Let's Talk About the Money:
Spousal Communication, Expenditures and Farm Production

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Abstract

There is a burgeoning literature highlighting asymmetric information among household members. However, little is known about the source of the asymmetry and its effect on efficiency. Using a unique survey of Ghanaian households, we examine the accuracy of spousal cross-reports and the effect of discrepancies on farm production. We find that information problems pertain to scale, the quantity of resources, and scope, the distribution of resources, as well as allocation decisions on the margin (Engel curves). Moreover, we find that information asymmetries lead to inefficiency in production, and the effect is equivalent to about 15% of the variation across households.

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A spate of recent studies has documented imperfect information among household members, and these information problems have been found to affect allocation within the household, shifting resources towards goods preferred by the individual with superior information (see, for example, Ashraf 2009; Chen 2012). This has potential implications not only for development programs (*e.g.*, the transparency of program eligibility/benefits) but also for more organic elements of the development process (*e.g.*, migration, women's employment), to the extent that they affect the flow of information among household members. However, we do not yet know whether and to what degree productivity and efficiency are affected. If, for example, significant resources are invested in monitoring and enforcement, then growth and development may be hindered. Alternatively, asymmetric information may simply induce a reallocation – information disparities may reinforce specialization in certain goods, prompt inter-temporal substitution, etc. – that, while affecting distribution among parties, has little or no effect on Pareto optimality.

This gap in the literature is largely the result of data limitations. Field and lab experiments can create variation in access to information and assess how it affects choices but, unless subjects are followed after the experiment has concluded, we often cannot ascertain the ultimate effect of those choices, or what other (compensating) choices may be made in the interim. In contrast, survey data typically requires that we examine allocation patterns to infer asymmetric information, making it difficult to then identify causation in the opposite direction. In this article, we utilize a unique dataset that includes cross reports of spouses' income and expenditures. This gives us clear measures of imperfect information and allows us to assess both its source and its impact on farm production and efficiency.

Our descriptive analysis reveals large discrepancies in aggregate income and expenditure, as well as in spending and budget shares for specific categories of goods. These discrepancies

pertain to both scale – the quantity of resources – as well as scope – the allocation of resources – and vary widely by gender and across goods. Moreover, husbands and wives have inaccurate perceptions of not only their spouse's absolute spending but also their spending behavior on the margin, as evidenced by our estimation of Engel curves using both actual and perceived expenditures. These discrepancies are indicative of imperfect information among spouses and are found to have a significant negative effect on agricultural output and profit, equivalent to about 50% of the sample mean for men. We also find suggestive evidence of crop choice as a response to imperfect information. However, discrepancies due to recall error are not strongly correlated with farm outcomes, and recall error, as opposed to strategic behavior, appears to account for the large majority of observed discrepancies. This suggests that, although spouses may be inattentive towards each other's expenditures and income, this has little effect on the household's ability to optimize. Conversely, our results also suggest that an exogenous change in information quality, even when it is minimal, can have very large effects on efficiency.

In the following section, we briefly describe our data and the socio-cultural context. We then present a descriptive analysis of various dimensions of asymmetric information, followed by an empirical analysis of the effect of discrepancies on farm outcomes. The final section provides some discussion and directions for future research.

Data and Context.

Data are drawn from a 1996-98 Ghanaian household survey covering four village clusters in the Akwapim South district of the eastern region of Ghana. The survey was conducted in 15 rounds in five- to six- week intervals. Sixty married couples (or triples) were randomly selected from each village, except for Village 3 in which all eligible households were selected. Respondents were interviewed in private by enumerators of the same gender. Survey questionnaires covered a

vast range of topics, including socio-demographic characteristics, farm and non-farm income, financial assets, expenditures, plot activities (*e.g.*, inputs and output), soil fertility and property rights, among others. The survey is unique in that respondents were also asked to provide cross reports of both income and expenditure, by category.

In Ghanaian households, plots are managed by individual household members. Husbands and wives rarely own, manage, or inherit property together; in fact, husbands are twice as likely to own property with their kin as with their wives (Oppong 1974). The cultivator of a particular plot is responsible for its expenses and makes decisions regarding the type, timing, and amount of inputs to be used during production. And, with the exception of certain communal crops, which are under the control of the husband for redistribution within the household, cultivators are the residual claimants, retaining control of both output and revenue (Baden et al. 1994; Goldstein and Udry 1999a, 1999b; Goldstein and Udry 2008). There is also a stark division of labor by gender, with men generally responsible for initial land clearing while women are responsible for sowing, weeding, harvesting, and transporting produce. Household members often provide labor on each other's plots, but typically only at certain stages of the production process (Abbas 1993; Chao 1999; Lloyd and Gage-Brandon 1993).

There is also very little coordination on the consumption side; husbands and wives do not pool resources but rather have separate income and expenditure streams (Abu 1983; Clark 1999; Goldstein 2004; Leach 1991). Women have little incentive to pool income with their husbands, due to marriage insecurity, and wives' incomes are considered neither supplementary to nor part of the family income (Vercruijsse *et. al.* 1974). Men are expected to contribute "chop money" or staple grains for food and to pay for children's school fees, while women are responsible for

childrearing, cooking, and cleaning (Baden et al. 1994; Bukh 1979; Chao 1998). Women also contribute to food, medical, and farm expenditures, although it is not solely their responsibility.

The norms surrounding both production and consumption tend to increase the scope for asymmetric information among spouses by creating separate "spheres" for influence and participation, particularly within farm households. We limit our attention in this article to households cultivating at least one plot during the survey period. Expenditure data, own and cross reports, are available in three rounds. Respondents were permitted to select the most convenient reporting period for expenditures, so all values are standardized to represent average monthly expenditure. Additionally, respondents reported gross farm sales for each crop in each round, while their spouses were asked to provide a cross report aggregating across crops and rounds. Consequently, we aggregate data on farm outcomes (sales, output, profit) to be consistent with the reporting period for spousal cross reports, which allows us to link farm production/ income data with expenditure data in two rounds. These two periods coincide approximately with the major and minor cropping seasons, respectively, in this region.

Comparing Cross Reports.

To assess the potential sources of asymmetric information, we look first at cross reports of total expenditure and gross farm revenue. We aggregate expenditures on specific goods to obtain a measure of total expenditure for each spouse, as well as a cross report from his/her spouse. From Table 1, we see that discrepancies in both expenditure and income are very large, for both husbands and wives, and a large majority of respondents under-estimate the resources available to their spouses. For expenditure, we observe absolute discrepancies of around 75%, with both spouses displaying roughly the same degree of accuracy, although husbands are slightly more likely to under-estimate their wives' expenditures. However, since respondents were asked to

estimate their spouses' expenditure by category rather than in total, some of this inaccuracy may result from the lack of any sort of "adding up" constraint.

Discrepancies in farm income are even greater, with wives estimates diverging from the true values by over 100% on average, although the discrepancies are more evenly split between positive and negative. The magnitude of these discrepancies is somewhat surprising, given that wives are often tasked with selling output from their husbands' plots. However, it should be noted that the reports here refer to gross revenue, and not output quantity or value. Thus, some of the estimation error may be reflect imperfect information about the disposition of output (*e.g.*, own consumption versus market sale), rather than the resources available to one's spouse. Finally, we have cross reports of the amount of chop money transferred between spouses. In this case, husbands and wives are reporting on a quantity that both have observed firsthand, so this measure can be seen as a proxy for baseline recall accuracy between spouses, related to inattention, beliefs, prior history, etc. The discrepancy here is smaller, on average, although still roughly 60%. Despite the caveats, the magnitude of these discrepancies suggests imperfect, and quite flawed, information with regard to scale – *i.e.*, the quantity of resources. Moreover, a significant portion of this seems to be related to some inherent or fixed information bottleneck, as opposed to idiosyncratic shocks or stochastic efforts to strategically conceal resources.

Spouses are also quite inaccurate in estimating each other's expenditures on specific goods (Table 2). Husbands are generally more accurate and less likely to under-estimate their wives' absolute spending, with the exception of personal goods and purchased food. The discrepancies are moderate, less than 10% of total expenditure in most cases (columns 3-4). But even the smallest discrepancies are economically meaningful: for education, the discrepancy between husbands' perceptions and wives' actual spending is just 1.1% (of wives' total

expenditure), but wives' only commit about 1% of their total expenditure to education. Thus, husbands' perceptions of absolute education spending are off by more than 100%, on average. However, as we saw in Table 1, both husbands and wives tend to under-estimate each other's total expenditures, by nearly 80%. It could be the case that spouses inaccurately estimate the level of expenditure (scale) for their spouses but have accurate beliefs about the proportion of expenditures devoted to each category (scope). In fact, discrepancies with respect to expenditure shares are somewhat larger, in most cases, and wives are more accurate, with the exception of education and recreation (columns 7-8). And, again, even the smallest discrepancies are economically meaningful: although husbands' estimates of their wives' expenditure share for recreation is accurate within 1.7 percentage points, wives spend only 1.1% of total expenditure on recreation, and husbands are again off by over 100%. It appears that, in Ghanaian households, imperfect information pertains to both scale and scope, to roughly the same degree.

Thus far, we have examined static information discrepancies. But this may not be the correct way to assess the economic relevance of imperfect information. Discrepancies at a single point in time may reflect strategic attempts to conceal income/expenditures, but also various types of idiosyncratic measurement error (inattention, recall, miscommunication, etc.). And what is relevant for efficiency and coordination are marginal, not absolute, decisions. Accurate information about marginal behavior is also what allows household members to re-optimize efficiently in a dynamic context. We assess whether spouses accurately perceive marginal allocation decisions by estimating Engel curves. We run two specifications for each expenditure category: one utilizing the respondent's own report, and one using his/her spouse's cross report (total and by category). Our specification follows Working (1943) and Leser (1963):

$$s_i^j = \alpha^j + \beta^j \ln\left(\frac{x_i}{n_i}\right) + \delta^j \ln(n_i) + \sum \theta_k^j \left(\frac{n_{ki}}{n_i}\right) + \pi^k z_i + \mu_{vt} + \varepsilon_i^k$$

where s_i^j is the share of total expenditure devoted to good *j* by individual *i*; x_i is total expenditure; n_i is the total number of individuals in the household; n_{ki} is the number of individuals in the household in the *k*-th age-sex category; z_i is a vector of other individual characteristics (education, age), and μ_{vt} are village-round fixed effects. Additionally, given that several studies have found differing expenditure patterns for men and women (see, for example, Phipps and Burton 1998; Collins 2013), we specify

$$\alpha^j = \alpha_0^j + \alpha_w^j wife_i \quad \text{and} \quad \beta^j = \beta_0^j + \beta_w^j wife_i$$

Despite our use of relatively broad expenditure categories, there are still many cases of zero expenditure; we use a Tobit model to account for this.[1] Estimates in Table 3 suggest that, in fact, individuals are reasonably accurate with respect to their spouses' Engel curves. For husbands, coefficients on total per capita expenditure estimated from cross reports have the same sign and are within one standard deviation of the coefficients estimated from own reports for three out of eight categories – housing, purchased food and transportation. For wives, the same is true for four of the eight categories – education, durable goods, clothing and recreation. That is, wives correctly perceive their husbands' Engel curves for three broad expenditure categories, and husbands correctly perceive their wives' Engel curves for four categories. Interestingly, the categories for which husbands most accurately perceive their wives' Engel curves are also those for which their cross reports of expenditure levels are most accurate, while the opposite is true for wives. Husbands appear to have a good sense of both scale and scope for certain goods, while wives have a good sense of scale for some goods and a good sense of scope for an entirely different sent of goods.

The accuracy of perceived expenditures and Engel curves is also not clearly related to the public or private nature of the good. This is somewhat surprising, as public goods would seem, *a*

priori, to be both more easily and more readily observable. However, some public goods are produced by the household with inputs purchased in the market, in which case expenditures may be difficult to ascertain even though outcomes are easily observed. And, if there are gender divisions even within expenditure categories (*e.g.*, men pay for major home repairs/renovations, while women pay for routine home maintenance), this could, explain why husbands and wives differ in their accuracy for the same (public good) category. In sum, our analysis of expenditure cross reports suggests a great deal of heterogeneity by gender and across expenditure categories, as well as important differences in scale versus scope. Perhaps most importantly, we find that imperfect information is not only prevalent but also salient – while much of the observed discrepancies may be due to inattention or classical measurement error, as suggested by the differing reports of chop money, spouses also have inaccurate beliefs about each other's marginal behavior (Engel curves), which is likely to result in inefficiency in consumption.

Information Discrepancies and Farm Outcomes.

Several studies have documented inefficiency in household production (Duflo and Udry 2004; Goldstein and Udry 2008; Dubois and Ligon 2010). However, to the best of our knowledge, only one study attempts to identify the source of this inefficiency; Akresh *et. al.* (2013) show that altruism among spouses may preempt cooperation by increasing payoffs in the non-cooperative equilibrium. Here, we look at whether imperfect information, already shown to be prevalent among spouses in our sample, may compromise efficiency. There are many potential sources of imperfect information – inattention, recall error, strategic behavior, monitoring costs – but, whatever the source, imperfect information creates uncertainty about returns, making it difficult to allocate resources efficiently.

We examine both plot output and profit and utilize discrepancies in farm income and total expenditure as measures of imperfect information. Basic descriptive statistics are presented in Table 4. Output value is calculated as the quantity harvested of each crop, valued at the prevailing market price. Profit is calculated as output value net of input and hired labor costs (cash and in-kind). Clearly, men are much more active in farming; on average, their plots are much larger, and their output and profit are much higher. Men also have higher quality plots, on average, with a larger proportion having desirable soil (clay) and toposequence (mid-slope and bottom). And there are clear differences in crop choice; the majority of women's plots are planted with cassava, while men have a larger proportion of plots in cash crops, predominantly pineapple (Goldstein and Udry 2008). To account for these factors, we express outcome Q (output/profit) for plot i, planted with crop c, in round t, in village v, in household h, as:

$$Q_{ictvh} = \boldsymbol{X}_{ictvh}\beta + \gamma \boldsymbol{G}_i + \delta_0 D_{tvh} + \delta_1 U_{tvh} + \mu_h + \lambda_{ctv} + \varepsilon_{htci}$$

where $\boldsymbol{X}$ is a vector of plot characteristics (size, soil type, toposequence); $\boldsymbol{G}$ is a vector of cultivator characteristics (gender, age); D is the discrepancy in expenditure/income, measured as the absolute difference between own and cross reports, scaled by the value of the own report; and U is an indicator for cross report < own report, to allow over- and under-estimates to have differing effects. Additionally, we control for village-crop-round fixed effects (λ) to account for local, crop-specific, time-varying shocks.[2] As shown in Udry (1996), efficient farm production implies that, controlling for land quality, crop choice, and shocks to the production process, farm outcomes should be unaffected by cultivator characteristics, including information about spousal expenditure/income.

In order to estimate the causal effect of imperfect information, we must also account for the fact that households differ in their proclivity for cooperation. Some couples may be unwilling

to share both information and farm inputs, resulting in a spurious correlation between expenditure/income discrepancies and farm outcomes. With panel data, we can employ household fixed effects to account for any such characteristics that are fixed over our study period (~18 months). Because we are focusing on spouses, who have interacted repeatedly and will continue to do so for the foreseeable future, it seems reasonable to assume that their beliefs about each other are stable in the short- and medium-run. But, shocks to farm production may also affect knowledge of spouses' expenditures/income. Ideally, we would use instrumental variables to address this issue; however, it is difficult to identify an exogenous source of variation that differentially affects the information available to husbands and wives.[3] Village-crop-round fixed effects will capture the effect of any local time-varying shocks, but there may be individual-specific shocks as well, so we return to this issue again below. Note that, with the inclusion of household fixed effects, our specifications focus on *efficiency* rather than productivity per se. That is, we examine the allocation of inputs across plots *within a household* (*i.e.*, the deviation of output/profit from the household mean, conditional on plot characteristics, shocks, and the household's specific constraints on technology, access to inputs, propensity for cooperation, etc.) rather than differences in the level of productivity across households. Thus, a negative coefficient on the expenditure/income discrepancy indicates that, when information is particularly poor, whether about a certain individual or in a certain time period, output and profit will be low, relative to the household mean, and the household will be further away from its own efficient frontier.[4]

In Panel A of Table 5, we see that discrepancies in total expenditure significantly reduce both output value and profit[5] at the plot-level, particularly when expenditures are being under-estimated by one's spouse. That is, the more imperfect is the husband's information about his

wife's expenditure, the lower is the wife's output/profit, and vice versa. This effect, although precisely estimated, is quite small: a 10 percentage point increase in the expenditure discrepancy reduces output (profit) by roughly 4100 (4700) cedis, equivalent to less than 1% (2%) of men's average output value (profit). However, if the spouse believes his/her spouse's expenditures are less than they actually are, there is a penalty of 200,000 (239,000) cedis, equivalent to about 45% (67%) of men's average output value (profit). Allowing discrepancies about husbands' and wives' expenditures to have differing effects (columns 2 and 4) gives very similar results, although under-estimates of wives' expenditures now have essentially no effect. The similarity between the point estimates for output value and profit suggests that information asymmetries are primarily affecting the quantity of output, rather than production costs. This is consistent with an inefficient allocation of inputs within households, rather than a reduction in the scale of production.[6] The negative effects of imperfect information also suggest that our results are not being driven by unobserved shocks. Akresh (2008) finds that households are more likely to exhibit Pareto efficiency in the presence of adverse production shocks; that is, shocks that reduce output/profit tend to improve coordination and information flows within the household, contrary to our results.

In Panel B of Table 5, we see that discrepancies about farm income have no significant effect on either output or profit, and the point estimates are much smaller in magnitude. Here, columns 1 and 3 are our preferred specification, as the additional interactions are estimated imprecisely and tend to inflate all of the point estimates. Recall that our measure of income discrepancy pertains to farm revenue, which is related to both output and marketing decisions. Thus, discrepancies here may be more indicative of noise than imperfect information, prompting individuals to ignore these discrepancies when making production decisions, in favor of the more

enlightening expenditure discrepancies. However, cross reports of income are also more limited than those for expenditure, particularly for wives, so we cannot rule out sample selection as an explanation for the differences between Panels A and B. The absence of a significant relationship between income discrepancies and output/profit does, however, indicate that variation in output/profit is not affecting the quality of information about spousal income. This provides suggestive evidence ruling out reverse causation as an explanation for our results.

With respect to imperfect information, it appears to be the extensive margin that matters most, not the intensive margin. Spouses seem acutely aware of imperfect information but do not place as much weight on the quality of the information as the existence of the imperfection. A formal behavioral model is beyond the scope of this article, but we offer some conjectures about this result, in the hope of guiding future research. First, we note that, even when the fixed effects successfully isolate exogenous variation in information quality, the ultimate effect on farm output/profit may still operate through different channels. For example, suppose one of the husband's cows becomes ill and, as a result, he misses a trip to the market with his spouse, limiting his ability to observe her purchases. The resulting discrepancy in their reports of her expenditure may then be due to the husband's inattention, his failure to acquire the information in another (perhaps more costly) way, or the wife's strategic behavior, her attempt to conceal the purchases he could not observe. The importance of the extensive margin seems to be more consistent with inattention or monitoring costs as a source of imperfect information, rather than strategic behavior. That is, a husband who does not pay attention to his wife's expenditures (and, therefore, under-estimates her spending) also will not pay attention to the need for inputs on her plots, pulling her away from the efficient frontier. Alternatively, if it is too expensive to acquire information about his wife's expenditures, the husband may incorrectly assess the optimal

allocation of inputs to her plots, again resulting in inefficiency. In both cases, the quality of information is not as important as the fact that it is inaccurate. Conversely, if the wife discovers that her husband is attempting to conceal expenditures, she would again be less likely to coordinate production decisions with him. But, since she will be updating her beliefs about his expenditure as well, she will be more responsive to the quality of her information than to the mere fact that it is imperfect.

Extensions and Robustness.

Although information discrepancies are at the individual-level and not at the plot-level, we conduct a plot-level analysis because it allows us to account for crop-specific shocks. However, one drawback is that it limits our analysis to efficiency conditional on crop choice, and changes in crop choice may be another response to imperfect information among spouses. For example, individuals may be incentivized to substitute away from crops being planted by their spouses when the potential for transparency and cooperation is limited. Thus, we also examine farm outcomes at the individual-level. To do so, we aggregate output value, profit and cropped area across plots cultivated by the same individual and control for land quality using the proportion of total cropped area with various soil types and toposequence. We continue to include household fixed effects to account for time-invariant characteristics that affect both information and farm production, as well as village-round fixed effects to account for local shocks.

Individual level regressions are presented in Table 6. Without appropriate controls for crop-specific shocks, our estimates are less precise but still strikingly similar to the plot-level analysis, and the magnitudes are consistent with an average of 2-3 plots for male cultivators. However, we find that when a husband under-estimates his wife's expenditure, there is a very large significant negative effect on her output and profit at the individual level and essentially

zero effect at the plot level. This suggests that, when husbands are poorly informed with respect to expenditures, wives do not reduce their work effort conditional on the crop that is planted but may switch to crops that are less valuable/profitable overall. Conversely, our point estimates suggest that discrepancies in farm income will increase husbands' output and profit at the individual level, and the effects are very large, although imprecisely estimated. This suggests that, when men are able to conceal some of their earnings, they may substitute towards higher value, higher profit cash crops, even though they do not adjust their work effort conditional on crop selection. The incentive for these actions stems from the relationship between chop money, given by husbands to wives, and spouses' perceptions of each other's resources. When wives have less or husbands have more, husbands must give more; thus, wives gain by minimizing their perceived expenditures while husbands gain by minimizing their perceived income. But, again, we must note that, not only are the point estimates imprecise, but these are only conjectures, as a complete theoretical model is beyond the scope of this article.

Finally, we examine outcomes at the household level, to assess the correlation between asymmetric information and productivity. In this case, our measure of imperfect information needs to be the aggregation of discrepancies, in absolute value, across spouses, and the use of household fixed effects would, therefore, force us to rely on variation across only two time periods, which we find insufficient to produce robust causal estimates. Thus, we forgo household fixed effects and look instead at the discrepancy in spousal reports of chop money. Recall that here both spouses are reporting on the same quantity and one that both individuals have observed directly, so any discrepancy must be somehow inherent – *i.e.*, caused by inattention or recall error, rather than strategic efforts to conceal expenditure/income. Unfortunately, cross reports of

chop money are available in only one survey round, so we utilize this data solely for the household-level analysis, in which fixed effects estimation is infeasible.

Results from the household-level analysis, which maintains the village-round fixed effects, are presented in Table 7. There is a significant negative correlation between discrepancies in reported chop money and household profit, but the magnitude of the effect is quite modest – a 10 percentage point increase in the discrepancy reduces total household farm profits by just 7200 cedis, compared to the sample mean of over 550,000 cedis. While we clearly cannot interpret this as a causal effect, it does suggest that inherent information problems among spouses are correlated with only minor deviations from the efficient frontier. Moreover, it seems unlikely that the causal effect would be much larger in magnitude, as we expect that households with weak preferences for cooperation will have both poor information flows and poor resource flows, which will ultimately prevent them from reaching the efficient frontier.

Conclusion.

In the same way that a bevy of papers in the 1980s demonstrated the need to recognize the household as collective rather than unitary, current research demonstrates the need to recognize household decision-making as potentially non-cooperative. For developing countries especially, the household remains the center of economic activity and the key to growth and poverty alleviation. Thus, we must have a clear and nuanced understanding of the behavior within households and any impediments to efficiency in the intra-household allocation of resources. While these inefficiencies are small relative to national- and global-level misallocations of labor and capital, they will both affect and be affected by broader changes in the global economy.

In this article, we consider asymmetric information among household members as a cause of non-cooperative behavior and inefficiency. We take a broad approach and consider many

different dimensions of asymmetric information, with the intent of highlighting several potential avenues for future research. We find that imperfect information pertains to both scale – the quantity of resources – as well as scope – the distribution of resources – although not always together, and there are stark differences across spouses and across goods. In some cases, individuals have accurate perceptions of their spouses' marginal behavior (Engel curves), while inaccurately estimating the level of expenditure but, in other cases, the opposite is true. Most importantly, we find that discrepancies in cross-reports of expenditure have significant negative effects on efficiency within households. Our empirical specification includes village-crop-round fixed effects to account for local crop-specific shocks as well as household fixed effects to account for unobserved characteristics of spouses that affect both information flows and farm production. We find that, while the magnitude of the discrepancy matters, simply having expenditures under-estimated by one's spouse results in a much larger reduction of output value and profit, relative to other household members. Our conjecture is that this points towards inattention, rather than strategic behavior, as the main source of asymmetric information.

Additionally, we find suggestive evidence of crop choice as a response to imperfect information. Our point estimates are imprecise, but they suggest that men substitute towards cash crops when wives have poor information about their income, while wives substitute toward lower value crops when husbands have poor information about their expenditure. This is consistent with strategic attempts by husbands (wives) to minimize (maximize) chop money. Finally, our household-level estimates suggest that inherent information problems, as represented by the discrepancy in reports of chop money, have a significant but very modest effect on farm profit. Conversely, our plot- and individual level results show that an exogenous decline in information quality has a very large penalty – our preferred estimates imply that for husbands

(wives) profits are approximately 45,000 (43,000) cedis lower at the mean expenditure discrepancy (78.7% and 76.3%), relative to the case of perfect information and, if the discrepancy is an under-estimate, profits are an additional 341,000 cedis lower for husbands. These effects are sizable, given that average output value (profit) in our sample is 459,000 (357,000) cedis for men and 66,000 (55,000) cedis for women.

A formal behavioral model, incorporating different forms of imperfect information, is beyond the scope of this paper but clearly should be a priority for future research. Discrepancies between own and cross reports are very large and have important effects on efficiency, and monitoring costs are likely to be an important determinant of these discrepancies, providing a clear channel for policy intervention. Our broad look at the different dimensions of asymmetric information points to the need for additional data incorporating cross reports, in order to gain a more complete understanding of which dimensions will be most salient in various contexts. The issue of asymmetric information within households is relevant for many elements of the development process. Migration, by putting physical space between household members, clearly increases the potential for information problems. However, migration may also lead to a "feminization" of agriculture, which would eliminate the need for coordination among cultivators, potentially mitigating any adverse effects of imperfect information. Similarly, the growth of off-farm work may both increase the potential for asymmetric information and reduce the need for coordination, having an ambiguous effect on intra-household efficiency. On the other hand, concerns about the distributional effects of asymmetric information and strategic behavior may also affect incentives to invest in migration and off-farm work. We hope that future research will consider in greater depth the myriad dimensions of asymmetric information

among household members, as well as the potential implications for efficiency throughout the development process.

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Table 1. Aggregate Discrepancies

	Husband	Wife
Total Expenditure	254138	152192
	(278027)	(88239)
Gross Farm Income	953625	37198
	(2756448)	(73700)
Observations	258	110
Expenditure Discrepancy[a]	0.787	0.763
	(1.206)	(0.315)
Expenditure Under-Estimate[b]	0.841	0.900
	(0.366)	(0.301)
Observations	258	110
Income Discrepancy[a]	1.249	0.939
	(2.510)	(0.213)
Income Under-Estimate[b]	0.770	0.590
	(0.422)	(0.494)
Observations	216	64
Chop Money Discrepancy[a]	0.604	
	(1.075)	
Observations	102	

Standard deviation in parentheses.

Data: 1996-98 Ghanaian Household Survey, www.econ.yale.edu/~cru2//ghanadata.html

[a]Calculated as |cross report-own report|/own report

[b]Proportion with cross report<own report.

Table 2. Expenditure Discrepancies for Specific Goods

	Expenditure Share		Exp. Discrepancy[a]		Under-Estimate[b]		Share Discrepancy[c]	
	Husband	Wife	Husband	Wife	Husband	Wife	Husband	Wife
Education	7.176	0.979	5.975	1.135	0.580	0.322	10.90	3.510
	(10.92)	(2.19)	(9.51)	(2.22)	(0.49)	(0.47)	(18.49)	(8.86)
Health	7.899	2.714	8.267	3.592	0.680	0.567	10.53	11.11
	(11.68)	(4.26)	(12.43)	(7.72)	(0.47)	(0.50)	(16.40)	(23.95)
Housing	14.59	11.49	14.26	10.94	0.712	0.789	15.37	18.10
	(12.80)	(9.44)	(17.05)	(10.32)	(0.45)	(0.41)	(15.13)	(21.70)
Durable Goods	0.81	0.08	0.07	0.00	0.13	0.01	1.43	0.79
	(3.75)	(0.76)	(0.91)	(0.01)	(0.34)	(0.11)	(7.03)	(4.93)
Purchased Food	34.92	57.60	34.09	44.55	0.659	0.722	24.06	25.21
	(20.50)	(16.76)	(60.69)	(31.36)	(0.48)	(0.45)	(17.11)	(19.28)
Transportation	8.856	3.401	8.535	3.446	0.780	0.667	8.758	12.60
	(13.25)	(3.29)	(15.64)	(3.80)	(0.42)	(0.47)	(13.57)	(23.04)
Personal	5.435	6.442	5.328	5.713	0.728	0.833	5.855	10.23
	(5.90)	(4.45)	(14.80)	(4.58)	(0.45)	(0.37)	(8.87)	(15.44)
Clothing	11.45	13.91	0.15	0.15	0.72	0.77	12.69	22.17
	(13.94)	(13.36)	(0.44)	(0.16)	(0.45)	(0.43)	(15.66)	(28.25)
Recreation	3.704	1.139	3.720	1.241	0.440	0.422	3.843	1.695
	(7.04)	(2.53)	(6.89)	(2.68)	(0.50)	(0.50)	(6.55)	(4.16)
Events	4.898	2.250	5.358	2.279	0.656	0.611	5.713	11.76
	(8.05)	(2.94)	(10.55)	(3.78)	(0.48)	(0.49)	(8.74)	(23.53)

Data:1996-98 Ghanaian Household Survey, www.econ.yale.edu/~cru2//ghanadata.html

[a]Calculated as |cross report-own report|/own report of total expenditure * 100

[b]Proportion of observations for which cross report<own report.

[c]Calculated as |cross report of expenditure share-own report of expenditure share|

Table 3. Actual Versus Perceived Engel Curves,
Working-Leser Specification, Tobit Estimates

	Own Report	Cross Report	Own Report	Cross Report
	Education		Health	
Ln(Per Capita Expenditure)	1.07	-5.69 **	0.374	6.64 ***
for Husband	(1.28)	(2.34)	(1.63)	(2.06)
Ln(Per Capita Expenditure)	5.21 **	2.299	1.087	-6.036 *
for Wife	(2.05)	(2.21)	(1.66)	(3.23)
Observations	340	352	340	352
	Housing		Durable Goods	
Ln(Per Capita Expenditure)	-3.41 ***	-2.364	5.95 ***	33.12 ***
for Husband	(1.03)	(1.92)	(0.09)	(0.24)
Ln(Per Capita Expenditure)	-2.76	0.897	9.01 ***	7.35 ***
for Wife	(1.88)	(2.71)	(0.19)	(0.43)
Observations	340	352	340	352
	Purchased Food		Transportation	
Ln(Per Capita Expenditure)	-0.46	-1.261	4.84 **	2.86
for Husband	(2.26)	(2.46)	(2.04)	(1.91)
Ln(Per Capita Expenditure)	-4.19	9.77 **	1.87	-0.39
for Wife	(4.38)	(4.79)	(1.69)	(2.15)
Observations	271	278	340	352
	Personal		Clothing	
Ln(Per Capita Expenditure)	-2.01 ***	0.16	3.55 *	8.53 **
for Husband	(0.58)	(1.39)	(1.84)	(3.65)
Ln(Per Capita Expenditure)	-0.52	-0.41	9.28 ***	9.57 ***
for Wife	(0.82)	(1.95)	(2.29)	(3.01)
Observations	340	352	340	352
	Recreation		Events	
Ln(Per Capita Expenditure)	-0.277	0.73	-0.556	2.859 **
for Husband	(1.14)	(1.15)	(1.03)	(1.38)
Ln(Per Capita Expenditure)	1.889	2.953	0.408	-9.50 ***
for Wife	(1.78)	(1.90)	(1.02)	(2.60)
Observations	340	352	340	352

Notes: Robust standard errors in parentheses. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. All specifications include controls for household size (natural log), proportion of household members in 10 age-sex categories, age, education and village-round fixed effects.
Data: Ghanaian Hh Survey, www.econ.yale.edu/~cru2//ghanadata.html
[a]Reported by respondent.
[b]Reported by respondent's spouse.

Table 4. Plot-Level Characteristics

	Husband	Wife
Output Value[a] (in thousands)	459.2	66.23
	(1336)	(232)
Profit[b] (in thousands)	357.1	55.44
	(1249)	(219)
Cropped Area (sq. yd.)	19175	5741
	(41990)	(11668)
Soil Type (%)		
Clay	11.42	5.26
Loam	6.36	4.51
Toposequence (%)		
Mid-slope	35.56	23.31
Bottom	47.31	61.65
Steep	11.09	7.52
Primary Crop (%)		
Cassava	30.72	57.89
Maize	25.82	33.08
Plantain	2.45	1.5
Cocoyam	2.29	1.5
Yam	2.78	1.5
Pineapple	25.65	1.5
Other Fruit/Veg	3.11	0.75
Oil Palm	6.21	0.75
Firewood	0.98	1.5
Observations	613	133

Standard deviation in parentheses.

Data: 1996-98 Ghanaian Household Survey, www.econ.yale.edu/~cru2//ghanadata.html

[a]Valued at prevailing market prices.

[b]Output value net of input and hired labor costs.

Table 5. Effect of Discrepancies on
Plot-Level Outcomes, Fixed Effects Estimates

	A. Expenditure Discrepancies			
	I. Output[c]		II. Profit[d]	
Discrepancy[a]	-40.51 *	-51.32 **	-46.77 **	-56.63 **
	(21.79)	(24.15)	(21.13)	(23.10)
Under-Estimate[b]	-200.6 **	-302.3 **	-239 ***	-341 ***
	(91.35)	(118)	(91.96)	(118)
Wife*Discrepancy		22.63		-31.00
		(190)		(180)
Wife*Under-Estimate		376.4 **		385 **
		(169)		(193)
Observations	745	745	745	745
	B. Income Discrepancies			
	I. Output[c]		II. Profit[d]	
Discrepancy[a]	8.56	10.47	6.97	7.66
	(20.35)	(21.15)	(17.72)	(18.46)
Under-Estimate[b]	83.83	126.0	17.49	51.93
	(235)	(251)	(207)	(221)
Wife*Discrepancy		51.55		-695
		(409)		(530)
Wife*Under-Estimate		-584.5		349
		(558)		(354)
Observations	691	691	691	691

Notes: Robust standard errors in parentheses. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. All specifications include household fixed effects, village-crop-round fixed effects, controls for plot size (by decile); soil type (clay, loam); toposequence (mid-slope, bottom, steep); age, age squared and indicator for wife.

Data: 1996-98 Ghanaian Hh Survey, www.econ.yale.edu/~cru2//ghanadata.html

[a]Calculated as |cross report-own report|/own report.

[b]Takes on a value of one if cross report<own report.

[c]Valued at prevailing market prices, in 1000s of cedis.

[d]Output value net of input and hired labor costs (cash and in-kind), in 1000s.

Table 6. Effect of Discrepancies on
Individual-Level Outcomes, Fixed Effects Estimates

	A. Expenditure Discrepancies			
	I. Output[c]		II. Profit[d]	
Discrepancy[a]	-175.9 **	-148.4 *	-143.6	-121.7
	(78.91)	(85.02)	(69.86)	(75.59)
Under-Estimate[b]	-458.8	-394.3	-472.1	-438.7
	(283)	(401)	(260)	(374)
Wife*Discrepancy		164.8		211.3
		(620)		(588)
Wife*Under-Estimate		-1427 **		-1,248 **
		(613)		(546)
Observations	368	368	368	368
	B. Income Discrepancies			
	I. Output[c]		II. Profit[d]	
Discrepancy[a]	16.98	35.28	15.68	30.06
	(42.18)	(45.57)	(35.17)	(38.10)
Under-Estimate[b]	516.8	843	335.4	607.4
	(655)	(698)	(555)	(591)
Wife*Discrepancy		-711		-831.3
		(1106)		(1058)
Wife*Under-Estimate		-2188		-1,550
		(1552)		(1364)
Observations	327	327	327	327

Notes: Robust standard errors in parentheses. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. All specifications include household fixed effects, village-crop-round fixed effects, controls for farm size (by decile); soil type (clay, loam); toposequence (mid-slope, bottom, steep); age, age squared and indicator for wife.

Data: 1996-98 Ghanaian Hh Survey, www.econ.yale.edu/~cru2//ghanadata.html

[a]Calculated as |cross report-own report|/own report.

[b]Takes on a value of one if cross report<own report.

[c]Valued at prevailing market prices, in 1000s of cedis.

[d]Output value net of input and hired labor costs (cash and in-kind), in 1000s.

Table 7. Effect of Chop Money Discrepancy on Household-Level Outcomes

	I. Output[b]	II. Profit[c]
Discrepancy[a]	-27.87	-72.37 ***
	(38.79)	(20.08)
Observations	102	102

Notes: Robust standard errors in parentheses. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. All specifications include village-round fixed effects, controls for farm size (by decile), soil type, toposequence, age, age squared, indicator for wife, household size, and proportion of household members in 10 age-sex categories.
Data: 1996-98 Ghanaian Hh Survey, www.econ.yale.edu/~cru2//ghanadata.html
[a]Calculated as |husband report-wife report|/husband report.
[b]Valued at prevailing market prices, in 1000s of cedis.
[c]Output value net of input and hired labor costs (cash and in-kind), in 1000s.

[1] Aslam and Kingdon (2008) note that Tobit estimation implicitly averages across two decisions – the zero/positive expenditure decision (extensive margin) and the decision of how much to spend conditional on positive spending (intensive margin). A hurdle model would allow us to assess the accuracy of perceptions about the extensive and intensive margins separately, rather than just average unconditional expenditure. However, with a relatively small sample size, our data are not well-behaved, and the likelihood for the Hurdle model does not converge in most cases.

[2] We do not use household-crop-round fixed effects as in Udry (1996) and Akresh *et. al.* (2012 and 2013) because women in Ghana typically cultivate only one or two plots, resulting in little overlap of crops across cultivators in the same household and round.

[3] Rainfall shocks differentially affect men's and women's crops (Duflo and Udry, 2004) but, in our case, they directly affect the dependent variables of interest (yield and profit) as well, making them invalid as instruments. Clan and bride wealth, used as instruments in Castilla (2012), do not differ across spouses.

[4] This specification does not, however, tell us how the position of the efficient frontier is related to information asymmetries within the household.

[5] We also calculate profits net of household labor, valued at the median wage. Results are very similar and available upon request.

[6] A reduction in scale would tend to reduce both output and costs, resulting in a smaller net effect on profit.