMI	
	Endogenous variable: empowerment score of woman coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: number of groups woman is an active member of coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: average number of decisions over credit coef/se	Endogenous variable: number of food crops produced by household coef/se
Pregnant (= 1, 0 otherwise)	−0.004	0.131	0.001	0.111	−0.113	0.109
	(0.021)	(0.116)	(0.045)	(0.112)	(0.099)	(0.112)
Lactating (= 1, 0 otherwise)	−0.022*	0.086	0.004	0.087	0.039	0.085
	(0.013)	(0.074)	(0.030)	(0.073)	(0.061)	(0.073)
Age (in years) of member	0.012***	0.017	0.019***	0.016	0.050***	0.016
	(0.003)	(0.014)	(0.005)	(0.014)	(0.012)	(0.014)
Age-squared of member	−0.000***	−0.000	−0.000***	−0.000	−0.001***	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of education of member	0.004***	0.002	−0.002	0.002	−0.006	0.002
	(0.001)	(0.009)	(0.003)	(0.009)	(0.006)	(0.009)
Household head is farmer (= 1, 0 otherwise)	−0.027***	0.522***	−0.154***	0.528***	−0.257***	0.528***
	(0.009)	(0.063)	(0.021)	(0.063)	(0.042)	(0.063)
Household head is trader (= 1, 0 otherwise)	0.022	−0.167**	0.032	−0.172***	0.009	−0.169***
	(0.015)	(0.066)	(0.038)	(0.065)	(0.069)	(0.065)
Household size	−0.009***	0.062***	0.004	0.062***	−0.022	0.061***
	(0.003)	(0.021)	(0.007)	(0.021)	(0.014)	(0.021)
Proportion of males 0–4 years old	0.142*	−0.729*	0.215	−0.719*	0.617*	−0.725*
	(0.074)	(0.426)	(0.155)	(0.416)	(0.331)	(0.415)
Proportion of males 5–10 years old	0.125*	−0.462	0.166	−0.455	0.480*	−0.457
	(0.064)	(0.376)	(0.134)	(0.367)	(0.288)	(0.366)
Proportion of males 11–18 years old	0.098	−0.171	0.225*	−0.163	0.580**	−0.166
	(0.061)	(0.359)	(0.126)	(0.349)	(0.274)	(0.349)
Proportion of males 19–59 years old	0.029	0.016	0.061	0.033	0.177	0.022
	(0.047)	(0.269)	(0.096)	(0.260)	(0.208)	(0.259)
Proportion of females 0–4 years old	0.069	−0.927**	0.009	−0.913**	0.340	−0.922**
	(0.071)	(0.399)	(0.149)	(0.391)	(0.320)	(0.390)
Proportion of females 5–10 years old	0.154**	−0.249	0.180	−0.239	0.405	−0.250
	(0.064)	(0.378)	(0.136)	(0.368)	(0.292)	(0.366)
Proportion of females 11–18 years old	0.185***	0.043	0.374***	0.054	0.507*	0.059
	(0.065)	(0.383)	(0.136)	(0.374)	(0.290)	(0.373)
Proportion of females 19–59 years old	0.088	−0.046	0.080	−0.038	0.204	−0.046
	(0.073)	(0.437)	(0.153)	(0.428)	(0.328)	(0.427)
Proportion of females 60 years and older	0.100	−0.166	0.146	−0.161	0.466	−0.169
	(0.080)	(0.475)	(0.170)	(0.464)	(0.354)	(0.464)
Ln (owned cultivable land + 1)	−0.002	0.018	−0.021***	0.015	0.010	0.017
	(0.003)	(0.019)	(0.006)	(0.018)	(0.012)	(0.018)
Access to electricity (= 1, 0 otherwise)	0.018**	−0.024	0.012	−0.023	0.060	−0.020
	(0.008)	(0.049)	(0.019)	(0.049)	(0.038)	(0.048)
Price of rice (in taka)	−0.003*	0.004	−0.006**	0.004	−0.012**	0.003
	(0.001)	(0.007)	(0.003)	(0.007)	(0.006)	(0.007)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of dairy cows owned	0.011***	0.142***	−0.017**	0.141***	−0.036**	0.142***
	(0.003)	(0.029)	(0.008)	(0.029)	(0.016)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.064***	0.197***	0.071***	0.188***	0.127***	0.206***
	(0.010)	(0.055)	(0.022)	(0.054)	(0.043)	(0.054)
Age difference (male–female)	−0.002**	0.001	−0.005***	0.001	−0.005	0.000
	(0.001)	(0.005)	(0.002)	(0.005)	(0.004)	(0.005)
Types of informal credit sources in village	0.024***	0.035**	0.017**	0.032**	0.044***	0.037**
	(0.003)	(0.015)	(0.007)	(0.014)	(0.013)	(0.014)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)	0.099***	0.034				
	(0.008)	(0.046)				

(*continued on next page*)

Table 17i—*continued*

	Table 3: Female BMI		Table 4: Female BMI First stage regression results		Table 5: Female BMI	
	Endogenous variable: empowerment score of woman coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: number of groups woman is an active member of coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: average number of decisions over credit coef/se	Endogenous variable: number of food crops produced by household coef/se
Clay-loam soil (= 1, 0 if otherwise)	−0.010	0.396***	−0.023	0.407***	0.057	0.403***
	(0.010)	(0.062)	(0.023)	(0.061)	(0.045)	(0.061)
Sandy-loam soil (= 1, 0 if otherwise)	−0.034***	0.554***	−0.025	0.566***	0.040	0.562***
	(0.012)	(0.071)	(0.026)	(0.071)	(0.051)	(0.071)
% of land irrigated by household	0.001***	0.010***	0.001***	0.010***	0.001**	0.010***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Number of community activities woman has participated in during the previous year			0.058***	0.032		
			(0.009)	(0.022)		
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)						
Constant	0.321***	−0.542	−0.212	−0.506	−0.068	−0.509
	(0.083)	(0.460)	(0.178)	(0.448)	(0.359)	(0.448)
Observations	3,263	3,203	3,263	3,263	3,263	3,263
F	22.916	47.399	12.953	48.535	7.504	49.047
Adjusted R^2	0.183	0.313	0.106	0.320	0.057	0.319

Table 17j. *First stage regressions*

	Table 6: Female BMI		Table 7: Female BMI First stage regression results		Table 8: Female BMI	
	Endogenous variable: number of assets woman has self/joint ownership of coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: number of self/joint decisions over purchase, sale, or transfer of assets made by woman coef/se	Endogenous variable: number of food crops produced by household coef/se	Endogenous variable: gender parity gap (= 0 if woman enjoys gender parity, "gap" if not) coef/se	Endogenous variable: number of food crops produced by household coef/se
Pregnant (= 1, 0 otherwise)	0.011	0.109	−0.567	0.109	0.004	0.131
	(0.132)	(0.112)	(0.876)	(0.112)	(0.020)	(0.116)
Lactating (= 1, 0 otherwise)	−0.193**	0.085	−1.022*	0.085	0.011	0.086
	(0.085)	(0.073)	(0.539)	(0.073)	(0.013)	(0.074)
Age (in years) of member	0.069***	0.016	0.578***	0.016	−0.009***	0.017
	(0.018)	(0.014)	(0.104)	(0.014)	(0.002)	(0.014)
Age-squared of member	−0.001***	−0.000	−0.006***	−0.000	0.000***	−0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Years of education of member	0.063***	0.002	0.342***	0.002	−0.001	0.002
	(0.009)	(0.009)	(0.059)	(0.009)	(0.001)	(0.009)
Household head is farmer (= 1, 0 otherwise)	−0.058	0.527***	0.313	0.527***	0.020**	0.522***
	(0.065)	(0.063)	(0.434)	(0.063)	(0.008)	(0.063)
Household head is trader (= 1, 0 otherwise)	0.127	−0.169***	1.398**	−0.169***	−0.027**	−0.167**
	(0.106)	(0.065)	(0.658)	(0.065)	(0.012)	(0.066)
Household size	−0.069**	0.061***	−0.585***	0.061***	0.010***	0.062***
	(0.027)	(0.021)	(0.144)	(0.021)	(0.003)	(0.021)
Proportion of males 0–4 years old	0.407	−0.726*	6.578**	−0.726*	−0.115*	−0.729*
	(0.495)	(0.416)	(2.992)	(0.416)	(0.069)	(0.426)
Proportion of males 5–10 years old	0.572	−0.458	6.479**	−0.458	−0.100*	−0.462
	(0.457)	(0.367)	(2.733)	(0.367)	(0.057)	(0.376)
Proportion of males 11–18 years old	0.808*	−0.166	7.532***	−0.166	−0.094*	−0.171
	(0.440)	(0.349)	(2.696)	(0.349)	(0.055)	(0.359)
Proportion of males 19–59 years old	0.169	0.022	0.141	0.022	−0.024	0.016
	(0.335)	(0.259)	(1.982)	(0.259)	(0.042)	(0.269)

(*continued on next page*)

Table 17j—*continued*

	Table 6: Female BMI		Table 7: Female BMI First stage regression results		Table 8: Female BMI	
	Endogenous variable: number of assets woman has self/joint ownership of	Endogenous variable: number of food crops produced by household	Endogenous variable: number of self/joint decisions over purchase, sale, or transfer of assets made by woman	Endogenous variable: number of food crops produced by household	Endogenous variable: gender parity gap (= 0 if woman enjoys gender parity, "gap" if not)	Endogenous variable: number of food crops produced by household
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Proportion of females 0–4 years old	0.802	−0.923**	5.817**	−0.923**	−0.047	−0.927**
	(0.496)	(0.391)	(2.949)	(0.391)	(0.066)	(0.399)
Proportion of females 5–10 years old	0.571	−0.251	6.339**	−0.251	−0.144**	−0.249
	(0.457)	(0.367)	(2.686)	(0.367)	(0.057)	(0.378)
Proportion of females 11–18 years old	1.367***	0.059	6.980**	0.059	−0.143**	0.043
	(0.465)	(0.373)	(2.768)	(0.373)	(0.058)	(0.383)
Proportion of females 19–59 years old	0.909	−0.046	5.713*	−0.046	−0.085	−0.046
	(0.563)	(0.427)	(3.267)	(0.427)	(0.065)	(0.437)
Proportion of females 60 years and older	1.197**	−0.170	7.650**	−0.170	−0.101	−0.166
	(0.593)	(0.464)	(3.546)	(0.464)	(0.070)	(0.475)
Ln (owned cultivable land + 1)	0.012	0.017	0.387***	0.017	0.006**	0.018
	(0.019)	(0.018)	(0.126)	(0.018)	(0.002)	(0.019)
Access to electricity (= 1, 0 otherwise)	0.150***	−0.020	1.064***	−0.020	−0.010	−0.024
	(0.056)	(0.048)	(0.352)	(0.048)	(0.007)	(0.049)
Price of rice (in taka)	−0.001	0.003	−0.009	0.003	0.002	0.004
	(0.009)	(0.007)	(0.056)	(0.007)	(0.001)	(0.007)
Division level fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of dairy cows owned	0.111***	0.142***	0.749***	0.142***	−0.005*	0.142***
	(0.026)	(0.029)	(0.169)	(0.029)	(0.003)	(0.029)
Owns hand tube well (= 1, 0 otherwise)	0.305***	0.205***	0.889**	0.205***	−0.041***	0.197***
	(0.068)	(0.054)	(0.397)	(0.054)	(0.008)	(0.055)
Age difference (male–female)	−0.012*	0.000	−0.032	0.000	0.001*	0.001
	(0.006)	(0.005)	(0.040)	(0.005)	(0.001)	(0.005)
Types of informal credit sources in village	0.237***	0.037**	1.524***	0.037**	−0.020***	0.035**
	(0.018)	(0.014)	(0.122)	(0.014)	(0.003)	(0.015)
Whether female has participated in any community activity during the previous year (= 1, 0 if otherwise)					−0.058***	0.034
					(0.007)	(0.046)
Clay-loam soil (= 1, 0 if otherwise)	0.062	0.403***	1.519***	0.403***	0.012	0.396***
	(0.068)	(0.061)	(0.431)	(0.061)	(0.009)	(0.062)
Sandy-loam soil (= 1, 0 if otherwise)	−0.066	0.562***	2.909***	0.562***	0.041***	0.554***
	(0.075)	(0.071)	(0.517)	(0.071)	(0.011)	(0.071)
% of land irrigated by household	0.002**	0.010***	0.011**	0.010***	−0.000***	0.010***
	(0.001)	(0.001)	(0.004)	(0.001)	(0.000)	(0.001)
Number of community activities woman has participated in last year						
Whether homestead land has been inherited by woman (= 1, 0 if otherwise)	0.373**	−0.017	2.691***	−0.017		
	(0.156)	(0.093)	(0.974)	(0.093)		
Constant	−0.965*	−0.508	−10.147***	−0.508	0.389***	−0.542
	(0.552)	(0.449)	(3.252)	(0.449)	(0.077)	(0.460)
Observations	3,263	3,263	3,263	3,263	3,203	3,203
F	15.813	47.597	18.908	47.597	11.771	47.399
Adjusted R^2	0.135	0.319	0.188	0.319	0.121	0.313

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.