A new index for gendered decision-making, considering all family members, its determinants, and effects on food security.

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Despite the broad range of studies measuring women's intra-household decision-making power, the possibility of all family members actively participating in family decisions is widely ignored or undervalued. Therefore, this article first develops a decision-making index that accounts for different decisions potentially being made solitarily or jointly by any number of individuals reported to participate in decision-making. Second, determinants of decision-making power are identified. Finally, the effect of higher women participation in decision-making on food security is assessed. Based on a random sample of 378 households living in a 200 km radius around the city of Hawassa in Southwestern Ethiopia, principal component analysis is applied to generate an index of empowerment proxy, i.e. participation in decision-making. Linear regression models revealed that livestock income, asset ownership, land endowment, and adultness of sons are significant determinants of women's participation in decision-making. In addition, women's bargaining power, education, access to credit and extension, and off-farm income significantly increased the food variety score as an indicator of food and nutrition security.

Acknowledegment: Acknowledgment: The financial support of the Deutsche Forschungsgemeinschaft (DFG) is kindly acknowledged.

JEL Codes: D13, C38

#932

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Therefore, this article first develops a decision-making index that accounts for different decisions potentially being made solitarily or jointly by any number of individuals reported to participate in decision-making. Second, determinants of decision-making power are identified. Finally, the effect of higher women participation in decision-making on food security is assessed.

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Keywords: gender, decision-making, bargaining, food variety score, Ethiopia

Acknowledgments: The financial support of the Deutsche Forschungsgemeinschaft (DFG) is kindly acknowledged.

Introduction

There is a consistently growing interest in female empowerment as it was one of the Millennium Development Goals (MDGs) and still is one of the goals mentioned in the new

sustainable development agenda of the United Nations (2017) where it states that women empowerment supports societies and their economies as a whole. Additionally, OECD (2012) refers to women empowerment as an important tool for sustainable economic growth and poverty reduction. Following Kabeer (2001), this article defines empowerment as the expansion of abilities which enable people to make crucial choices that affect their life.

Decision-making power is a commonly used proxy for measuring household level bargaining power of women. The decisions are affected by some particular factors within the household. Those factors determine the household level decision-making processes where decisions are either made by the household head alone or made jointly by involving other household members in the processes. Several researchers put clear emphasis on the decision-making participation as a suitable proxy approach to measure bargaining power (see Malhotra & Mather 1997; Sen 1999; Becker, Fonseca-Becker & Schenck-Yglesias 2006).

Researchers have used different methods and/or indicators for estimating empowerment. Malhotra, Schuler & Boender (2002) conclude that access to household resources and their control, household levels decision-making, and freedom of movement are the most common proxy measures of empowerment. Women's asset ownership has also been used as a measure of her bargaining power (see Doss 1996a). Acharya & Bennett (1983) and Schuler et al. (1996) see women's participation in the decision-making processes as a valid dimension of empowerment. This was also relevant for the analysis of Allendorf (2007) who used decision-making power to analyze the effect of land rights on women empowerment. Decision-making was used as women empowerment indicator also by Bhagowalia et al. (2012) where they studied empowerment dimensions that are important for child nutrition. The latest method of assessing women empowerment was developed by Alkire et al. (2013a), called Women's Empowerment in Agriculture Index (WEAI). This index assesses empowerment in domains

which are resource, leadership, income, production and time allocation. Production and resource domains include decisions made within household for these particular domains.

Clearly, decision-making has been widely used as a measure of empowerment of women within households. All above cited studies have in common that they exclusively focus on the decision-making power of wives (or one adult female member) in comparison with the adult male household head- who actually is only one of many household members (e.g. Hashemi, Schuler & Riley 1996; Allendorf 2007; Bhagowalia et al. 2012; Mishra & Sam 2016). This approach ignores the fact that other female and male members may also be present and eligible for contributing to decision-making processes that effect the household or individual members. This critique also applies for the WEAI, where respondents are usually either jointly wife and husband or separately one male and one female adult over 18 years of age. Moreover, as noted by Ragasa (2012), most studies concentrate on households headed by a single male or female person, ignoring other males or females in these households. If joint decision-making is considered, then only the case of household head and spouse, i.e. if two persons, are analyzed. This approach under-evaluates the participation of other household members, e.g. adolescent children and elderly members, in household decision-making. There is no study known to the authors that offer a solution for cases where decisions are reached through bargaining between all eligible household members, whether female or male. Household decision-making processes are very complex and most of the time they presumably involve more than just two household members especially if areas such as time allocation, school education, sanitation and nutrition are concerned. We argue that the measurement of decision-making power of women versus men can benefit from a wider context than just a process of husband and wife's bargaining over decisions is much more appropriate and yet, insufficiently analyzed.

Considering this conceptual gap in the analyses of women's participation in household decision-making, the objectives of this article are: (i) to create an index for women's

participation in household decision-making, (ii) to identify determinants of women's part in intra-household decision-making, and (iii) to analyze the effects of women's decision-making power within the family on households' food security.

Based on a short literature review and theoretical reflection on different models in household decision-making as an indicator for women empowerment and bargaining, the article develops the decision-making index. After describing the database and the methods, the determinants of women's participation in decision-making are assessed. This is followed by an estimation of the effect of higher women empowerment on household food security (food variety score). To conclude, further implications and critical remarks on the index are discussed.

Empowerment and intra-household bargaining

This section reflects on theoretical considerations to be taken regarding empowerment and intra-household bargaining. First, it discusses why empowerment is often measured by the power in decision-making, reflecting bargaining within the household. Second, different models of intra-household decision-making are presented. In general, researchers distinguish between unitary and non-unitary models. In the first case, the household is seen as a single production and consumption unit, i.e. the household acts like a unit and bargaining power does not change the outcome. Bringing in intra-household aspects, the non-unitary models assume that there is bargaining carried out between several adults with influence on decisions. The latter can be divided into cooperative models, non-cooperative models, or collective models.

Decision-making power as a measure of empowerment

Empowerment is a difficult process to measure. To capture the real change in this process, use of direct measures can be much more suitable than using proxy indicators (Malhotra & Schuler 2005). Different dimensions of empowerment have been analyzed in the literature. Malhotra & Schuler (2005) identify six basic dimensions of empowerment, i.e. political, socio-cultural,

economic, legal, psychological, and familiar. Moreover, they have different operationalization at the household and community level. This article is specifically interested in the household level operationalization of the familiar dimension which is a household level decision-making processes.

Decision-making is used as a measure of empowerment in many cases. Bhagowalia et al. (2012) analysis of dimensions of women empowerment that matters for child nutrition, identified decision-making as one of three most important dimensions. The other two were identified as mobility and attitudes towards violence. Garikipati (2008) also uses decision-making as well as asset ownership and time allocation as measures of empowerment in the analysis of effects of lending to women on their empowerment. Hashemi, Schuler & Riley (1996) used six indicators for measuring empowerment including the participation in decision-making (others were mobility, off farm employment, political awareness, possibility of making small and large purchases). Another example is from the analysis of effects of land rights on female empowerment by Allendorf (2007). He concentrates on the female participation in household decision-making as a measure of their empowerment. Similar work was done by Mishra & Sam (2016) where they concentrated on decisions about healthcare, purchases and family visits as measure of women empowerment. Consideration of decision-making as a measure of empowerment is present in many other literatures as well (Malhotra & Mather 1997; Sen 1999; Kishor 2000; Becker, Fonseca-Becker & Schenck-Yglesias 2006).

The most recent tool for measuring women empowerment in agriculture, referred to as WEAI, was developed within the *Feed the Future* project (IFPRI, 2012). The index defines five major dimensions (5DE) of women empowerment in the agricultural sector. These are production, productive resources, income, time allocation and leadership. In total, these dimensions consist of 10 indicators that have different weights. Decision-making is present in the indicators of three out of the five dimensions. One of the indicators of production dimension weighs person's

input to production related decisions. Two of the indicators of resources dimension are about person's participation in decision-making processes related to productive resources (purchase, sale, transfer and etc.), and decisions about credit (obtain and use). Income dimension's only indicator is about the decisions on the use of income (Alkire et al. 2013a). Thus, WEAI considers decision-making as a key dimension of empowerment. Like many other earlier approaches of capturing empowerment, WEAI only considers the main decision makers. The respondents are asked to report whether the decision maker is male, female, or husband and wife jointly, ignoring the potential participation of other household members in decision-making processes. Therefore, the index does not sufficiently allow the analysis of decision-making in rural settings where household size may range between 2-13 members, like in the survey data for Ethiopia. Moreover, including a WEAI-module in the survey instrument will increase the survey costs and enumeration time substantially (see Alkire et al. 2013b). In this regard, the approach we are exploring in this article is less costly and more time efficient, and can be easily adapted into any kind of agricultural survey (e.g. technology adoption studies).

Unitary model

A unitary model assumes that the whole household decides as a sole production or consumption unit. It is not relevant who earns the income or owns the assets. The model ignores potentially unequal bargaining power distribution between household members and concludes that a single household utility is maximized (Doss, 2013; Scheebaum & Mader, 2013; Becker, 1981; Samuelson, 1956). Beninger & Laisney (2002) present this utility function as a function of wife's and husband's consumption and leisure demand together which is constrained by time and budget. This reflects how a unitary model assumes no income distribution within the household. It rather assumes a united family income which matters for consumption and leisure (Tiefenthaler, 1999). This assumption of the unitary model has generated a pathway for scholars to test its appropriateness (see Doss, 2013; Doss, 1996b; Chiappori, 1988).

Non-unitary model

Non-unitary models consider household utility not as a single utility strived for by a household, but rather assumes that household members have different preferences and work towards their individual utility by bargaining between the members. One generally distinguishes between non-cooperative and cooperative models, including the collective model as a subset of the latter model (Rode, 2011).

Non-cooperative model

The non-cooperative model does not make the assumption of income pooling. It rather suggests that depending on the level of income and access to production resources, household members will have different preferences of decisions within the household. These differences may or may not result in Pareto efficient results. The model assumes the presence of bargaining processes within the household that is a direct determinant of who spends how much and on what. Here, "who" are the members of household whom the model expects to have different preferences and access to resources; "how much" is determined by the income of particular member and finally, on what they make their consumption choices is independent and interrelated among members (Doss, 1996b).

Woolley (1993) (cited in Doss, 1996b, p.1600) mentions that each family member is a utility maximizer who has his/her own consumption preferences. Each member is maximizing his/her utility given the other member's utility level. Household members have a common consumption which is the household goods. Each member has his/her own contribution to the household expenditures which is constrained by his/her income. An increase in one member's income disturbs the equality within the households. Hence, the household moves to the corner solution where that particular household member finances most of the household expenditures. This affects the family commodity choice. This is also emphasized by Ulph (1988) (as cited

in Doss, 1996b, p.1601) where he mentions that household members share some consumption units. For example, if a man provides the housing while his wife takes care of food, an increase in income of one of the spouses would result in the increase of particular household consumption unit.

Income pooling and possibility of non-Pareto efficient outcomes are the mean distinguishing features of non-cooperative models. In a case where household members share public goods there is a high possibility of non-Pareto efficient outcome (Rode, 2011). Obviously, these types of household models are less restrictive than the previously mentioned household models. Nevertheless, in non-cooperative models, researchers need very detailed data that includes income, expenditure and access to the resources of spouses (Doss, 1996a)

Cooperative model

The cooperative model presents intra-household decision-making as a Nash bargaining situation. Households consist of two members who have their own maximum utility obtained out of wedlock. The Nash bargaining problem is solved considering these individuals' utilities as threat points (McElroy & Horney, 1981; Doss, 1996b). McElroy (1990) mentions that threat points might also be affected by some environmental factors which are called "Extra-household Environmental Parameters" (EEPs). These parameters include factors that shift members' utilities. As an example, McElroy (1990) mentions welfare payments that unmarried women may receive. This would shift their threat points, because they would gain this benefit in case of divorce.

According to the model, wife and husband stay in marriage only in the case where their utilities from being married outweigh their utilities in case of divorce. In contrast to the unitary model, here each household member is trying to cooperatively increase their individual utilities using his/her out of the household as a threat in bargaining process. Finally, gained benefits of

belonging to the household is divided based on Nash bargaining (Tiefenthaler, 1999). These threats are called external threats, while there are also internal threats as mentioned by Lunderg & Pollak (1993). Their model is called "separate spheres" bargaining model which differs from McElroy & Horney (1981)'s model of divorce threat bargaining model with its internal threat approach within the marriage. It is assumed that policies directed to the mothers or fathers enable unequal distributions within the marriage. In this model, if the agreement is not reached it results in the non-cooperative equilibrium. In this case, public goods are willingly provided by members that maximize the utility considering the action of the other member. This approach is better at explaining daily marital bargaining compared to the external threats model, as it is obvious that divorce is a terminal threat (Lunderg & Pollak, 1993; Lundberg & Pollak, 2007).

Plainly, cooperative models assume that policies favoring women may increase their power by the help of increased utility from divorce. The model predicts the outcome of bargaining to be Pareto efficient and additionally, it defines the point of efficiency (Doss, 1996b).

Collective model

Cooperative models are seen to be a subset of collective model where the household is assumed to be Pareto efficient, meaning for one member to be better off, other member has to become worse off (Doss, 2013).

The collective model was first proposed by Chiappori (1988) where the approach of unitary model is seen to be lacking. The study mentioned a household to be consisting of two members who take Pareto efficient decision. He suggested that a household consists of members who have their own utility functions, and that is why final decisions of households result from an interaction between members. Here, Pareto efficiency refers to the existence of "sharing rule" which implies that total income of the household is divided based on sharing rule and flowingly

every member has their own utility function to be maximized which is constrained by the assigned share of household income (Chiappori, 1988; Bourguignon & Chiappori, 1992). Apps & Rees (1996) mention the deficiency that household production is not considered in the collective model. They improve the model considering that time spent at home is not totally used for leisure, but there is household production going on. This results in a noteworthy modification to the model that members of the household are able to exchange household production for market goods inside the family.

The collective model assumes that collectively made decisions will result in Pareto efficient decision. It presents the existence of sharing rules. It is noteworthy to mention that cooperative models identify the Pareto efficient point that is likely to be selected, while the collective model only assumes the final result to be Pareto efficient (Doss, 1996b)

Key hypothesis

Based on these theoretical considerations, we state the hypothesis that: Both unitary and non-unitary processes of intra-household decision-making exist. In fact, we suppose that the different processes may even occur within the same household, i.e. depending on the decision domain or specific decision to be taken.

Therefore, an indicator or index considering the occurrence of different decision cases will allow a more accurate results and consequently conclusions. Therefore, the index must allow cases with one sole decision maker, two (male and female) decision makers, as well as joint (all eligible) decision makers.

Methodology and Data

This section first shortly describes the database of the research. Then it explicitly describes how the newly suggested index for women's participation in decision-making (WPDMI) is derived. Finally, it explains the econometric models used to determine the determinants of

women's participation in decision-making, and exemplifies WPDMI by estimating the effect of women's participation in decision-making on the food variety score (FVS) as an indicator for food and nutrition security.

Data

This article draws upon data collected in 2014 in Ethiopia, where a randomly selected household survey was conducted covering 404 farmers living in a radius of 200 km around Hawassa town. This reflects a sub-sample of a nationally representative baseline survey conducted in 2012 by the Agricultural Transformation Agency (ATA) of Ethiopia together with the International Food Policy Research Institute (IFPRI). The full sample includes cases where only one gender (eligible male or female) forms the household. In such cases, there is no gender related bargaining regarding household decisions. Therefore, 26 cases were dropped from the analyses, leaving 378 households with a mixed household member composition. A team of trained enumerators used computer assisted personal interviews (CAPI) to collect information on various socio-economic household characteristics including detailed questions on various household decisions.

Deriving the women's participation in decision-making index (WPDMI)

As discussed in the literature review, different decision-making domains are encountered. In order to reflect these, the data contains information about decisions related to many household level activities related to crop production, livestock, use of income from various sources, technology adoption, health, food and clothing expenditures, harvest use, input use for crops, use of non-labor income, gifts given away, and decision about borrowing or lending loans. Naturally, not all of the households are engaged in the same activities. This results in decisions that are only relevant for some households. For example, decisions about the use of transfer income is only relevant for those households which actually received remittances and/or food

aid; decision about loan repayment is only relevant for the households who received a loan. To have a better coverage of the population, primary concentration is given to decisions that are relevant for most of the sample households. In this regard, decisions are considered most relevant where decisions were made by more than 88% of the population and therefore reflect the most important decision-making domains for the households in the research area. The seven decisions relate to: (i) Animal purchases; (ii) Use of income from animal sales; (iii) Agricultural technology adoption; (iv) Crop grown; (v) Input use; (vi) Harvest use; and (vii) Household purchases (e.g. food, clothing, household and agricultural assets).

Principal Component Analysis

The WPDMI is created by employing Principal Component Analysis (PCA). PCA is used for linear transformation of a large set of correlated variables into an uncorrelated set of components while the information from the original set of variables is still represented in this transformation. This enables decreasing the number of variables while retaining the information of interest in the dataset. It is widely used in many fields like social, behavioral, geological, biological, medical, or economic studies. It is also applicable while dealing with multicollinearity in regression analysis (Dunteman 1989).

When conducting PCA, statistical software will most often find statistically sound principal components, however the applicability of these components should be carefully questioned and answered. The starting point is to look at the intercorrelation. A high level of correlation is not a problem in PCA, while a low level of correlation is a problematic case. The problem is checked using Bartlett's test of sphericity which has a null-hypothesis that the correlation matrix is an identity matrix. Failing to reject the null-hypothesis would mean that correlation of every variable with all other variables is very low. In conducting PCA, we are interested in finding components that capture information in the variables that share some common

phenomenon. Thus, failing to reject the null-hypothesis is a negative sign for the analysis. It is advised to remove variables that are poorly correlated with all other variables (Field, 2009).

For the results of PCA to be valid, Kaiser (1960) (cited in Field, 2009, p 640) suggests retaining only principal components with an Eigenvalue greater than 1. After determining the components, the next step is to identify the variables that are important for the particular factors. For this purpose, Stevens (2002) (cited in Field, 2009, p 645) suggests the interpretation of only those variables that have an absolute factor loading greater than 0.4. The final step for checking the validity of PCA results is associated with the Kaiser-Meyer-Olkin (KMO) measure of adequacy. To calculate the KMO, the squared total correlation between variables is divided by the sum of squared total correlation and squared partial correlation between them (Pett, Lackey & Sullivan, 2003). The result ranges between 0 and 1. A value close to 1 is always preferable as it indicates the factors to be reliable. In the range of 0.5-0.7, 0.7-0.8, 0.8-0.9, 0.9-1.0 results are mediocre, good, great and superb, respectively (Kaiser, 1974 cited in Field, 2009, p 647).

Participation in decision-making

Of the 378 households with a mixed gender composition, 49 (13%) are female headed. Regarding household members, 1,156 (47%) of 2,564 persons are female. However, the analyses in this article only considers those household members who are in their eligible age. The eligibility criterion to participate in decision-making process is set according to the potential marriage age in Ethiopia, i.e. the age in which a person theoretically may form his or her own household and may be considered head. The Central Statistical Agency [Ethiopia] (2014) in its Ethiopian Demographics and Health Survey analyzes marital status of population starting from an age of 15. Therefore, women and men aged 15 years and above are regarded as eligible to participate in decision-making process. This restriction results in 1,254 decision makers (DM) of which 580 (47%) are female. This is especially important, because the

suggested index must allow for all eligible members to participate in household decisions, i.e. for decisions that are taken jointly by the whole family.

In order to collect the required information, respondents were asked by whom the decisions were made. In detail the survey question is designed to first ask whether the decision was made by one, two, all household members, or an external person. This is followed up by explicitly naming the household member (cross validated with the household roster). Gathering this information allows identifying who took the decision, thus, how many female decision makers participated in the process. Putting this in relation to the total number of potential decision-makers, for each decision variable *i* used in the PCA, the women participation in decision-making ($WPDM_i$) is calculated using formula 1:

$$WPDM_i = \frac{\sum FDM_i}{\sum DM_i} \quad (1)$$

where:

- FDM_i = female decision maker(s) in the *i*th decision domain
- DM_i = decision maker in the *i*th decision domain

This leads to $WPDM_i$ ranging between 0 and 1, with 0 implying no female participation and 1 implying only female participation. Table 1 summarizes how different weights may occur based on the design of the research instrument.

Table 1: Possible derivation of assigned and/or calculated weights

WPDM	**Decisions made**	**Occurs if**
1	by women only	(i) household head is female and takes decision alone (ii) joint decision makers are all female
0.5	jointly	(i) joint decision-making by one female and one male decision maker

		(ii) joint decision makers are equally numbered male and female
0-1	jointly	Joint decision-making (share of female decision makers)
0	by men only	(i) household head is male and takes decision alone (ii) joint decision makers are all male

Source: own data.

Determinants of WPDMI and its impact on the food variety score (FVS)

In order to better understand the determinants of the women's participation in decision-making index, OLS linear regression models are applied. Variables included in the analyses are based on an extensive literature review and limited to those expected to affect WPDMI. Considered are variables related to asset ownership, land holdings, education, family status (sons younger or older than 15 years), region and agro-ecological zone, household composition, and income.

To exemplify the impact of WPDMI on livelihood outcomes, the Food Variety Score (FVS) was chosen as an indicator capturing the food and nutrition diversity of a household. It reflects the number of different food items consumed by the household within the past 7 days prior to the interview. FVS is often used as an indicator for dietary adequacy within a household (see Hatloy et al., 1998; Steyn et al, 2006). A very limited dietary diversity may result in negative outcomes with regard to health and well-being of household members (Underwood, 1988 cited in Savy et al., 2005). As the main variable of interest, WPDMI is used as an independent variable in an OLS linear regression model. Other control variables relate to income and expenditures, education, household size, farm size, and access to markets and other services.

Empirical results

This section first addresses the key hypothesis by presenting the occurrence of different intra-household bargaining models. Then, it describes how the suggested index is generated.

Following the identification of determining factors of WPDMI, we finally estimate the effect of women's bargaining power on the Food Variety Score.

Occurrence of intra-household decision-making models

Addressing the hypothesis of different models of intra-household bargaining and resource allocation occurring across and within households, figure 1 presents the share of households falling into unitary and non-unitary intra-household models. It is clearly shown that both models are present in all key household decision-making processes. Regarding agricultural decisions (crop choice, inputs, harvest use, livestock marketing and use of livestock income) about 25-35% of households show sole deciders, i.e. a unitary model; 65-75% show some sort of bargaining between gender, i.e. a non-unitary model. Regarding technology adoption, the majority (54%) of households decide unitarily, (46%) jointly. As expected, it is observed that households are almost always (93%) bargaining between male and female members when it comes to decisions related to household purchases. This is likely to be caused by household members having different preferences which they articulate when it comes to purchases. As expected, both unitary and non-unitary models are present in the sample households when looking both in general and form a gender perspective.

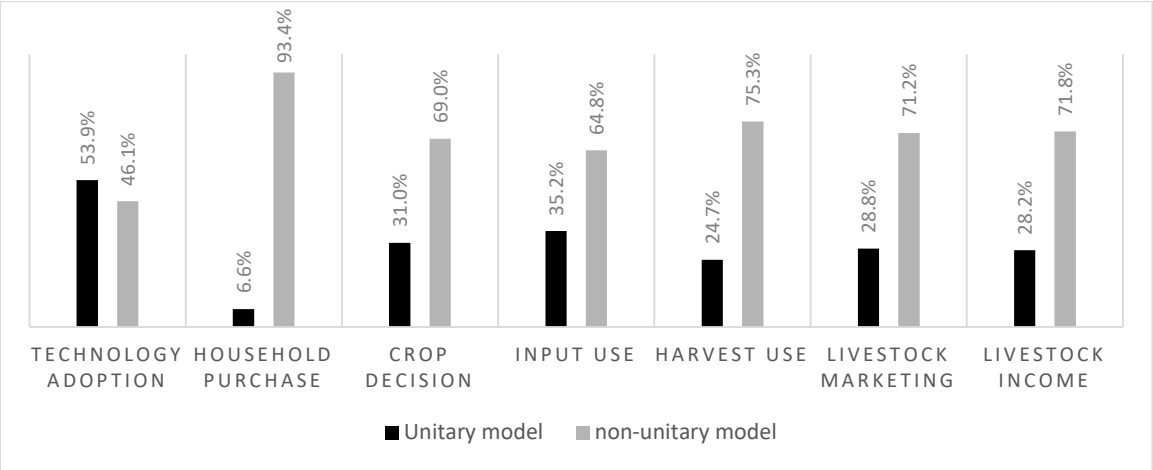

Figure 1: Share of intra-household decision-making models occurring in the sample, by key decisions
Source: own calculation.

Generating WPDMI using PCA

The factor analyses of the decision variables revealed only one factor with an Eigenvalue larger than 1, hence remaining in the analysis (Kaiser, 1960; cited in Field 2009, p 640), as it may be interpreted as the participation in decision-making. The key results of the PCA for this factor are shown in table 2. It captures approximately 71% of the variation in the different decision variables. All decision variables have absolute factor loadings greater than 0.4, implying that all are important for the factor, i.e. the participation in decision-making. As a final validity test for PCA results, the KMO measure of adequacy is presented. All decision variables have values close to 1 and the overall KMO is 0.86 which indicates an adequate sampling. In more detail, with respect to the corresponding factor loadings, decisions related to technology adoption and household purchases showed good results; decisions related to cropping and livestock showed great results. All validity tests yielded positive results, meaning that the predicted values referring to WPDMI are good at presenting the information contained in the decision variables.

Table 2: Means and factor loadings of PCA

Decision related to…	**Mean (sd)**	**Factor loading**	**KMO**
Technology adoption	0.20 (0.27)	0.7970	0.9329
Household purchases	0.41 (0.20)	0.7436	0.9734
Crop grown	0.32 (0.25)	0.8837	0.8493
Input use	0.31 (0.26)	0.8969	0.9020
Harvest use	0.36 (0.24)	0.8660	0.8914
Livestock purchase, sale, etc.	0.36 (0.25)	0.8747	0.7905

Livestock income	0.38 (0.26)	0.8425	0.7749

Eigenvalue = 4.9982

KMO_{total} = 0.8969

Source: own calculation

Determinants of WPDMI

Regarding determinants of women's participation in household level decision-making, i.e. WPDMI as the dependent variable, two models were adopted. One considers the number of sons aged 14 years or younger; the other considers sons older than 14 years, i.e. sons who are defined as eligible decision makers. We term the two age groups juvenile sons and adult sons, respectively. While e.g. Friedberg & Webb (2006) concentrated on the effect of having children below 18, the Ethiopian setting lead us to draw the age-line at 15 years, because they may be considered decision makers who potentially decrease the power of women in decision-making process. This can be further investigated in future studies of this kind. The regression results for the determining factors of WPDMI are presented in Table 3.

Table 3: Determining factors of women's participation in decision-making

Independent variables	Model 1 (adult sons)			Model 2 (juvenile sons)		
	Coefficient		S.E.	Coefficient		S.E.
Gender of household head [1-male]	-0.882	***	(0.138)	-0.794	***	(0.146)
Household size	0.140	*	(0.072)	0.113		(0.070)
Share of female owned asset value	0.386	**	(0.193)	0.391	**	(0.195)
Land endowment	1.385	***	(0.173)	1.472	***	(0.175)
Max. female education [years]	0.005		(0.016)	0.005		(0.016)

Share of income from livestock [%]	0.003	***	(0.001)	0.003	***	(0.001)
Per capita income [ETB]	0.000	***	(0.000)	0.000	***	(0.000)
Per capita farmsize [ha]	-0.309		(0.223)	-0.245		(0.228)
Altitude [masl]	0.000		(0.000)	0.000		(0.000)
Region [1-Oromiya]	-0.087		(0.093)	-0.114		(0.094)
Number of adult sons	-0.102	***	(0.036)			
Number of juvenile sons				0.0077		(0.035)
_cons	-0.142		(0.257)	-0.327		(0.273)
N	378			378		
R^2	0.406			0.396		
adj. R^2	0.388			0.378		

Heteroscedasticity robust standard errors in parenthesis

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: own calculation

As expected, adult sons significantly reduce decision-making power of females in the households. On the other hand, having juvenile sons has a slight positive effect, though insignificant in our sample. The gender of the household head is one of the main determinants of WPDMI, i.e. if the household head is male then women will be significantly less participative in household decisions. The main driver of female decision power is linked to asset ownership and land endowment, which both have a significantly positive effect on WPDMI. This is consistent with other authors' findings (e.g. Allendorf, 2007; Ngenzebuke, Rock & Verwimp, 2016). Other than generally found in the literature (see e.g. Elder & Rudolph, 2003; Lührmann & Maurer, 2008; Li & Wu, 2011), the effect of education, though positive, is not significant. As women are often the main caretakers of livestock, the significant

increase in WPDMI through higher shares of livestock related income, was expected. Also the total per capita household income showed a significantly positive effect. Other control variables like region, altitude and per capita farm size did not show significant influence.

Effect of WPDMI on Food Variety Score

In order exemplify the use of WPDMI, the effect of women's participation in decision-making on food and nutrition security is estimated by running a linear regression model. Table 4 shows the respective regression results with FVS as the outcome variable, and WPDMI as the main independent variable of interest.

Table 4: Effect of WPDMI on the Food Variety Score

Independent variables	**Coefficient**		**s.e.**
WPDMI	0.3587	**	(0.1704)
Credit [1-access]	1.1557	***	(0.4381)
Household size	0.0344		(0.0928)
Per capita farmsize [ha]	0.2493		(0.9127)
Off-farm income [ETB]	0.0001	***	(0.0000)
Total per capita income [ETB]	0.0000		(0.0000)
Total expenditures on food [ETB]	0.0003		(0.0003)
Highest education level [years]	0.1366	**	(0.0551)
Travel time to nearest market [minutes]	-0.0035		(0.0045)
Extension [1-access]	1.8460	***	(0.3877)
Region [1-Oromiya]	1.0659	***	(0.4067)
_cons	7.4907	***	(0.6337)
N	378		
R^2	0.241		

adj. R^2	0.219

Heteroscedasticity robust standard errors in parenthesis

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: own calculation

The findings support the hypothesis of a significantly positive effect of increasing women's participation in decision-making on food consumption patterns of households. Results indicate that, ceteris paribus, a unit increase in the WPDMI increases the FVS by on average 0.36 units. This supports the assumed and often observed positive effect of women empowerment on the dietary diversity of households (see e.g. Yimer & Tadesse, 2016; Sraboni et al., 2014).

All independent variables have the expected signs. Off-farm income, credit and extension accesses have significant positive effects on the FVS of the households. In addition, taking the years of formal schooling of member with the highest number of years as a proxy for households' education level, educated households are significantly more likely to invest in better nutrition.

Discussion and conclusions

This article addresses the conceptual gap in using women's participation in decision-making as an indicator for women empowerment, i.e. that indicators do not allow decision-making scenarios in which all household members participate in decision processes. Based on theoretical considerations of intra-household bargaining models the hypothesis of different models occurring within households was addressed. The first objective of this article was to suggest a suitable decision-making index that measures women's bargaining power. Following up, the second objective was to identify determining factors of women's participation in decision-making. To exemplify the suggested index, the third objective was to estimate the effect of women's bargaining power on the food variety score (FVS), as an indicator for food and nutrition security.

The analysis of different decision domains within a household revealed that different intra-household bargaining models in fact do occur. Therefore, the new index suggested is justified. Considering seven key fields of household decision-making, principle component analysis (PCA) was employed so as to generate the women's participation in decision-making index (WPDMI). Determining factors of WPDMI were identified by running linear regression models. Similar, OLS regressions were used to estimate the effect of the WPDMI on the FVS.

Regarding the WPDMI, all validity tests of PCA yielded sufficient results enabling us to conclude that the index is excellent at capturing the common information, i.e. women's participation in decision-making, presented in the most important fields of household decision-making. This implies that the suggested index is a suitable method that allows considering all female and/or male decision makers in a household to be participants of decision-making processes. Hence, the prevailing conceptual flaw may be closed to some extent. What still remains unsolved by design is whether an increase from none to some level of female participation should be valued more, less, or equal to an increase from some level of participation to a total control over decisions. In order to address this particular research question, it appears necessary to follow up with more qualitative oriented research approaches in the future.

Looking at the determinants of women's participation in decision-making, the findings indicated that women's land endowment and women's asset ownership are key factors which significantly contribute to their bargaining power. In this context, policies and cultural norms favoring male ownership of the land resources and assets are limiting women's participation in household decisions which is likely to have further effects on livelihoods. Therefore, any institutional efforts concentrating on local capacity building that would support women's land or asset ownership can foster women empowerment. Yet, it should be implemented in parallel with other institutional adjustments that support credit access, social safety nets and culturally

encourage female favoritism so as to support behavioral change in the respective communities and the whole society. This may then also have some effect on the importance of the household head being male or female, which also was shown to be a key determinant of WPDMI. In detail, a male household head significantly reduced female bargaining power, which again hints to the importance of customs and cultural norms. The same arguments are relevant for the role of sons, i.e. the number of adult sons which significantly reduces the bargaining power of women. Any policy or project aiming at improving the livelihoods through improving the bargaining power of women should be aware of this situation. Moreover, whether specific actions can be put into place to "keep" women's decision-making power high after sons turn of age is ethically debatable. Besides, this would imply changing behavior of intra-household dynamics which may have an influence on future household heads. That is why any institution or organization should recognize this situation and carefully consider it when designing interventions that influence existing structures.

Further, income generated from livestock as share of total income had a significant and positive effect on women's participation in decision-making. Because this may be related to the predominant role of women in livestock husbandry, a stronger role of livestock in household livelihood strategies may be especially beneficial for women. Therefore, institutional or policy interventions encouraging livestock ownership is expected to contribute to women's decision-making power. Here, one adjustment approach may be to facilitate women targeted access to credit and livestock markets in order to foster increasing their stock. Moreover, institutional changes concentrated on improving access to and quality of extension, input and veterinary services would inevitably support household livestock ownership, which in turn has shown to improve women's decision-making power. Although not significant, education did have a positive effect on women's decision-making power and may still be considered, because improving women's participation in household decisions without enhancing their educational

capabilities may have very limited effects with regard to household livelihood development in the long run.

Looking at the food variety score as an indicator for household food and nutrition security, an increase of women's participation in decision-making significantly improved diversity. Additional variables with a significant and positive effect include access to credit, access to extension, off-farm income, and education. Linking these findings with the thoughts and discussion on the determinants of women empowerment, it comes to mind that fostering education and access to information (extension) may be helpful for both increasing women's decision-making power, as well as have beneficial effects on essential livelihood outcomes, food security in particular. In the presence of strong social norms, any activity to increase women's participation in decision-making processes can be expected to be a long term task, but appears to be a promising target.

The data reflects the answers to structured questions on who makes decisions with respect to various decision domains. Reported information may not fully reflect reality leading to under- or overestimating decision-making power of women or men. This may be addressed in future research in which the quantitative findings are triangulated and validated through qualitative in-depth information gathered in the field. Another quantitative based option could be to have respondents of both gender answering the questions related to decision-making. This would enable cross checking and help with the identification of the decision makers within the household more precisely. However, overall the article suggests a useful approach to tackling intra-household decision-making, discusses its determinants, and briefly exemplifies the effect of women's bargaining power on food and nutrition security.

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