Hiding or Pleasing: Spousal Disagreement among Ugandan Maize Farmers

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Abstract

To gain a better understanding of intrahousehold bargaining processes, surveys increasingly collect data from co-heads individually, especially on decision-making, asset ownership and labour contributions. However, answers provided by co-heads to the same set of questions often differ substantially. Recent research suggests that while some of this disagreement is due to random measurement error and cognitive bias, part also reflects non-overlapping information sets. We document differences in answers between male and female co-heads in monogamous smallholder maize-farming households in Uganda. We first confirm that not all disagreement can be explained by measurement error or bias. Using a field experiment, we then test if disagreement is due to information asymmetry between male and female co-heads. We also test an alternative explanation where discord is attributed to

co-heads' tendency to respond in line with prevailing gender norms and social customs. While the interventions did seem to reduce discord in survey response about decision-making, we do not find that information asymmetry nor reporting in line with gender norms and customs are the primary drivers of disagreement.

Keywords: gender, farm households, disagreement, information asymmetry, norms, Uganda

1 Introduction

Increased attention to the internal dynamics of agricultural households by both researchers and practitioners has led to various innovations in data collection (Doss & Quisumbing, 2020; Alkire et al., 2013). Examples of best practice in data collection on intrahousehold dynamics include separate interviewing of male and female co-heads of (dual-headed) households using distinct survey instruments that may nonetheless cover common topics and questions. Studies using these instruments often find that co-heads provide different answers to even the most basic questions (Ambler et al., 2021; Annan et al., 2021; Acosta et al., 2020; Anderson et al., 2017; Twyman et al., 2015).

Ambler et al. (2021) demonstrate that, while part of these divergent responses may be attributable to measurement error, there is also a systematic component that reflects asymmetric information within households where one co-head does not have accurate knowledge about the decisions made, actions taken, or assets

owned by the other. Furthermore, they show that disagreement is larger for assets and decisions that are easier to hide, possibly indicating that spouses hide information from each other. A number of lab-in-the-field experiments similarly indicate that household members often conceal some of their resources from each other (for example, Ashraf, 2009; Fiala & He, 2016; Castilla & Walker, 2013; Hoel, 2015).

In this paper, we investigate spousal disagreement in survey responses from monogamous smallholder maize-farming households in eastern Uganda. Drawing on Ambler et al. (2021), we explore the same three types of explanation for discord—random measurement error, bias caused by men and women interpreting questions differently, and asymmetric information where men and women have only partly overlapping information sets. However, while Ambler et al. (2021) use variation in the probability of overall disagreement by asset and activity to draw conclusions about asymmetric information, we designed a field experiment to formally test the asymmetric information hypothesis. This is done by randomly assigning a sample of households to a video-based intervention designed to reduce information advantages of a single spouse, and then comparing spousal disagreement to a control group. Furthermore, we test for an alternative explanation: that discord is not the result of asymmetric information, but is instead caused by spouses answering survey questions in line with prevailing gender norms. Inspired by recent research on the use of role models to change attitudes and behavior in traditionally male dominated sectors, we also test the impact of a video-based intervention that aims to promote a mental image of maize farming as a cooper-

ative or joint venture in which both spouses play an equal role (Porter & Serra, 2020; Bernard et al., 2015). We expect that especially women will be prone to "pleasing" the husband and the wider community.

We consider spousal disagreement with respect to the role of both female and male co-heads in decision-making and labor provision. For disagreement about the female co-head's role in decision-making, we consider the likelihood that the female co-head reports she was involved in decision making but the male co-head says she was not.[1] For disagreement about the male co-head's role in decision-making, we consider the likelihood that the male co-head reports he was involved in the decision but the female co-head says he was not. For labour provision, we focus on instances where the one co-head reports to have worked less than how much the other co-head reports they worked, as working is assumed to reduce utility. We examine hiding of labour contributions by both female and male co-heads.

We find that measurement error alone can not explain observed spousal disagreement in survey responses. We also reject the idea that differences in how male and female co-heads interpret the questions is the main driver behind observed disagreement. For decision making, we find that both interventions significantly reduce disagreement about the role of the female co-head. Disagreement about the role of the male co-head is only reduced by the video-based intervention that is intended to reduce information asymmetry. Further inquiry into the impact pathways do not allow us to determine the exact mechanisms for the impact. The video-based intervention does not affect disagreement related to labour

time allocations.

The remainder of the paper is organized as follows. The next section provides an overview of the literature on spousal disagreement. Section 3 presents the experimental design and the rationale underlying the intervention, followed by an outline of our hypotheses and how we they are tested. Section 5 offers a brief description of the context and characteristics of the households in our sample, and describes the variables used in the analysis. We then examine our results in Section 6. A last section concludes with a discussion of our study's implications.

2 Literature

Our review of prior work on spousal disagreement focuses mainly on the empirical literature on intrahousehold resource allocation and decision-making in (dual-headed) agricultural households in low- and middle-income countries, and draws primarily on analyses that use observational data from surveys in which both male and female co-heads are interviewed separately and are asked the same set of questions. Such studies often focus on research questions related to women's empowerment and autonomy. For example Jejeebhoy (2002) asks both co-heads questions on the locus of decision-making on a variety of issues, as well as specific questions concerning women's mobility and access to resources. Ghuman et al. (2006) collect data from both co-heads on a range of autonomy-related topics, including the need of the female co-head to obtain the male co-head's permission to go to different types of places, the female co-head's capacity to decide on their

children's affairs, whether the female co-head is allowed to have a job, and her role in deciding on the number of children and on household expenditures.

A common finding in studies that ask the same set of questions to different individuals within the household is that substantial disagreement often arises between co-heads, even on questions that would seem easily and objectively verifiable, such as the number of children or type of material used for house construction. This divergence may simply be attributable to measurement error by the respondents. But Ghuman et al. (2006) suggest that such divergence may also be partly due to the fact that the response categories do not have the same cognitive or semantic meanings to women and men. Seymour & Peterman (2018) note that co-heads often give inconsistent answers when asked about who made a particular decision. They then test whether female unilateral decision-making is equally empowering if the male co-head disagrees that the woman took the decision alone, as compared to when the male co-head agrees. They conclude that disagreement may signal underlying power dynamics within the household that are likely to be relevant when assessing individual-level agency and empowerment. Annan et al. (2021) similarly examine underlying power dynamics, focusing on cases where the female co-head reported she made decisions, while the male co-head said the female co-head was not involved. They refer to this type of disagreement as "women taking power" and show that it is positively correlated with a range of outcomes for women and children. They conclude that more research is needed to establish causality and identify which interventions affect disagreement.

Ambler et al. (2021) provide a particularly insightful conceptual framework

that teases out the various perspectives on spousal disagreement. First, they note that if disagreement solely derives from measurement error, disagreement should be symmetric, and the female co-head's responses should not differ systematically from the male co-head's responses. Second, they point out that if disagreement results from asymmetric measurement error in which men and women interpret questions differently (as suggested by Ghuman et al. (2006) and Anderson et al. (2017)), then answers should differ systematically between co-heads, but disagreement should be similar for different questions asked in a survey (or at least for a sets of similar questions like questions related to asset ownership or different decisions).[2] Finally, they argue that finding differing rates of disagreement across survey questions, and higher rates of disagreement for assets and activities that are easier to hide in particular, points to the presence of intrahousehold information asymmetries. Using observational data collected in Bangladesh, they find evidence that such information asymmetries in the form of hidden assets and decisions are present in their sampled households.

However, differential disagreement on different decisions, asset categories, or activities need not always reflect intrahousehold information asymmetry. There may be other reasons why spouses agree more in one area and less in another area. One reason may be that spouses respond in line with what society expects from them, such that disagreement related to decisions, actions, and asset ownership is also partly shaped by prevailing gender stereotypes and norms, i.e., role congruity. For example, in a case study in northern Uganda, Acosta et al. (2020) find that men often report unilateral decision-making in areas where they are as-

sumed to bear final responsibility, even if women had some degree of involvement. Women rather report these scenarios as joint decisions. Hence, it is important to understand the local cultural context to differentiate spousal disagreement as a function of information asymmetries stemming from information asymmetry versus other gender-related systematic biases.

3 Experimental design and interventions

In addition to random error and cognitive bias due to spouses interpreting questions differently, the previous section shows that the emerging literature on spousal disagreement in survey responses suggests two potential mechanisms. First, spousal disagreement may be due to the cultural context in which these questions are asked and answered, with co-heads responding in line with what would be expected in society (Acosta et al., 2020). Second, the literature also suggests that spousal disagreement reflects information asymmetries between co-heads, for example when co-heads hide decisions, actions and assets from each other (Ambler et al., 2021). We designed two corresponding interventions to empirically test these two explanations in a field experiment. A first intervention attempts to challenge preconceived ideas of what decision-making by a male or female co-head involves and who is expected to make decisions in a farm-household by promoting a cooperative approach to maize farming, in which maize cultivation and management activities are seen as a joint responsibility of both co-heads. A second intervention tests if these asymmetries can be influenced by providing co-heads equal access to

information about best practices in maize farming prior to the point in time when decisions are made on cultivation and management, as this would facilitate mutual monitoring.

At the heart of both interventions is a short video that is shown twice to individual co-heads using tablet computers. The aim of the video is to increase viewers' knowledge of recommended practices in maize farming such as timely planting, row planting, and the use of improved inputs, primarily hybrid seed and inorganic fertilizer. It does this through an aspirational story in which a farmer (or farmers) recounts how he/she/they used to be poor but managed to increase yields over time by applying a set of recommended techniques and inputs.[3] It also suggests that farmers should view maize farming as a business that needs continuous investment over time, and includes some simple intertemporal cost-benefit calculations to illustrate this, followed by encouragements to follow the example of the model farmer(s) featured in the video.

The first intervention, referred to as T1 in the remainder of the paper, involves varying the gender composition of the actors featured in the video and randomizing which version of the video is viewed by farmers. The second intervention, which we refer to as T2, randomly varies whether the video is viewed by the spouses jointly or by only one of the spouses. These variations and the rationale behind them are explained below.

We begin with a conceptual explanation that ties to our first intervention (T1): projecting a cooperative image of farming as a household, thereby challenging the local consensus that maize farming is a male activity (Peterman et al., 2011).

Generally, men make the more strategic decisions such as which plots to plant maize on, when to start planting, and what seeds to use. Men also generally decide on how much labor is needed, while women assist men. In many situations, labor division in maize farming is organised according to gender roles, with men performing tasks such as land clearing and marketing of surplus output, while women perform weeding and post-harvest processing tasks. While these are broad and stylized characterizations of Uganda's maize production system, their widespread acceptance as conventional wisdom makes maize farming a topic ripe for this study. The fact that maize is not exclusively in the male domain provides scope to strengthen women's involvement in decision-making about maize.

We expect that differing spheres of influence between male and female co-heads and the gendered division of labor may contribute to spousal disagreement in survey responses. Therefore, our first intervention randomly varies which version of our video is screened to our study participants. One version features a couple comprised of a male and a female actor-farmer who present themselves as role models to convey a world view in which both male and female co-heads participate equally in maize farming. Another version of the video features only a male actor-farmer.[4] This approach capitalizes on recent evidence exploring the influence of role models on aspirations, investment choices, and other future-oriented behaviors (Bernard et al., 2015); on increasing women's participation in otherwise male-dominated sectors (Porter & Serra, 2020; Beaman et al., 2012); and the influence of engaging media content to expose large numbers of people to role models (La Ferrara et al., 2012; Riley, 2022).

To test the hypothesis that male and female co-heads disagree less if they view farming as a joint spousal activity, we randomly assign 261 households from our sample to view the cooperative image version of the video, such that both the male and female co-heads in the household watch the video together. This group functions as the treatment group. We also randomly assign 240 households from our sample to view the version of the video featuring only a male actor-farmer, again with both the male and female co-heads watching together. Because the only difference between the two videos is the gender composition of the actors featured (a couple of male and female actor-farmers versus a male actor), any difference in outcomes between the two groups should be attributed to the role model effect of the cooperative image intervention.

Next, we turn to our second hypothesis about asymmetric information within the household. Consider the farm-household as a collection of individuals, each with their own preferences, skills, assets, and access to resources, including knowledge. Information within households does not always flow friction-less between household members, and so one member may not be cognizant of the full range of decisions made, activities undertaken or assets held by other members of the household. Furthermore, in many contexts, the household's existence and the welfare of its members depend on their collective capacity to invest in common goods by drawing on each individual's skills, assets, and resources. As such, households can be considered as collective action institutions, and many of the problems encountered in common pool resource management, such as free-riding and overextraction of resources, apply to the household (Doss & Meinzen-Dick, 2015). One

way to attenuate collective action problems is by increasing mutual monitoring by making sure both spouses have access to the same information (Agrawal, 2001).

In a second treatment (T2), we therefore ensure that both co-heads begin with symmetric information on recommended agronomic practices for maize farming, as this is assumed to facilitate mutual monitoring and directly reduce asymmetric information. To do so, we show the video that showcases recommended practices in maize farming to both male and female co-heads together in a random sample of 261 households.[5] This group acts as the treatment group. In another random sample of 540 households, the control group, the same video is shown, but only to one of the two co-heads.[6] As the only difference between the two groups is related to who viewed the video (the male and female co-heads together versus an individual co-head), any difference in outcomes between the two groups should be attributed to a reduction in information asymmetries between co-heads.

4 Hypotheses and tests

A first hypothesis we will test is that disagreement between husband and wife is simply due to random noise. Ambler et al. (2021) show that if random measurement error is the only factor leading to disagreement, then disagreement should be symmetric: One would thus expect, for instance, that the likelihood that the female co-head says she was involved in a particular decision while the male co-head says she was not is about the same as the likelihood that the male co-head says the female co-head was involved in that decision, while the female co-head

says she was not. Testing if disagreement between male and female co-heads is simply due to random measurement error is thus equivalent to testing if two proportions are significantly different from each other, which we will do using a Pearson χ-squared test for equality of proportions.

Once it is established that disagreement can not be fully explained by random noise alone, Ambler et al. (2021) test for asymmetric measurement error. They define asymmetric measurement error as "...measurement error that occurs systematically and leads to different patterns of responses for men and women" (p. 770). They go on to explain that this could be due to differences in understanding or interpretation of the questions, or differences in perceptions of what it means to make a decision, what constitutes agricultural labour, or what it entails to own an asset.

Ambler et al. (2021) test for asymmetric measurement error by checking if the probability of disagreement about a spouse's role in decision making, labor provision, or marketing is equal across the various decisions and activities under consideration. This is done by performing a series of t-tests that test for the equality of disagreement between pairs of decisions or asset holdings. We employ a more principled and conservative approach, where we use a Wald test for joint significance. We start from the following equation:

$$y_{i,d} = \alpha_d + \varepsilon_{i,d} \tag{1}$$

where, $y_{i,d}$ represents disagreement within the household i about a particular

decision d, and $\varepsilon_{i,d}$ is an error term that is assumed to be independently distributed across both households and decisions.[7] We then test the joint null hypothesis that disagreement levels are equal across decisions, which amounts to constraining the intercepts (α_d) to be equal to each other. If we reject the null, this means that disagreement about decision-making between spouses can not be fully explained by asymmetric measurement error.

Ambler et al. (2021)argue that rejecting both types of measurement error indicates that disagreement also partly reflects a real difference in what spouses know from each other, a situation they refer to as asymmetric information within the household. While they admit that some of this disagreement may be unintentional, they also note that the fact that disagreement seems to be highest among assets that are more easily hidden (small livestock, poultry, and small durables) suggests that at least part of this hiding is strategic. We provide an explicit test for the hypothesis that some disagreement is related to asymmetric information within the household by comparing average disagreement between co-heads in households that were exposed to the intervention designed to provide spouses with equal information (T2) to average disagreement between spouses in households that did not receive this intervention. This is done using the following OLS regression:

$$y_{i,d} = \alpha + \beta . T_i + \varepsilon_{i,d} \tag{2}$$

where T_i denotes the treatment status of household i, which is a dummy that

takes the value of one for households that received the intervention and zero for the control group. We expect that providing both co-heads with the same information will lead to a reduction in disagreement, and so $\beta < 0$.

If disagreement is due to spouses hiding information from each other, we expect that a treatment designed to facilitating mutual monitoring such as T2 would be more effective for activities that are easier to hide. Following this line of reasoning, we define H_d, a measure of how easy it is to hide a particular activity d, and estimate conditional average treatment effects by interacting the treatment indicator with the measure of how easy it is to hide activity *d:*

$$y_{i,d} = \alpha + \beta.T_i + \gamma.H_d + \delta.T_i * H_d + \varepsilon_{i,d} \tag{3}$$

Finding that $\delta < 0$ can then be taken as further evidence in support of the hypothesis that disagreement is driven by co-heads hiding activities from each other.[8]

We mentioned earlier that disagreement may also result from spouses responding in line with expectations in society. While Ambler et al. (2021) consider this form of disagreement part of symmetric measurement error, we argued earlier that disagreement that arises from spouses responding in line with expectations may also lead to differing rates of disagreement between decisions or activities. For instance, disagreement stemming from spouses responding in line with expectations on the role of women in weeding may be very different from disagreement related to the role of women in land preparation. In the former case, as weeding is seen as a typical female activity, men may have no problems admitting that the female

co-head did all the work. For the second case, as society expects men to do the often heavy work of land preparation, men may be more reluctant to disclose that their female co-head also spent considerable time on this task. This is in line with what Acosta et al. (2020) find in in northern Uganda, where men often exaggerate their own role in areas where they are expected to bear final responsibility.

We thus test if part of the disagreement that Ambler et al. (2021) attribute to asymmetric information may actually be the result of spouses reporting in line with expectations, and estimate models similar to 2 and 3. Now, the treatment status of household i, T_i, is a dummy that takes the value of one if spouses were exposed to the video intervention projecting a cooperative approach to farming (T1), and zero if a video was shown where only a male actor-farmer featured in the video. If cultural norms indeed drive disagreement, we expect the intervention to reduce disagreement ($\beta < 0$). For this hypothesis, we also define a measure indicating whether the man within the household is deemed responsible for decision d according to prevailing norms and customs (H_d), and interact H_d with the treatment, as we expect that challenging gender norms by projecting a cooperative approach to farming will have the largest effect on activities or decisions that are most sensitive to gender norms and customs. Finding that $\delta < 0$ can then be taken as further evidence that disagreement is driven by co-heads reporting in line with expectations and gender norms.

5 Study context and data collected

The study was conducted among monogamous maize-farming households in five districts of eastern Uganda, an area known for maize production. Participating households were recruited using a two-stage cluster sampling approach to obtain a representative sample of this population. Specifically, we first selected 50 parishes randomly and in proportion to the number of villages within each parish. In the selected parishes, all villages were included in the study. Within each village, we listed all households, and randomly selected 10 households from the list to participate in the study. This resulted in an effective sample of 2,548 households. The interventions described in Section 3 were implemented in random subsets of this sample.

We focused on the second maize-growing season of 2017, which ran from about August 2017, when fields were prepared, to January 2018, when maize was harvested. Interventions were administered twice, once in August 2017 when farmers were preparing fields, and one month later during planting time. Concurrent with the first intervention in 2017, we also collected information on household characteristics. End-line data was collected after the harvest in February 2018.

According to baseline data, households in our study area cultivated on average about 1.5 plots of maize. Yields during the first season of 2017 were extremely low (about 270 kilograms per acre) as a result of a fall armyworm outbreak that significantly affected the maize crop. Baseline data indicated that the average household in our sample consisted of eight individuals. Female co-heads in these

households were on average 35 years old and 30 percent had completed their primary education. Male co-heads were on average 43 years old and 42 percent had completed their primary education. Only 11 percent of households reported that they had access to agricultural extension services in the year prior to our survey. Only 17 percent of households used fertilizer on at least one plot, and 38 percent reported using improved seed bought from an agro-input dealer during the last cropping season (April-July 2017).

A first area in which we explore disagreement between male and female co-head is in decision-making related to maize farming. In our endline survey, we asked the male co-head of household to list all maize plots that the household was cultivating during the season preceding the endline survey (that is, the second agricultural season of 2017). We then cycled through the different plots and asked a series of questions for each plot, and repeated the same questions separately with the female co-head. For a range of key decisions that need to be made and that are known to significantly affect maize yields, we asked who made the decision on that particular plot. Respondents could answer that decisions were made by (1) the respondent himself or herself alone, (2) the respondent's spouse alone, (3) the respondent jointly with his or her spouse, (4) someone else inside or outside the respondent's household, (5) the respondent together with someone else inside or outside the household, or (6) the respondent's spouse together with someone else inside or outside the household. Respondents could also indicate that they did not know who made the decision.

The first decision we consider is simply who decided that maize should be

planted on the particular plot. A second decision relates to timing of planting, recognizing that planting date is a strong agronomic determinant of yields.[9] The third decision considers the spacing of seed and the seeding rate, which reflects the fact that row planting at a rate of one seed per mound is also a strong determinant of yield.[10] We also consider decisions related to weed control. For weeding, we differentiate between decision-making related to strategies used to combat striga infestation (a parasitic weed that feeds off the roots of the maize plant) and weeding more generally. Finally, we look at decision-making related to maize marketing, and ask who took the decision to sell any part of the maize that was harvested.

We also collected detailed information on labor time. On each maize plot, we asked each co-head separately how much time, expressed in labor days over the entire agricultural season, he or she worked on a particular activity. We also asked each co-head to give an estimate of how much time the other co-head worked on the plot on that particular task. The activities we inquired about are land preparation, planting, weeding, spraying, and harvesting.

The way in which we collected data about spouses' labor time could have been subject to some limitations, that could have implications for symmetric measurement error as well as asymmetric measurement bias. Yet, as there is no reason to believe these challenges manifest differently in our respective treatment and control groups, there are no likely implications for the results of our experiments. The main issue relates to the stylized questions that each co-head was asked about total labor days spent on specific maize farming-related activities on specific maize

plots during the previous maize-growing season. Their responses may have been subject to recall bias, particularly for less salient or irregular activities (Arthi et al., 2018; Seymour et al., 2020). If such activities are gender-specific, then this could have contributed to observed difference between male and female co-heads. There are also cognitive issues related to properly identifying the activity in question and remembering and aggregating all instances of labor spent on the particular activity, which is possibly variable over the reference period (Seymour et al., 2020). Gender differences in education levels and numeracy skills could have also induced gender-specific challenges with regard to the latter, with lower education levels associated with higher likelihood of overestimation in recall (Arthi et al., 2018). The reference period (the previous maize-growing season) is relatively long, thereby increasing the risk of recall bias and estimation based on established patterns of activity, yet, it is likely to be clear and salient for these maize farmers. Besides, the reference period is not likely to be subject to gender differences in correctly identifying it (Seymour et al., 2020). Seasonality bias is not likely given the season-specific nature of our experiment.

In addition to the outcome variables and the treatment indicators, there are two additional variables in equation 3 that require attention. First, to test if hiding is the main cause for disagreement related to labor contributions, we construct an indicator (H2) of how easy it is for co-heads of households to monitor particular activities and actions. To do so, we asked 30 local experts to score each activity (eg. time spent on weeding) in terms of its ease of monitoring on a scale between zero and 100, with zero being impossible to find out the actions of one's co-head

and 100 being very easy to find out. The indicator H2 takes a value of one for an activity of the average expert score was larger than 40, indicating that it is difficult to monitor; and zero otherwise.[11]

Second, to test if gender norms and customs are driving spousal disagreement, we also created an indicator (H1) for the extent to which a particular action or decision is culturally believed to be more in the male domain. This was done by asking the same 30 experts to indicate who, within the household, is typically expected to make the particular decision or perform a particular action. This was again scored on a scale running from zero (typically the female co-head alone) to 100 (typically the male co-head alone). The indicator H1 takes a value of one for an activity or decision if the average expert score is larger than 55, situating it in the male domain; and zero otherwise.

6 Results

We provide separate analyses for disagreement between co-heads related to decision-making and disagreement between spouses related to labor contributions. We consider disagreement related to the role of the female co-head and the role of the male co-head separately.

6.1 Decision-making

To investigate disagreement between responses from male and female co-heads about who made various decisions related to maize cultivation, we construct in-

dicators based on the answers of both co-heads. To assess (dis)agreement about the role of the female co-head in decision-making, we define three different categories: (1) both co-heads agree on the woman's role in decision making[12]; (2) the female co-head says that she was involved (either alone or jointly with the male co-head), but the male co-head says she was not; and (3) the male co-head says the female co-head was involved (either alone or as part of the couple), but the female co-head says she was not. Similarly, to assess (dis)agreement about the role of the the male co-head, the three categories are: (1) spouses agree on the man's role in decision-making; (2) the male co-head says that he was involved (either alone or jointly with the female co-head), but the female co-head says he was not; and (3) the female co-head says the male co-head was involved (either alone or as part of the couple), but the male co-head says he was not. Categories (2) and (3) can be pooled to obtain an indicator for disagreement over the co-head's involvement in decision-making.

Table 1 shows agreement and disagreement about the female co-head's involvement in decision-making (top panel) and the male co-head's involvement in decision-making (bottom panel). The top panel shows that co-heads mostly agree on the female co-head's role in decision-making. Focusing on disagreement, we see that on the average plot the likelihood that the female co-head says she was involved in a particular decision but the male co-head disagrees (category 2) is always higher than the likelihood that the male co-head says the female co-head was involved but the female co-head disagrees (category 3) except for the decision to sell maize. P-values from a Pearson χ-squared test for equality of proportions

for category 2 and 3 indicate that in all but one case, we reject the null of random measurement error. We also reject the null hypothesis that disagreement about the female co-head's role in decision-making is equal across different decision categories, based on a Wald test after estimating equation 1 (p-value = 0.012). This means that discord can not be explained by cognitive differences between spouses alone (i.e., asymmetric measurement error or cognitive bias).

The bottom panel shows that spouses agree even more about the role of the male co-head in decision-making. The likelihood that the male co-head claims he was involved in the decision while the female co-head disagrees is now consistently higher than the likelihood that the female co-head says the male co-head was involved but the male co-head says he was not. Also here, the p-values from the same Pearson χ-squared test indicate that we reject the null of random measurement error. Comparing disagreement about the role of the husband across different decision-making domains also leads us to reject the hypothesis that this disagreement is only due to cognitive bias (p-value = 0.000).

Table 1 also shows the male task score (H_d in equation 3 in Section 4). Disagreement related to the role of the male co-head is highest for the decision to sell maize (34 percent), which is also the task with the highest H_d score (82/100). This could indicate that the male co-head insists he made decisions about marketing, which is typically a male activity, even though the female co-head made the decision. We do not see a clear pattern for disagreement related to the role of the female co-head in decision-making.

Table 2 reports regression results for the analysis of the intervention's im-

pact based on equations 2 and 3. The outcome variable $y_{i,d}$ used is disagreement wherein the co-head reports that he or she was involved but the other co-head reports that he or she was not, which suggests that the former co-head made the decision secretly (category 2).[13]

The first column of the table corresponds to equation 2 and tests if the intervention designed to change the likelihood that spouses respond in line with norms and customs (T1) had an impact on category 2 disagreement. The top panel shows that for 22.6 percent of the decisions that were made, the female co-head says she was involved but the male co-head claims she was not. We also see that among households that were exposed to the intervention aimed at reducing the influence of norms and customs, this type of disagreement reduced to 17.1 percent and the difference is statistically significant. This suggests that at least part of the disagreement is due to co-heads responding in line with gender norms and customs.[14]

The second column in the table shows that disagreement also reduces in response to the intervention that tries to reduce asymmetric information (T2). In the control group where co-heads did not receive the same information, female co-heads reported they were involved but male co-heads disagreed on 19.8 percent of decisions. In the treatment group where both co-heads start off with exactly the same information, disagreement was reduced by 2.7 percentage points. This may indicate that female co-heads may hide decision-making from the male co-head, or it may be that male co-heads are not aware of the various decisions female co-heads make.

The third column regresses H_d—an indicator of the sensitivity of the particular

decision to prevailing gender norms defining it as a male domain—on disagreement about the female co-head's role in decision-making. We do not find that the indicator is correlated with disagreement.

The fourth column in Table 2 corresponds to equation 3 and includes the indicator for the treatment that challenges norms and customs by projecting a co-operative approach to farming, the indicator for susceptibility of the decision to gender norms, and an interaction between the two. We see that the treatment still leads to a reduction in disagreement. However, and contrary to expectations, we do not find that the intervention reduced disagreement particularly for decisions that are assumed to be in the male domain. This goes against our hypothesis that the change in disagreement in response to intervention T1 is primarily mediated by gender norms and customs.

The bottom panel repeats the analysis, but the dependent variable is now an indicator for instances where the male co-head says he decided but the female co-head says he was not involved in the decision. As we saw earlier, disagreement about the male co-head's role is lower. The first column confirms that in the control group where households were not exposed to the intervention that aims to challenge norms and customs (T1), male co-heads claim a larger role than female co-heads admit in 16.9 percent of decisions. This percentage is not significantly different in the treatment group, which suggests that the role of men in agricultural decision-making is less socially contested.

In the second column, we do see that the intervention aimed at reducing information asymmetries (T2) reduced disagreement. In the control group where

only one of the co-heads was shown a video on what maize farming entails, male co-heads report they were involved but the female co-head disagreed in 18.8 percent of the decisions. In the treatment group where both co-heads were exposed to the same information, disagreement was reduced by 3.1 percentage points. This suggests that male co-heads may hide decision-making from the female co-head, or that the female co-head is not aware of all the decisions that the male co-head makes.

The third column in the table shows no significant correlation between spousal disagreement related to the role of the male co-head and the indicator that attempts to measure how sensitive a decision is in terms of gender norms defining it as a male domain. Apparently, the likelihood that the male co-head reports he was involved while the female co-head claims he was not is significantly higher for decisions that were judged to be more in the male domain (specifically, the decisions to sell, plant maize, and fight striga) than for decisions that were seen less a responsibility for the man (the decision on when to weed). However, the statistically insignificant coefficient of the interaction term of the intervention challenging norms and customs and the indicator that captures if the decision is typically in the male domain in the fourth column again runs against the hypothesis that disagreement is primarily driven by gender norms and customs.

6.2 Labor Provision

For labor contributions, we define the three categories of (dis)agreement as follows. A first category (1) consists of cases where there is agreement on a spouse's

labor contribution. For disagreement, we differentiate between cases where (2) the co-head reported having spent more time on a particular task than the other co-head thinks they did, and (3) the co-head reported having spent less time than the other co-head thinks they did. Labor contribution (and hence disagreement about it) is also measured at the plot level. We consider disagreement related to labor provided by the female co-head and disagreement related to labor provided by the male co-head separately.

As mentioned above, we consider labor to be a "bad", with co-heads preferring to work less rather than more. The category of interest is therefore category (3), where co-heads are putting in less hours than what the other co-head believes. The fact that one spouse is putting in less hours than the other spouse believes may be due to one spouse reneging on their responsibilities, but it may also be because one spouse is simply not aware of the full range of activities the other preforms.

One complication here is that labor time is measured as a continuous variable (days spent on the activity), so it becomes necessary to define agreement or disagreement based on how close reported labour time estimates provided by spouses are.[15] Furthermore, there may be substantial differences in total number of days spent on the different activities. For example, for an activity such as spraying pesticides, female co-heads report that they spend on average only 0.4 days. Female co-heads report that they spend considerably more time on weeding (23.8 days). These differences in magnitude will also have consequences for the likelihood that co-heads agree, and it seems hard to argue that disagreement of one hour for spraying pesticides is directly comparable to disagreement of one hour

in estimated time spent on weeding. Our solution is to first standardizing hours worked for each activity, such that differences in reporting between spouses of days worked on, for example, weeding by a co-head become directly comparable to differences in estimates between spouses of time spent of a co-head on, for instance, spraying. Second, based on these standardized variables, we construct an indicator variable for agreement if estimates are "close enough" to each other. Specifically, if the (standardized) labor time difference is within one standard deviation of the average time reported by male and female co-head, we consider there is agreement.[16]

The top panel of Table 3 shows that co-heads again generally agree on the labor contribution of the female co-head. Agreement seems to be highest for the female co-head's role in spraying. This is not surprising because spraying pesticides involves carrying a heavy knapsack sprayer and handling dangerous substances, and is generally considered to be the responsibility of the male co-head in the household. As such, in most cases co-heads agree that the female co-head had no role in this activity. This is also reflected in scores of the experts, who overwhelmingly state this is a typical male task (87/100).

The table further shows that agreement is lowest for female co-head's labor provision in weeding, which the experts claim is predominantly a female task. Interestingly, we find a relatively high share of plots where the female co-head says she worked more than what the male co-head believes. But there are also instances where female co-heads claim they worked less than what the male co-head thinks. For example, on 15 percent of the plots, there are indications that the female co-

head worked less on her weeding activities than what the male co-head believes. Pearson χ-squared tests comparing rows 2 and 3 show that we reject equality of the two disagreement categories for all labor types, suggesting that disagreement on female co-heads' labor time is not caused by random measurement error alone. We also reject the null hypothesis that disagreement about the female co-head's labor contribution is equal across different labor categories, based on a Wald test after estimating equation 1 (p-value = 0.000). This again establishes that discord can not be explained by cognitive differences between spouses alone (i.e., cognitive bias or asymmetric measurement error).

The bottom panel of Table 3 shows results for disagreement about the male co-head's labor contribution, which are similar to the results discussed above. Instances where the male co-head reports to be putting in less time than what the female co-head thinks are relatively high for labor allocated to spraying, a typical male activity that is also difficult to monitor according to our experts. Surprisingly, category 3 disagreement is equally high for weeding, a typically female task. Pearson χ-squared tests again reject random measurement error and the Wald test rejects cognitive bias as driving disagreement (p-value = 0.000).

Next, we conduct a series of regressions to test if disagreement reflects information asymmetries with respect to labor contributions, or whether disagreement has its origin in norms and expectations about who, according to society, should do most of the work on the different tasks. The top panel in Table 4 reports results where the outcome variable is the proportion of activities on which the female co-head reports to have worked less than what the male co-head believes; the bot-

tom panel reports on regressions where the dependent variable is the proportion of activities on which the male co-head reports to have worked less than what the female co-head believes.

As evidenced in the results in the upper panel, neither the intervention reducing information asymmetries (T2) nor the intervention challenging customs and norms (T1) seems to have an effect on the proportion of activities on which the female co-head reports to have worked less than what the male co-head believes. We find the proportion of activities on which the female co-head reports to have worked less than what the male co-head believes to be lower for activities that are considered in the male domain. More surprisingly, we also find that the proportion of activities on which the female co-head reports to have worked less than what the male co-head believes is lower for activities that are harder to monitor, which goes against the hypothesis that women try to hide from their husbands that they work less than agreed. We do not find any significant interaction effects between the intervention challenging customs and norms and the indicator for male domain sensitivity. In the bottom panel, we also find no evidence that our interventions affect the likelihood that male co-heads report putting in less labor time than female co-heads believe.

7 Conclusion

Household surveys that are serious about capturing gender-related insights on intrahousehold decision-making, allocation of labor, and household assets often

collect data from separate interviews with male and female respondents. This is an important means of reducing biases introduced by responses from the (typically male) household head or "most knowledgeable person" in the household, and represents an important advancement in the study of intrahousehold power dynamics, especially in non-separable agricultural households where production and consumption decisions are so closely intertwined. A common finding in these surveys is that male and female co-heads often give substantially different answers to the same questions. While some discordance is inevitable due to random measurement error, recent studies have searched for patterns in this disagreement, and suggest that systematic disagreement between spouses may be key in understanding these intrahousehold dynamics.

In this study, we follow Ambler et al. (2021) and reject the notion that all disagreement between male and female co-heads in monogamous Ugandan maize-farming households is due to random measurement error or cognitive bias due to spouses differently understanding or interpreting the questions. We then test if discord is mainly driven by co-heads possessing only partly overlapping information sets (hiding), or if it is due to co-heads responding in line with what society expects from them given prevailing gender norms and roles (pleasing). This is done through a field experiment, with one video-based intervention designed to provide co-heads with equal information to facilitate mutual monitoring and another video-based intervention designed to encourage spouses to view maize farming as a cooperative or joint household enterprise rather than the domain of the male co-head (as society tends to). We explore possible impact pathways by looking at

conditional average treatment effects, as we expect that the interventions would be most effective for decisions, activities and assets that are easier to hide or more susceptible to gender norms and customs.

We find that co-heads generally agree with each other. Disagreement can not be fully explained by either random measurement error nor cognitive bias alone. Rather, we find that disagreement about the role of the female co-head in decision-making was reduced after co-heads were exposed to our intervention designed to reduce the influence of gender norms and customs. We also find that disagreement about the role of both male and female co-heads in decision-making reduced in response to our intervention designed to reduce information asymmetry. We did not find that the intervention designed to reduce the influence of gender norms and customs was more effective for decisions that are considered to be more in the male domain. When looking at disagreement related to labor contributions of the female and male co-heads respectively, we did not find that the intervention designed to reduce information disadvantages of one spouse had an impact, nor that activities that are more easily hidden are more likely to result in disagreement. We also did not find that the intervention challenging role congruity, gender norms and customs made a difference, or more so for activities defined as typical male tasks according to gender norms and roles.

Notes

[1]In the literature, this type of disagreement is interpreted in different ways. For instance, Ambler et al. (2021) note this is consistent with women (intentionally or unintentionally) hiding decisions from their husband, while Annan et al. (2021) consider this proof of women taking power. We follow Ambler et al. (2021) in interpreting this as instances where the female co-head could be hiding her decisions or the husband simply is not cognizant of the full range of decisions that she makes.

[2]It is important to note the implicit assumption that asymmetric measurement error has its origin at the level of the individuals within the household (for example the female co-head has lower education leading her to systematically underestimate effort), and so should not lead to heterogeneity within the household. Therefore, instead of referring to this as asymmetric measurement error, we see this more as bias caused by factors that emanate from the individual level. Generally, this individual level variation will manifest itself in differing cognitive capacities of co-heads and differences in how questions are interpreted by male and female co-heads (Ghuman et al., 2006). In this paper, we will refer to this type of disagreement as cognitive bias, rather than categorizing this as a type of measurement error.

[3]The techniques and inputs that are demonstrated in the videos are the ones recommended by the National Agricultural Research Organization (NARO) and are also used by the public agricultural advisory system. More details can be found in [placeholder for reference removed for double blind review].

[4]A third version of the video features only a female actor, but is not used in this study.

[5]We show the version of the video that features a couple (male and female actor-farmers), that is, the video used in the treatment group of the previous intervention.

[6]We made sure that in about half of the cases the video was shown to the male co-head alone and in the other half of cases to the female co-head alone.

[7]We will refer to decision making here to keep the exposition simple, but in the analysis we also consider disagreement between spouses on labor contributions.

[8]This part of the analysis is only done for disagreement related to labour time allocations and not decision making, as it is hard to operationalize H_d as an indicator denoting how easy it is to monitor particular decisions.

[9]NARO recommends that maize planting start immediately after the first rains of the season. This often results in significant time pressure on household members' labor time, especially when large areas need to be planted.

[10]There is a wide range of seed methods used by farmers in Uganda. While some simply broadcast seeds, NARO recommends row planting because it results in significantly higher yields since it reduces competition between plants for sunlight and soil nutrients. Farmers also often plant more than one seed per mound because they fear some seeds may not germinate. However, planting more than one seed per mound also tends to increase competition for light and nutrients, leading to stunted plant growth. It is therefore recommended to use only one seed per mound and engage in gap filling when seeds do not germinate after one week.

[11]We convert the indicator to a dummy to keep the analysis simple. The threshold was chosen to maximize variability. That is, we chose a cut-off such that we obtained approximately 50 percent of 1s and 50 percent of 0s. The results have proven not to be sensitive to conversion into a binary indicator nor the choice of the threshold for defining the binary indicator. The same is true for H1 below.

[12]This includes cases where neither spouse says that the wife was involved in decision making as well as cases where both spouses say that the wife was involved in decision making (either alone or as part of the couple).

[13]We confine attention to category 2 only (instead of total disagreement which pools category 2 and 3) because we consider decision making a good (as opposed to labor, which we will consider a bad below). If a decision, action, or consequence is considered desirable for the individual, spouses may want to hide information about it and under-report, in which case category 2 is the relevant outcome. If a decision, action, or consequence is considered undesirable for the individual, spouses may want things to appear better than reality and over-report, in which case category 3 is the relevant outcome.

[14]The underlying assumption here is that the co-head that is farthest from the—unknown—truth adjusts most towards this truth.

[15]It almost never happens that spouses completely agree on the number of days that a co-head worked on for example weeding, but some are very close (for instance 22 and 23 days).

[16]A threshold of one standard deviation was chosen to make sure there are sufficient levels of disagreement, as it is well know that outcomes with limited variation contribute little power in experiments. However, we also reran the analysis with thresholds of 0.5 standard deviations and 1.5 standard deviations to show that the choice of the threshold does not affect the conclusions. Results are available from authors upon request.

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Table 1: Agreement and disagreement about spouses' roles in agricultural decision making

	plant maize	timing of planting	spacing and seed rate	strategies to fight striga	frequency weeding	sell maize
	female co-head decides but male co-head disagrees					
(1) Agree:	0.63	0.64	0.64	0.62	0.65	0.67
Disagree:	0.37	0.36	0.36	0.38	0.35	0.33
(2) Female co-head says she decided but male co-head says no	0.20	0.19	0.21	0.23	0.21	0.13
(3) Male co-head says female co-head decided but female co-head says no	0.17	0.17	0.15	0.15	0.14	0.20
p-value (2)==(3):	0.000	0.105	0.000	0.000	0.000	0.000
Number of plots:	3,723	3,723	3,723	3,632	3,723	2,548
	male co-head decides but female co-head disagrees					
(1) Agree:	0.74	0.72	0.75	0.68	0.74	0.67
Disagree:	0.26	0.28	0.25	0.32	0.27	0.34
(2) Male co-head says he decided but female co-head says no	0.16	0.18	0.16	0.20	0.18	0.23
(3) Female co-head says male co-head decided but male co-head says no	0.10	0.10	0.09	0.12	0.09	0.11
p-value (2)==(3):	0.000	0.000	0.000	0.000	0.000	0.000
Number of plots:	3,723	3,723	3,723	3,632	3,723	2,548
Male task score (/100):	62	50	55	60	41	82

Table 2: Disagreement about decision making

	(1)	(2)	(3)	(4)
	female co-head decides but male co-head disagrees			
constant	0.226	0.198	0.191	0.225
	(0.016)	(0.011)	(0.013)	(0.019)
challenge gender norms (T1)	-0.055**			-0.066***
	(0.022)			(0.026)
reduce info asymmetry (T2)		-0.027*		
		(0.018)		
male domain (H1)			0.013	0.001
			(0.011)	(0.017)
interaction (T1*H1)				0.024
				(0.021)
Number of observations	4076	6477	4076	4076
	male co-head decides but female co-head disagrees			
constant	0.169	0.188	0.153	0.166
	(0.014)	(0.010)	(0.011)	(0.018)
challenge gender norms (T1)	-0.012			-0.025
	(0.018)			(0.023)
reduce info asymmetry (T2)		-0.031**		
		(0.016)		
male domain (H1)			0.020*	0.006
			(0.010)	(0.015)
interaction (T1*H1)				0.028
				(0.021)
Number of observations	4076	6477	4076	4076

Note: Standard errors are clustered at the household level. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 3: Agreement and disagreement about spouses' roles in labor contributions

	land prepare	planting	weeding	spraying	harvesting
	female co-head reports to have worked less than what male co-head believes				
(1) Agree:	0.66	0.67	0.61	0.79	0.69
Disagree:	0.35	0.33	0.4	0.21	0.31
(2) female co-head says she worked more than male co-head thinks	0.19	0.19	0.25	0.14	0.17
(3) male co-head says female co-head worked more than female co-head admits	0.16	0.14	0.15	0.07	0.14
p-value (2)==(3):	0.001	0.000	0.000	0.000	0.006
Number of plots:	3,181	3,373	3,096	3,377	3,350
	male co-head reports to have worked less than what female co-head believes				
(1) Agree:	0.61	0.68	0.62	0.60	0.70
Disagree: Disagree:	0.39	0.31	0.38	0.41	0.31
(2) male co-head says he worked more than female co-head thinks	0.26	0.17	0.21	0.24	0.17
(3) female co-head says male co-head worked more than male co-head admits	0.13	0.14	0.17	0.17	0.14
p-value (2)==(3):	0.000	0.002	0.000	0.000	0.001
Number of plots:	3,217	3,373	3,137	3,383	3,376
Male task score (/100):	56	46	28	87	48
Ease of monitoring (/100):	57	74	57	45	65

Table 4: Disagreement about labor provision

	(1)	(2)	(3)	(4)	(5)	(6)
	female co-head reports to have worked less than what male co-head believes					
constant	0.130	0.128	0.146	0.143	0.143	0.141
	(0.012)	(0.008)	(0.011)	(0.009)	(0.016)	(0.011)
challenging gender norms (T1)	0.006				0.007	
	(0.017)				(0.022)	
reduce info asymmetry (T2)		0.009				0.005
		(0.014)				(0.020)
male domain (H1)			-0.032**		-0.031*	
			(0.013)		(0.019)	
hard to monitor (H2)				-0.021**		-0.023*
				(0.010)		(0.012)
interaction (T1*H1)					-0.001	
					(0.026)	
interaction (T2*H2)						0.006
						(0.022)
Number of observations	3188	5037	3188	5037	3188	5037
	male co-head reports to have worked less than what female co-head believes					
constant	0.169	0.144	0.171	0.140	0.172	0.134
	(0.013)	(0.008)	(0.011)	(0.009)	(0.016)	(0.011)
challenge gender norms (T1)	-0.014				-0.001	
	(0.018)				(0.023)	
reduce info asymmetry (T2)		0.011				0.020
		(0.014)				(0.020)
male domain (H1)			-0.024*		-0.008	
			(0.014)		(0.021)	
hard to monitor (H2)				0.012		0.016
				(0.011)		(0.013)
interaction (T1*H1)					-0.031	
					(0.028)	
interaction (T2*H2)						-0.015
						(0.024)
Number of observations	3184	5060	3184	5060	3184	5060

Note: Standard errors are clustered at the household level. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.