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Ties that bind

The kin system as a mechanism of income-hiding between spouses in rural Ghana

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Abstract

I present a model of intra-household allocation to show that when income is not perfectly observed by both spouses, hiding of income can occur even when revelation increases bargaining power. I draw data from Ghana and exploit the variation in the degree of asymmetric information between spouses, measured as the difference between the husband's own reporting of farm sales and the wife's reporting of his farm sales, to test whether the allocation of resources is consistent with hiding. Findings indicate that allocations are suggestive of men hiding farm sales income in the form of gifts to extended family members.

Keywords: incomplete information, income-hiding, non-cooperative family bargaining
JEL classification: D13, D82, J12

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1 Introduction

Recent empirical evidence has documented inefficient allocations (Udry 1996) and non-cooperative behavior as a result of asymmetric information (Chen 2009; de Laat 2009; Ashraf 2009; Souza 2011). Migration introduces asymmetric information between household members as the migrant spouse cannot perfectly monitor her spouse’s behavior, and this can lead to inefficient allocation of resources. However, households living under the same roof can be subject to asymmetric information as well (Pahl 1983, 1990; Boozer et al. 2009), and the literature on the response of household members to having informational advantages over own income is scarce. Ashraf (2009) finds that when husbands have private information over their own resources, they deposit the money into their private accounts, while committing the money to gift cards when resources are observed by their wives, even when husbands can decide privately how to allocate the money. Because Ashraf’s experiments vary the information and communication environment between spouses, no inferences can be made regarding the prevalence of asymmetric information outside of the laboratory, nor can we observe the way the money deposited in the husband’s private account is allocated.

Asymmetric information over expenditure and income between household members has important policy implications. When spouses choose to exploit their information advantages by hiding income, they must allocate resources away from goods that can easily be monitored, which can result in underinvestment in household goods. Child human capital investments, such as education and nutrition, tend to be easily monitored. These investments have important spillover effects in a household’s ability to step out of poverty because they increase child productivity later in life, providing further sources of income diversification to the household (Duflo 2001; Rosenzweig 1990). Further, household surveys where expenditure and income of the entire household is reported by one spouse are commonly used for poverty measurement. However, when imperfect information flows exist between household members over resources, reporting of expenditures other than one’s own is unreliable.

When an individual has private information over income, they face a trade-off when deciding to inform their spouse of the additional resources. If they choose to hide, they can spend the resources without influence from their spouse, but the set of possible expenditures is restricted to goods that cannot be monitored. If they choose to reveal, then they can increase their bargaining power and have access to the full set of expenditures but they must bargain with their spouse over how to allocate those resources. Thus the decision to reveal or hide depends on how responsive bargaining power is to revelation of the additional resources.

In what follows, I first derive a test to formally identify hiding of income empirically through two simple theoretical models. In the first stage, the husband receives income from two different plots: the farm income from the first plot is common knowledge to both spouses, while the second is not observed by his wife. He must decide whether to reveal the unobservable income or to hide it. In the second stage, spouses negotiate over the allocation of observable resources between private consumption and household good expenditure (child expenditures). I consider two different models for the bargaining stage. The first is based on the anthropological evidence regarding management of resources between spouses in Ghanaian households, which suggests there is gender specialization. Among agricultural households in Ghana, each spouse farms multiple plots making farm income difficult to monitor. Further, the anthropology literature has documented that Ghanaian men and women maintain separate economies, with a gender-based division of responsibilities for different type of expenditures (Chao 1998; Vercruijsse et al. 1974). The notion of spouses having different spheres of income and expenditure, however, does not necessarily imply that they will behave non-cooperatively. For this reason, in the second model I consider the possibility of spouses realizing there are opportunities for improvement and decide on cooperation. In equilibrium, hiding occurs if household bargaining is cooperative and the change in bargaining power is not significant enough to compensate for the loss in discretionary expenditure. The model predictions provide a simple way to identify hiding of income empirically.

To determine whether asymmetric information between spouses over farm income result in hiding, a household survey conducted in 4 villages in Southern Ghana between 1996 and 1998 by Udry and Goldstein is used. Hiding requires for the husband to have money that his wife does not know about, as well as expenditure alternatives that are also not monitored. I exploit the variation in the degree of asymmetric information between spouses, measured as the difference between the husband's own reporting of his farm sales and the wife's reporting of her husband's farm sales. Among the households in the survey these differences are on average equivalent to a fourth of mean household expenditure. The differences in reporting of income between spouses constitute only one of the components required to identify hiding. I examine the effect of asymmetric information regarding farm income on the husband's gifts to extended family members, which are not easily monitored, as well as on adult clothing, food expenditure, and wife's personal spending, all of which are observed by the wife.

For identification, the wife's clan and the husband's bride wealth payments upon marriage are used as instruments for asymmetric information. In Ghana, clan membership can influence the husband's decision to reveal his unobservable income because among matrilineal clans in particular, the husband comes third in the wife's ranking of her affective relationships (Robertson 1984), and also because women in matrilineal clans have more initial bargaining power since they are able to own assets and have access to social support such as access to land. The payment of bride wealth, on the other hand, influences asymmetric information differently depending on the clan the wife belongs to. Among matrilineal clans, bride wealth is less likely to be returned upon divorce, thus the husband has an incentive to reveal less information about his income to his wife in order to recoup his initial investment in the event of the termination of the marriage.

The econometric results indicate that expenditures of these households are consistent with hiding of the husband's income. Husbands hide farm sales income in the form of gifts to extended family members. These gifts are not observable by his wife because she would have to be familiar with her husband's family spending patterns in order to become suspicious. But even if she suspected, the strength of the lineage blood ties would prevent the husband's family from revealing the source of their additional resources. Asymmetric information has no effect on adult clothing or public transportation. Because hiding occurs in the form of gifts, instead of expenditure in alcohol or tobacco, it is unclear whether hiding has negative consequences in the long run. If the gifts represent a form of risk-sharing, then these gifts will return to the household in the future, and hiding is not necessarily inefficient. However, if these gifts are motivated by social pressure then hiding can result on poverty traps caused by kin system (Hoff and Sen 2005). The wife's response is also consistent with hiding. As the degree of asymmetric information increases, she reduces her expenditure in prepared foods and oil, which are goods that can be substituted for less expensive alternatives. There is evidence that hiding results in a reduction in household nutrition because it causes a reduction in expenditure in oil, which is one of the main sources of calories among poor households in the region.

2 Intra-household decision-making under asymmetric information

Consider a model with two family members, wife (*f)* and husband (*m)*, who have preferences over consumption of one private (or personal) good, denoted x_i, and one household public good, Q. The household resource allocation decision is made in two stages. In the first stage the husband receives two forms of income, Y_m which is common knowledge to both spouses and T which is not observed by his wife, while household the wife receives Y_f which is also common knowledge. For the husband, we can think about this as being a result of the allocation of labour hours towards two different productive activities, such as farming two different plots of land that vary in the degree of observability by his wife. The husband distributes the total number of hours he allocates towards productive activities between working in plots whose yields can be easily monitored by his wife, such as plots they farm jointly or that are owned by her family, and plots where income is not easily monitored, such as those farmed by the husband alone, or the ones that are located further away from the house.

The husband has to decide whether to reveal the unobserved income to his wife or to keep it for private consumption. For simplicity *T* is assumed to be observable with probability zero and it is also assumed that the wife cannot observe *m*'s private consumption choices, nor does she invest in monitoring m's income,[1] though f can infer the presence of additional income through the public good allocation, which is perfectly observable. In the second stage, each household member makes his consumption choices conditional on the amount of income spouse *m* revealed. The family decision-making process is solved by backwards induction.

First, the consumption choices conditional on the amount of resources that become known are described, and then the circumstances under which it is optimal for *m* to hide income are determined.

Both family members face the same price for private goods which is normalized to 1 (one can think about the private good as being money for discretionary expenditure), and p is the price for the public good. If both household members pool their income, the joint budget constraint is:

$$x_f + x_m + pQ = Y_f + Y_m + T \tag{1}$$

where Y_f is the wife's overall income. If each member decides to allocate the income at his/her disposal separately between private and household public goods, their individual budget constraints are:

$$x_i + pQ_i = Y_i + T_i \qquad \text{for } i = f,m \tag{2}$$

[1] This assumption is not trivial, but it can be justified if the opportunity cost of spending time monitoring her husband's plot is too high relative to spending time in productive activities of her own, such as working his own land. The model can be extended to incorporate both, time allocation decisions and a cost of monitoring.

Preferences over own consumption are represented by an egotistic utility function, U_i. Utility depends on the aggregate level of consumption of household public goods ($Q = Q_f + Q_m$) and private goods and it is assumed to be separable in x_i and Q:

$$U_i = U(Q, x_i) = u(x_i) + v(Q) \qquad \text{for } i = f,m \tag{3}$$

The functions $u(\cdot)$ and $v(\cdot)$ satisfy the standard assumptions that $u' > 0$, $v' > 0$, $u'' < 0$, $v'' < 0$, and $u'(0) = \infty$. $v'(0) = \infty$, implying x_i and Q are normal goods. Both spouses have the same functional form for simplicity. The characterization of goods as public or private depends on the nature of the good. The household public goods are assumed to be non-rival in utility, so they are of the Samuelson type. For instance, a clean house provides utility to both members of the household, while food provides utility only to the person who consumed it.

2.1 Separate spheres bargaining in Ghanaian households

It is not the norm for men and women to pool resources in Ghanaian households (Chao 1998; Clark 1999). Women are as economically active as men, and their income is neither a supplement, nor it is conceived as part of the family income (Vercruijsse et al. 1974). The responsibility for day-to-day maintenance of the family, however, seems to be shared by both husbands and wives (Oppong 1974). However, men and women tend to have separate income and expenditure streams,[2] often with a traditional gender-based division of responsibilities for different type of expenditures (Chao 1998). Oppong (1974) observed that husbands were twice as likely to own property with their kin as with their wives, and only ten percent of households had joint accounts. Generally, men are expected to contribute either staple grains from their farms for household consumption, or 'chop money' for food and pay for children's school fees (Chao 1998). Women bear primary responsibility for childrearing, cooking, washing and collecting fuel, wood, and water. Thus, additional expenditures for children, such as clothes are met by the women, as well as meal preparation and ingredients (Chao 1998).

Therefore, it seems as if in Ghanaian households no spouse has access to all of the household's resources, and spending patterns differ by gender. Nonetheless, it is generally the case (and so it is observed in the data) for intra-household transfers to occur in the form of 'chop money', loans and farm produce, particularly from husbands to wives. It seems plausible to consider the possibility then that either the intra-household allocation of resources is non-cooperative (each spouse controls his/her own resources), or that the fall back alternative when household members cannot reach a bargaining agreement (threat point) corresponds to a non-cooperative equilibrium within marriage where the husband makes positive transfers to his wife. In previous literature, this threat point has been of little interest because the redistribution of resources between spouses would have no effect on allocations. However, when household bargaining is non-cooperative and strictly positive transfers occur between spouses, the incentives to hide money when there is asymmetric information over money between spouses differ depending on the role each plays within the household.

2 Among the Ewe, husbands and wives seldom compose a unified production unit, while Ashanti women commonly earn their living and inherit property. Further, inter-household relations are not simply relations between male heads. Women too have their inter-household exchange networks, and their control of their own independent resources enables them to fulfill obligations to family members and kin living elsewhere (in Tambiah et al. 1989).

In this section, I examine the incentives to hide when household bargaining is non-cooperative: when there is gender specialization in the household, such that the husband is in charge of providing money, while the wife specializes in the provision of the public good. I draw from the Lundberg and Pollak (1993) separate spheres model. Consistent with Ghanaian households, the marital contract states that the husband must pay for children's school fees and provide chop money to his wife.[3] Thus, upon marriage the husband makes a binding commitment to pay for school fees and these are fixed as in these villages there are not many schooling choices. The amount of the chop money allowance, s, however, is the husband's choice. The wife, on the other hand, chooses the household good allocation (Q). The wife's household good can be thought of as child expenditures other than school fees, such as clothing and books, as well as fuel or wood, and ingredients to prepare food for all members of the household. In this case spouses do not commit to any binding agreements.

The game consists of 3 stages: in the first stage, the husband (m) receives both sources of income (Y_m and T) and chooses whether to reveal the unobservable income (T) or to hide it. In the second stage, he chooses the housekeeping allowance (s) he will give his wife (f); and in stage three, the wife decides the public good provision conditional on both T and s. The model is solved by backwards induction. In the benchmark case, i.e. when T is revealed, spouse f solves the following optimization problem,

$$max_{Q\geq 0;\, x_f\geq 0}\, U_f = v(Q) + u\big(x_f\big) \quad s.t. \quad x_f \leq Y_f + s - pQ \text{ [4]} \tag{4}$$

Substituting in the budget constraint, the First-Order condition for Q is

$$v'(Q) - pu'\big(Y_f + s - pQ\big) \leq 0 \tag{5}$$

Conducting comparative statics on the above condition yields,

$$\frac{\partial Q}{\partial s} = \frac{pu''\big(Y_f+s-pQ\big)}{v''(Q)+p^2u''\big(Y_f+s-pQ\big)} > 0 \tag{6}$$

Thus, the housekeeping allowance is the husband's way to increase his household good consumption, but the correspondence is not one-to-one. Note that, the public good allocation will be strictly positive, thus equation (5) holds with equality.

Taking spouse f's first-order condition as given, spouse m solves:

$$\begin{aligned} &max_{s\geq 0;\, x_m\geq 0; Q\geq 0}\, U_m = v(Q) + u(x_m) \\ &s.t. \quad x_m \leq Y_m + T - s; \;\; v'(Q) - pu'\big(Y_f + s - pQ\big) = 0 \end{aligned} \tag{7}$$

The Lagrangian is:

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[3] Among the Akan and the Ashanti, the wife can file for divorce in the case lack of economic support by her husband (Ogbu 1978). Husbands are also expected to pay for school fees (Chao 1998).

[4] Technically, the utility function is given by: $U_i = v(Q,t) + u(x_i)$ but since the schooling fees are assumed fixed, it does not affect the outcomes. One can also think about Y_m as being the husband's disposable income after paying for school fees.

$$\mathcal{L} = v(Q) + u(Y_m + T - s) + \lambda\left[pu'\left(Y_f + s - pQ\right) - v'(Q)\right]$$

which yields the following Kuhn-Tucker first-order conditions,

$$\frac{\partial \mathcal{L}}{\partial Q} = v'(Q) - \lambda p^2 u''\left(Y_f + s - pQ\right) - \lambda v''(Q) \leq 0 \quad (8)$$

$$\frac{\partial \mathcal{L}}{\partial s} = -u'(Y_m + T - s) + \lambda p u''\left(Y_f + s - pQ\right) \leq 0 \quad (9)$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = pu'\left(Y_f + s - pQ\right) - v'(Q) = 0 \quad (10)$$

$$Q\left[\frac{\partial \mathcal{L}}{\partial Q}\right] = 0,\ s\left[\frac{\partial \mathcal{L}}{\partial s}\right] = 0;\ \lambda\left[\frac{\partial \mathcal{L}}{\partial \lambda}\right] = 0;\ Q \geq 0;\ s \geq 0$$

Solving the system of first-order conditions simultaneously yields the Subgame Perfect Nash equilibrium. There is a corner solution where the housekeeping allowance can be non-positive, as well as an interior solution. Proposition 1 specifies the conditions that must be met for an equilibrium with a strictly positive housekeeping allowance to exist.

Proposition 1: *Given $Y_m + T$, there exists a $\overline{Y_m}$ in the interval $\left(0, Y_f\right)$ such that if $Y_m + T \leq \overline{Y_m}$ a corner solution with $s = 0$ and $Q > 0$ is possible.*

Following Proposition 1, if $Y_m + T \leq \overline{Y_m} \in \left(0, Y_f\right)$, it is optimal for *m* to give a non-positive housekeeping allowance to *f*. Proposition 2 states the properties of the equilibrium with respect to changes of income for both cases, and provides the foundations as to why when household bargaining is non-cooperative there are no incentives for the husband to hide income.

Proposition 2: *When spouses behave non-cooperatively and all income is revealed:*

Case (i) If $Y_m + T \leq \overline{Y_m} \in \left(0, Y_f\right)$, $s = 0$ and $Q > 0$, then an increase in Y_f results in $\frac{\partial x_f}{\partial Y_f} > 0$; $\frac{\partial Q}{\partial Y_f} > 0$; $\frac{\partial s}{\partial Y_f} = \frac{\partial x_m}{\partial Y_f} = 0$, while an increase in Y_m or T results in $\frac{\partial x_m}{\partial Y_m} = \frac{\partial x_m}{\partial T} > 0$; $\frac{\partial s}{\partial Y_m} = \frac{\partial s}{\partial T} = 0$; $\frac{\partial Q}{\partial Y_m} = \frac{\partial Q}{\partial T} = \frac{\partial x_f}{\partial Y_m} = \frac{\partial x_f}{\partial T} = 0$.

Case (ii) If $Y_m + T > \overline{Y_m}$, $s, Q > 0$, then an increase in Y_f results in $\frac{\partial x_f}{\partial Y_f} > 0$; $\frac{\partial Q}{\partial Y_f} > 0$; $\frac{\partial x_m}{\partial Y_f} > 0$; $\frac{\partial s}{\partial Y_f} < 0$ while an increase in Y_m or T results in $\frac{\partial x_m}{\partial Y_m} = \frac{\partial x_m}{\partial T} > 0$; $\frac{\partial s}{\partial Y_m} = \frac{\partial s}{\partial T} > 0$; $\frac{\partial Q}{\partial Y_m} = \frac{\partial Q}{\partial T} > 0$; $\frac{\partial x_f}{\partial Y_m} = \frac{\partial x_f}{\partial T} > 0$.

If spouse *m* is not giving a positive housekeeping allowance to *f*, changes in husband's resources have no impact on *f*'s allocations. Now consider the case when *m* receives income that is observable to household member *f* with probability zero. If the distribution of income is such that $Y_m + T \leq \overline{Y_m} \in \left(0, Y_f\right)$, hiding is indistinguishable from non-cooperative behavior under perfect information because in both cases a change in *m*'s resources only impacts m's allocations.[5] This is intuitive because when all sources of cooperation and interaction fail between household members, the information asymmetries become irrelevant. In the case where $Y_m + T > \overline{Y_m}$, it is m's best response to give a strictly positive housekeeping allowance to f in order to increase his household good consumption. In this case, an increase in m's resources increases his discretionary expenditure and his housekeeping allowance, and therefore the provision of the public good. However, it also increases f's private consumption. To decide whether to reveal or to hide, m compares the utility per unit change of T in both cases.

Proposition 3: *Given Y_f and Y_m when $Y_m + T > \overline{Y_m}$, the Subgame Perfect Nash Equilibrium of the game is to always reveal.*

Propositions 2 and 3 imply that when household bargaining is non-cooperative, i.e. when there is gender specialization, the husband will never hide income in equilibrium. When allocations default to separate spheres and no intra-household transfers occur, information asymmetries over household income are irrelevant. If strictly positive transfers occur between household members, the husband is better off revealing his unobservable income. This contrasts with the case where the wife receives income that is unobservable to her husband, where hiding is the equilibrium if the unobservable income does not exceed a certain threshold (Castilla 2010).

2.2 Cooperative bargaining

But what happens if household bargaining is cooperative? If household allocations are fully cooperative, differences in the observability of the two sources of income would have no effect on allocations. In this case, even when the wife is unable to observe her husband's resources, he would reveal them directly or indirectly through expenditure. However, there exists the possibility of partial cooperation, where the husband is cooperative with respect to the allocation of observable income, but depending on the responsiveness of bargaining power to the revelation of additional income, he could choose to allocate the unobservable resources at his discretion. Thus, in deciding to reveal or hide income, the husband faces a trade-off between increasing his own discretionary spending and increasing his bargaining power. I model this case drawing from the Browning and Chiappori (1998) collective bargaining model, where household members bargain over all allocations, and it is assumed they can negotiate binding agreements with zero transaction costs. The information asymmetry is introduced by allowing a portion of spouse m's income (T) to be observable with probability zero.

The collective bargaining game is solved by backwards induction, so first I find the optimal public good allocation and private expenditure shares conditional on the amount of income that is revealed, and then derive the conditions that must be met for m to reveal the transfer. In the second stage, the objective function of the collective household is the bargaining power weighted sum of each member's utility:

$$C = \mu\{u(x_m) + v(Q)\} + (1-\mu)\{u(x_f) + v(Q)\} \qquad (11)$$

[5] There exists another case that is not being examined in this paper, corresponding to when T is such that, if revealed, it makes the interior equilibrium possible. In that case, comparisons cannot be made on the margin because the baseline utility is not the same across cases.

Where $\mu = \mu(Y_f, Y_m, I, z, p)$ is the bargaining power of spouse m and $\left(1 - \mu(Y_f, Y_m, I, z, p)\right)$ is the bargaining power of spouse f. This is the weight given to each spouse's utility in the household welfare function when bargaining, and it is partially determined by each spouse's outside options, as well as by resources originally brought into the marriage and distribution factors (z). The unobservable income only influences bargaining power when it is revealed, such that $I = T$ if m reveals, and $I = 0$ if he hides. I do not specify a functional form in order to avoid making further assumptions about the relative weights additional resources would have over other factors that influence bargaining power, but are unaffected by changes in the quantity of resources. Thus, the bargaining weight is used as a generic way to incorporate the existence of an outside option if spouses fail to reach a bargaining agreement (threat point). Consistent with both non-cooperative equilibria within marriage and divorce threat points, income increases m's bargaining power.

The collective household's problem when income is fully revealed is to maximize (11) subject to the aggregate budget constraint (1). I solve the collective model assuming that the participation constraints do not bind, i.e. assuming that both spouses are better off cooperating than under the threat points.[6]

$$max_{Q,x_m \geq 0} \quad \begin{array}{c} \mu(Y_f, Y_m, T, p, z)\{u(x_m) + v(Q)\} \\ + \left(1 - \mu(Y_f, Y_m, T, p, z)\right)\{u(Y_f + Y_m + T - x_m - pQ) + v(Q)\} \end{array} \tag{12}$$

The Kuhn-Tucker first-order conditions of the problem in (12) are:

$$\begin{aligned} &\frac{\partial C}{\partial Q} = v'(Q) - (1-\mu)pu'(Y_f + Y_m + T - x_m - pQ) \leq 0 \\ &\frac{\partial C}{\partial x_m} = \mu u'(x_m) - (1-\mu)u'(Y_f + Y_m + T - x_m - pQ) \leq 0 \\ &Q\left[\frac{\partial C}{\partial Q}\right] = 0;\, x_m\left[\frac{\partial C}{\partial x_m}\right] = 0;\, Q, x_f \geq 0 \end{aligned} \tag{13}$$

Solving this system yields the demand for the household public good and the demand for private consumption. The optimal demands respond to changes in aggregate income (i.e. income pooling feature) and to changes in individual income through its resulting changes in bargaining power.

Proposition 4: *An increase in the husband's (wife's) income increases the public good allocation and his (her) private expenditure, whereas it may increase or decrease the wife's (husband's) private expenditure depending on which, the income effect or the bargaining power effect is larger.*

When spouse m hides his unobservable income, in order to avoid detection he must allocate it all towards private consumption which is unobservable. Spouses bargain over public and private consumption given only the resources that are common knowledge, i.e. $Y = Y_f + Y_m$, such that household good consumption and f's private consumption does not respond to changes in T. In the second stage, spouse m compares the change in utility per unit change in

[6] This is not a strong assumption given that spouses are bargaining over all allocations, such that the public good provision will be efficient (at least when all income is revealed).

the unobservable income when it is revealed to when it is hidden. The equilibrium conditions are stated in Proposition 5.

Proposition 5: *Given Y_f, Y_m and T, there exists a strictly positive threshold change in bargaining power $\overline{\Delta\mu}$ such that for any $\frac{\partial\mu}{\partial T} < \overline{\Delta\mu}$ hiding is the Subgame Perfect Nash Equilibrium iff*

$$\mu u'(x_m^H)v''(Q^R)u''(x_m^R)+p^2\mu(1-\mu)u''\left(x_f^R\right)u''(x_m^R)[u'(x_m^H)-\mu u'(x_m^R)] \\ +(1-\mu)v''(Q^R)u''\left(x_f^R\right)[u'(x_m^H)-u'(x_m^R)]>0$$

Corollary 1: *Given Y_f, Y_m and T, as μ approaches zero, the threshold level of bargaining power $\overline{\Delta\mu}$ is strictly negative, whereas when μ tends to 1 it is positive.*

Proposition 5 implies that the decision to hide money depends not only on the change in bargaining power but on the initial level of bargaining power as well. The threshold level of change required to induce revelation is increasing and concave in initial bargaining power. The result is intuitive because if *m*'s bargaining power is low, he is less likely to influence household allocations towards his preferences and thus his private consumption is 'taxed' more severely, but at the same time, any increase in bargaining power makes him better off. Conversely, when bargaining power is high, the public good allocation is going to be close to what he prefers, thus on the margin the benefit per unit of income of revelation is not as high.

3 Indentifying income-hiding between spouses: empirical application

In the previous section, it was shown that when household bargaining is non-cooperative and strictly positive transfers are observed between spouses, hiding never occurs in equilibrium. The models also indicate that income pooling of all of the husband's income sources is observed when spouses behave non-cooperatively and the husband makes strictly positive transfers, as well as when household bargaining is collective and hiding does not occur. In Ghana, the marital contract implies that strictly positive transfers between spouses take place, and so is observed in the data, thus the separate spheres threat point with no marital transfers is irrelevant.

There are then two ways to test for income-hiding empirically. When information about both sources of income of the husband is available, hiding can be identified empirically if there are differences in the effect of changes in observable and unobservable income on allocations that are not monitored. Pooling of all sources of husband's income is a feature of the collective household, as well as of the non-cooperative household with spousal transfers when hiding is not observed. Because hiding never occurs in equilibrium when household bargaining is non-cooperative, rejection of pooling of the different sources of income of the husband implies hiding, and not another form of non-cooperative behavior. However, different sources of income are not necessarily going to be fungible (Duflo and Udry 2004), and this test could be confounding hiding with lack of fungibility. From Propositions 4 and 5 it can be inferred that if resources are to successfully be hidden, they would have to be spent on goods that are not monitored. Therefore in a hiding equilibrium, it suffices to find that the wife's allocations, as well as allocations that are observable do not respond to changes in the resources that are unobserved, whereas the allocations that are not monitored do. This test of hiding relies only on looking at the effect on allocations of the source of income that is not monitored, thus minimizing data requirements.

Implication 1: *Given that T is only observed by spouse m, if x_m is not observed by spouse f, and Q and x_f are perfectly observable by spouse f, income-hiding occurs if* $\frac{\partial x_m}{\partial T} \neq 0$, *while* $\frac{\partial Q}{\partial T} = \frac{\partial x_f}{\partial T} = 0$.

The model does not allow differentiating income-hiding from a change in bargaining power because spouses need to have preferences towards more than one attributable private good. In that case, a change in bargaining power would be accompanied by shifts in all attributable goods favored by that spouse, irrespective of the ease with which those goods are monitored (Chen 2009). The model can easily be extended to show that if there exists more than one private good, expenditures of the husband that are not easily monitored will be more responsive to changes in unobservable income relative to expenditures in goods that are easily observed.

3.1 Data description

The data consists of a two year survey of 240 households, drawn from 4 villages in Southern Ghana conducted by Udry and Goldstein between 1996 and 1998. The sample was constructed in two stages. Four villages were selected such that they were near the towns of Nsawam and Aburi. The primary income earning activity of the residents of these villages is agriculture, both in food crops (mainly maize and cassava) and export crops (pineapple). However, given the proximity of two of these villages to larger towns, a significant number of the respondents in the survey work for pay, own a business, or trade. Within each village, 60 married couples (or triples)[7] were randomly selected to be interviewed, except in village 3 where all households were interviewed. Single headed households were excluded from the sample. Enumerators interviewed the male and female respondents privately. Each person was interviewed 15 times during the course of 2 years (Goldstein and Udry 1999).

The unique feature of the survey for the purposes of this paper is that each respondent was asked to report on their own expenditure and farm income, and the expenditure and farm income of their spouse. The information on expenditure is available for rounds 4, 8 (conducted in 1997), and 12 (conducted in 1998), and it is reported for the previous 12 months. Data on cross-reporting of income is only available for farm sales, and only for the year 1998 (rounds 10 to 15). There is a timing mismatch between the rounds where expenditure data was collected (April through June 1998) and the rounds where farm income was collected (January through August 1998).[8] It would be possible to examine if expenditure is stable by examining the previous two rounds. However, one of the enumerators consistently underreported expenditure in village 1 during rounds 4 and 8. Among the households that reside in the villages where no underreporting was observed, Goldstein (2004) indicates that expenditure is very stable. Therefore, I rely on the 1998 surveys and use annual expenditure in round 12 and farm sales collected in rounds 10 through 15 for the empirical analysis. For data on gifts I use round 11, where each spouse specified the amount of money given in the form of gifts and to whom these were given.

7 Some of these households are polygamous.

8 The two main farming seasons are in December and then May through July. The January round covers the months of December and January.

Among the 240 households originally surveyed, 163 are agricultural households. Some of these households additionally engage in other economic activities such as businesses, as well as casual or formal work for pay. I exclude polygamous households, as well as households where only one spouse participates in the survey, the latter because the information for both spouses is not generally available, and the former because the intra-household dynamics are structurally different relative to monogamous households. After restricting the sample, 130 households are left. Of these, 125 contain information of husband's farm income reported by both the husband and the wife. Cross-reporting of wife's farm income is not used because only 31 households contain information on both cross-reporting of wife's farm income and cross-reporting of husband's farm income. Finally, 107 of these report information on expenditure, as well as the instruments required for identification, such that no out-of-sample inferences can be made.

3.2 Empirical approach and identification strategy

Reduced-form demand equations of household attributable expenditure of both the husband and the wife are estimated. Implication 1 stated that to test for hiding it suffices to find that unobservable income has a significant effect on expenditure that is not monitored, while no significant effect on observable expenditure. The husband's farm sales are difficult to monitor by the wife because in these households, men farm 5 plots on average, and women farm their own plots. Thus, the cost of acquiring information about her husband's sales includes, both the direct time cost associating with monitoring and the opportunity cost of farming her own plots.

Among the households in the sample, the information asymmetries over farm sales are considerable (see Table 2.2 in Appendix 2), though relying solely on whether farm sales are observable or not would not be taking advantage of the full extent of asymmetric information.[9] Thus, in the empirical analysis I exploit the variation in the difference between the husband's own reporting of his farm sales and the wife's reporting of his farm sales.

Identification of income-hiding further requires there to be attributable expenditures of the husband that vary in their degree of observability. I consider husband's expenditure in clothing, public transportation, and gifts to extended family, which are progressively decreasing in the wife's ability to monitor. Gifts to extended family are likely to be unobserved by the wife because they are distributed over 5 recipients on average, the money leaves the household because these gifts exclude those given to the wife or their children, as well as the wife's family. But even if she suspected that the husband is giving money to his family, it would be hard for her to verify the amount because it is on the recipient's best interest not to confirm her suspicions in order to keep having access to those gifts, and because of the strength of the kinship ties, which imply that their allegiance is to him over his wife.

Expenditure is then estimated as a function of asymmetric information over farm sales, such that identification rests on the comparison of households as the degree of asymmetric information increases. For household i in village v, the demand for good g, x_i^g, is given by:

$$x_i^g = \alpha D_i^h + \gamma C_i^f + \theta C_i^m + \pi StdAsym_i^m + \sum_{v=1}^{4} \alpha_v + \varepsilon_i \tag{14}$$

9 Robustness estimates including farm sales reported by the husband are presented in Appendix 2.

Where $\sum_{v=1}^{4}\alpha_v$ corresponds to village fixed effects; D_i^h includes household level variables such as years of marriage, number of crops farmed and if they farm pineapple, total area of plots, an indicator of whether one member of the household has a business or works for pay, number of household members, of boys and girls, and number of members under 5 years of age, between 5 and 14, and over 60, total household income, and husband's share of household income; C_i^f includes the wife's education level and age, while C_i^m includes the husband's education level and age. Additionally, for each spouse, an indicator of the number of plots that were harvested solely by each spouse is included as a control for monitoring, and to extract some of the measurement error in the differences in cross-reporting of the husband's farm sales.

Asymmetric information is measured as the difference in the husband's reporting of his farm sales minus his wife's reporting of his farm sales. Depending on the wife's beliefs, there can be over-reporting and under-reporting, though, in either case, differences in cross-reporting indicate asymmetric information.[10] The asymmetry is then defined as the absolute value of the difference in reporting. The resulting value is normalized by the average farm sales reported by the husband.

$$Asym_i^m = \frac{abs\left(FarmSales_i^{m,m} - FarmSales_i^{m,f}\right)}{\frac{1}{N}\sum_{i=1}^{N} FarmSales_i^{m,m}} \tag{15}$$

However, there exists the possibility that there is a certain norm of acceptable asymmetric information between spouses in Ghanaian societies. To relax the assumption of any differences being asymmetric information, I use the standardized asymmetry in the empirical analysis, though in Appendix 2 results on the normalized asymmetry are also presented.

$$StdAsym_i^m = \frac{Asym_i^m - \overline{Asym_i^m}}{\frac{1}{N}\sum\left(Asym_i^m - \overline{Asym_i^m}\right)^2} \tag{16}$$

There are two reasons why the degree of asymmetric information is endogenous: farm sales can be reported with error, and observed asymmetric information in 1998 could be the result of previous bargaining outcomes. To address this, I instrument for asymmetry using clan membership, the amount of bride wealth payments, and interaction of the two.

$$StdAsym_i^m = \beta_1 BW_i^h + \beta_2 Clan_i^f + \beta_3 BW_i^h * Clan_i^f + \tau D_i^h + \varphi C_i^f + \delta C_i^m + \sum_{v=1}^{4}\alpha_v + \upsilon_i \tag{17}$$

Where BW_i^h is the amount given by the husband's family in gifts to the wife's family upon marriage, or bride wealth; and $Clan_i^f$ is an indicator variable equal to 1 if the wife speaks Akwapim or Twi, and 0 otherwise. The amount reported of bride wealth is deflated using the consumer price index obtained from the World Development Indicators. For spouses that married before 1964, the 1964 consumer price index is used because information is unavailable for previous years. Lineage or clan membership is identified using language or dialect. For the most part, dialects are highly correlated with clan except in the case of those speaking Akan. In 1978 the Akan Orthography Committee established a common orthography for all of Akan dialects, now called Akan (proper) which is used as the medium

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[10] In the results section, I also restrict the sample only to households where the wife underestimates her husband's income as a check for robustness.

of instruction in primary school by speakers of several other Akan languages. The Akan people are of both matrilineal and patrilineal descent, thus those speaking Akan have the potential to be of a non-matrilineal clan. The Akwapim (or Akwapem), speak Akwapim or Twi, and are matrilineal. Of the households considered in this paper, 58 per cent speak Akwapim or Twi, while the rest speak Ewe (12.5 per cent), Akan (19.5 per cent), or other (10 per cent). If indeed some of the households that speak Akan are matrilineal, the indicator as I defined it would attenuate the effect of clan membership on asymmetric information. A detailed description of all the variables can be found in Table 2.1 in Appendix 2.

In Ghana, clan membership influences asymmetric information because, among matrilineal clans in particular, the allegiance to the lineage overrides any other loyalty, including conjugal ties (Takyi and Gyimah 2007). Robertson (1984) finds that the husband is third in the wife's ranking of her affective relationships (Robertson 1984). The practice of maintaining separate marital accounts (Clark 1999) coupled with the allegiance of the wife to her own maternal family could undermine the authority of the husband (Takyi and Gyimah 2007). Further, women in matrilineal clans have more initial bargaining power since they are able to own assets and have access to social support such as access to land[11] (Guyer 1981). From the model we know that lower initial bargaining power of the husband results in a lower threshold change in bargaining power required to induce revelation, and thus less asymmetric information.

The payment of bride wealth, on the other hand, gives the husband rights over his wife (in Takyi and Gyimah 2007), but it is also a significant transfer of wealth between families. In Ghana, relocation after marriage is mostly virilocal (Ogbu 1978). Bride wealth is thus paid, in part, because marriage effectively involves loss of labour to the bride's family (Murdock 1967). In these societies, bride wealth is not transferred to the bride in the form of dowry, as in India or China, but the bride's parents keep it (Goody 1973), and upon divorce bride wealth will generally have to be returned (Tambiah et al. 1989). Among matrilineal clans, bride wealth is less likely to be returned upon divorce, and the payments are smaller; thus the husband has an incentive to reveal less information about his income to his wife in order to recoup his initial investment in the event of the termination of the marriage.[12] Contrastingly, among patrilineal clans bride wealth is most likely returned upon divorce and the payments are larger; thus the husband has no incentives to keep money from his wife because he knows he will recoup his investment in the event of termination of the marriage.

Bride-price (which is similar to bride wealth) has been found not to influence allocations among households in Southeast Asia (Zhang and Chan 1998), while dowry does because it is transferred to the bride, shifting her bargaining power. In Ghana, bride wealth is kept by the wife's family, thus it should not affect allocations. Nonetheless, it is possible that bride wealth is correlated with characteristics of the wife that also influence expenditure, such as things that would make her more desirable in the marriage market. The number of boys and girls she has produced within the marriage, her income and the area of her plots are

[11] Matrilineal women family members are guaranteed significant social support such as access to land, not found among non-matrilineal societies, and upon divorce, women may reintegrate more easily back into their lineage (Takyi and Gyimah 2007).

[12] Among the matrilineal clans, if the husband files for divorce, bride wealth has to be returned. When the wife files for divorce, the husband's custody over children and bride wealth refund is contingent upon his innocence in the matter. Contrastingly, women in patrilineal clans cannot file for divorce, not even in the case of adultery or mistreatment (Ogbu 1978).

characteristics that would have influenced the payment of bride wealth, and also would correlate with her outside option in the marriage market. These are included in the expenditure equations in hopes that they account for the potential endogeneity of bride wealth.

Farm sales and the wife's reporting of her husband's sales are likely to be measured with error, though the differences cannot be entirely attributed to measurement error. Using the same data, Boozer et al. (2009) show that the differences in reporting of expenditure across household members is partially due to measurement error, but also indicative of asymmetric information. Nonetheless, the use of instruments should take care of the endogeneity caused by measurement error, such that we are left with the proportion of the differences that are not pure error. Note that under measurement error the estimates of the first stage equation are inefficient, implying that the significance of the instruments will be underestimated.

4 Econometric results

The data indicates that asymmetric information over farm income exist within spouses among the households in the survey as the average in differences in reporting of farm income by each spouse are 28 thousand Cedis and represent 14 per cent of household income on average.[13] However, incomplete information will not always result in hiding. Implication 1 indicates that hiding can be identified empirically if the proportion of farm sales that is unobserved has no effect on observable expenditure, while it has a significant effect on expenditure that is not monitored. In what follows, results are shown on the estimates of the reduced-form demand equations for expenditure on observable household goods such as children's clothing, schooling and utilities, as well as goods attributable to either the husband or the wife. The wife's expenditures include clothing, commuting, and personal items. I also consider expenditure in food items such as oil and prepared foods, which for the most part are in the wife's sphere of responsibilities, but that also provide information about her beliefs regarding their availability of resources.

For the husband, commuting and clothing expenditures are used, as well as the gifts granted to his extended family, excluding children and wives.[14] Both commuting and clothing are easily observable by the wife, while the gifts are not. Clothing is easily monitorable, while commuting perhaps less so, but since these households live in small villages, the cost of monitoring of transportation expenditures by the wife is low. The gifts to his family are much harder to monitor because the money effectively leaves their household, and she would need to have a very good idea of the regular spending patterns of her husband's family in order to become suspicious. But even in that case, she would not easily learn that it is her husband who is providing them with money, particularly given that their allegiance is stronger towards their kin, which would make the husband's family unlikely to reveal the source of their additional resources. Table 1 contains the results.

The first column corresponds to the estimation results for equation (3.17). The instruments are statistically significant individually, except for the case of the dummy variable indicating

13 Table 2.2 in Appendix 2 contains descriptive statistics of all variables.

14 The definition of gifts is money given to individuals other than the husband's children, wife or previous wives, and that is not going to be returned. Thus, these do not include loans. Also, these do not include gifts to in-laws.

matrilineal clan membership, and they are all jointly significant at the 95 per cent confidence level. These results are consistent with the arguments presented earlier: in matrilineal clans men have less initial bargaining power which makes them less likely to hide because there are greater benefits from cooperation. The degree of asymmetric information of the wife over the husband's farm income is decreasing in bride wealth among households with wives of non-matrilineal descent as it is more likely to be returned upon divorce, while it is increasing in bride wealth for matrilineal households as the husband is less likely to recoup his initial investment in the event of divorce. However, the value of the F-statistic is small, suggesting the instruments are weak. This can partially be attributed to measurement error in both husband's farm sales and the wife's reporting of his sales, which results in larger standard errors. To account for this, weak instrument robust tests are used (Finley and Magnusson, forthcoming). The J-test for over-identifying restrictions in all cases fails to reject the null, such that at least one of the instruments is exogenous (except for the wife's public transportation expenditure). The weak instrument robust LM test for the coefficient on asymmetric information in the second stage being equal to zero is also reported. Nonetheless, in the presence of weak instruments the coefficients are biased towards OLS. In this case, I also present OLS results which are smaller.

It can be observed in Table 1 that the degree of asymmetric information over farm sales has a significant, large and positive effect on gifts given to the husband's extended family. This result is indicative of hiding because gifts are not easily monitored. Even though the effect is statistically significant only at the 93 per cent confidence level, it is significant in magnitude since one standard deviation increase in the asymmetry, on average, increases gifts in more than half the average monthly amount of chop money transferred from husbands to wives. This result is robust when using the weak instrument LM test.

In Section 2, when the collective model was discussed, it was argued that in deciding whether to reveal or to hide his unobservable income the husband was faced with a trade-off between increasing his bargaining power and deciding what to do with the unobservable resources without influence from his wife. Expenditure in public transportation makes the husband presumably better off since otherwise he would have to walk to work (particularly since none of these households own vehicles). The significant and negative effect of asymmetric information on public transportation expenditure suggests that relative to households where the wife is better informed of her husband's farm income, husbands that are keeping information from their wives are giving up bargaining power as a result of hiding. Both the negative effect on public transportation and the lack of significance of asymmetric information on the husband's clothing expenditure indicate that the results are not being driven by a shift in bargaining power, given that it would result in an increase in all allocations preferred by the husband, and because household income is controlled for, these are not explained by income effects either. Consistent with the husband giving up some bargaining power as a result of hiding, asymmetric information has a slight but significant increase on the wife's personal expenditures. However, this result is not robust to the weak instruments LM test. Asymmetric information has no effect on the rest of the wife's attributable expenditures.

Table 1: Results for the effect of asymmetric information on husband's expenditure

Variable	First Stage	Husband Assignable Expenditure					
		Public Transportation		Clothing		Gifts Husband Family	
		OLS	IV	OLS	IV	OLS	IV
Clan (=*1 if Matrilineal Clan*)	-0.366 (0.243)	-	-	-	-	-	-
Bridewealth *(Millions of 1998 Cedis)*	-0.005** (0.002)	-	-	-	-	-	-
Clan * Bridewealth (*Millions of 1998 Cedis*)	0.049** (0.019)	-	-	-	-	-	-
Asymmetry Husband's Farm Y (*Std. Dev. from Mean*)	-	-1.607* (0.956)	-2.635* (1.572)	0.191 (0.198)	-0.057 (0.731)	7.045 (8.986)	48.65* (27.98)
No. Plots of Husband Harvested by Husband	0.070 (0.055)	0.173 (0.204)	0.236 (0.226)	0.003 (0.110)	0.016 (0.115)	3.874 (4.275)	1.710 (4.647)
No. Plots of Wife Harvested by Wife	-0.268** (0.109)	-1.179 (0.754)	-1.406* (0.794)	-0.375 (0.233)	-0.428 (0.288)	7.202 (9.220)	16.56* (9.659)
Weak Instruments F-test	3.96**	-	-	-	-	-	-
LM-Test (WI Robust)	-	-	2.49	-	0.01	-	2.68*
J-Test (WI Robust)	-	-	0.33	-	0.33	-	1.27
N	107	107	107	107	107	107	107

Note: Robust Standard errors in parentheses. All models are estimated using Tobits.
These estimates inlcude all control variables. Full results in Appendix III.
Montly expenditures in 1998 thousands of cedis.
*** p-value<0.001, ** p-value<0.05, * p-value<0.1

Source: author's estimation.

Table 2: Results for the effect of asymmetric information on wife's expenditure

Variable	First Stage	Wife's Assignable Expenditure					
		Public Transportation		Clothing		Personal Expenditure	
		OLS	IV	OLS	IV	OLS	IV
Clan (=*1 if Matrilineal Clan*)	-0.366 (0.243)	-	-	-	-	-	-
Bridewealth *(Millions of 1998 Cedis)*	-0.005** (0.002)	-	-	-	-	-	-
Clan * Bridewealth (*Millions of 1998 Cedis*)	0.049** (0.019)	-	-	-	-	-	-
Asymmetry Husband's Farm Y (*Std. Dev. from Mean*)	-	-0.043 (0.064)	0.323 (0.773)	0.107 (0.133)	0.169 (0.458)	0.040** (0.019)	0.119** (0.053)
No. Plots of Husband Harvested by Husband	0.070 (0.055)	0.109** (0.051)	0.090 (0.060)	0.187* (0.095)	0.186** (0.094)	0.014 (0.012)	0.011 (0.013)
No. Plots of Wife Harvested by Wife	-0.268** (0.109)	-0.075 (0.076)	0.002 (0.167)	0.124 (0.215)	0.137 (0.175)	0.015 (0.023)	0.032 (0.028)
Weak Instruments F-test	3.96**	-	-	-	-	-	-
LM-Test (WI Robust)	-	-	0.21	-	2.38	-	0.08
J-Test (WI Robust)	-	-	8.71	-	0.4	-	0.86
N	107	107	107	107	107	107	107

Note: Robust Standard errors in parentheses. All models are estimated using Tobits.
These estimates inlcude all control variables. Full results in Appendix III.
Montly expenditures in 1998 thousands of cedis.
*** p-value<0.001, ** p-value<0.05, * p-value<0.1

Source: author's estimation.

Interestingly, asymmetric information has a negative and significant effect on expenditure in oil and prepared foods. The magnitude is also considerably large, as it is around the average daily amount of chop money for the case of prepared foods. The wife is responsible for these non-essential expenditures, such that when she believes her husband has less money, she decreases the amount of money spent on non-essential goods. Results of the wife's food expenditures, as well as expenditure in household goods are presented in Table 3.

Table 3: Results for the effect of asymmetric information on food expenditures

Variable	First Stage	Food Expenditures							
		Oil		Protein		Wife's Prep. Food		Total Prep. Food	
		OLS	IV	OLS	IV	OLS	IV	OLS	IV
Clan (=1 *if Matrilineal Clan*)	-0.366 (0.243)	-	-	-	-	-	-	-	-
Bridewealth *(Millions of 1998 Cedis)*	-0.005** (0.002)	-	-	-	-	-	-	-	-
Clan * Bridewealth (*Millions of 1998 Cedis*)	0.049** (0.019)	-	-	-	-	-	-	-	-
Asymmetry Husband's Farm Y (*Std. Dev. from Mean*)	-	-0.148 (0.117)	-1.160** (0.579)	0.712 (0.632)	-0.666 (1.229)	-0.297 (0.243)	-2.086** (0.943)	-0.107 (0.207)	-2.774** (1.357)
No. Plots of Husband Harvested by Husband	0.070 (0.055)	0.067 (0.098)	0.118 (0.113)	0.283 (0.235)	0.354 (0.242)	-0.082 (0.129)	0.027 (0.165)	-0.195 (0.147)	-0.042 (0.212)
No. Plots of Wife Harvested by Wife	-0.268** (0.109)	0.021 (0.116)	-0.192 (0.184)	0.241 (0.378)	-0.053 (0.447)	-0.257 (0.177)	-0.661** (0.313)	-0.375* (0.214)	-0.975** (0.423)
Weak Instruments F-test	3.96**	-	-	-	-	-	-	-	-
LM-Test (WI Robust)	-	-	4.91**	-	0.24	-	6.65**	-	6.96**
J-Test (WI Robust)	-	-	2.19	-	1.1	-	1.37	-	1.43
N	107	107	107	107	107	107	107	107	107

Note: Robust Standard errors in parentheses. All models are estimated using Tobits to account for censoring.
These estimates inlcude all control variables. Full results in Appendix III.
Montly expenditures in 1998 thousands of cedis.
*** p-value<0.001, ** p-value<0.05, * p-value<0.1

Source: author's estimation.

The degree of asymmetric information has no significant effect on household goods that are easily monitored, such as child clothing and utilities.[15] The results are presented in Table 4. The magnitude is small, provided that one standard deviation increase in the degree of asymmetric information increases monthly expenditure in utilities (wood, fuel, candles) in 200 Cedis, or decreases child clothing expenditure in 322 Cedis, which corresponds to between 10 and 13 per cent of the average daily amount of chop money. Asymmetric information over farm sales has no statistically significant effect on schooling and protein expenditure (see Appendix 2). The magnitude, even though it is larger than the case of children's clothing and oil, is equivalent to half the daily amount of chop money for schooling, and around one fourth for protein.

15 In Tables 2.3 and 2.6 results for schooling expenditures are also presented, where the asymmetry has no effect either. These were excluded from the main text given that it is the husband's obligation to cover school fees and those comprise most of the schooling expenditures.

Table 4: Results on the effect of asymmetric information on household goods

Variable	First Stage	Household Public Goods					
		Tot. School		Child Clothing		Utilities	
		OLS	IV	OLS	IV	OLS	IV
Clan (=1 *if Matrilineal Clan*)	-0.366 (0.243)	-	-	-	-	-	-
Bridewealth *(Millions of 1998 Cedis*)	-0.005** (0.002)	-	-	-	-	-	-
Clan * Bridewealth (*Millions of 1998 Cedis*)	0.049** (0.019)	-	-	-	-	-	-
Asymmetry Husband's Farm Y (*Std. Dev. from Mean*)	-	0.772 (0.725)	-1.189 (2.684)	-0.301** (0.151)	-0.395 (0.452)	0.176 (0.136)	0.193 (0.367)
No. Plots of Husband Harvested by Husband	0.070 (0.055)	-0.309 (0.289)	-0.200 (0.343)	0.256** (0.112)	0.262** (0.112)	0.069 (0.051)	0.068 (0.057)
No. Plots of Wife Harvested by Wife	-0.268** (0.109)	-0.119 (0.473)	-0.565 (0.810)	0.179 (0.184)	0.158 (0.206)	-0.115 (0.129)	-0.111 (0.163)
Weak Instruments F-test	3.96**	-	-	-	-	-	-
LM-Test (WI Robust)	-	-	0.3	-	0.36	-	0.2
J-Test (WI Robust)	-	-	2.32	-	0.95	-	1.55
N	107	107	107	107	107	107	107

Note: Robust Standard errors in parentheses. All models are estimated using Tobits.
These estimates inlcude all control variables. Full results in Appendix III.
Montly expenditures in 1998 thousands of cedis.
*** p-value<0.001, ** p-value<0.05, * p-value<0.1

Source: author's estimation.

Asymmetric information is measured as the absolute differences of the husband's reporting of his farm sales minus his wife's reporting. The negative differences indicate that the wife is overestimating her husband's sales. There are 80 out of the 107 households where this difference is either zero (indicating perfect information) or positive, whereas 27 are negative. To address the concern of the negative differences driving the aforementioned results, in Table 2.5 in Appendix 2 I restrict the sample to only the households that reported zero or positive differences. The results on husband's gifts, wife's expenditure in prepared foods, oil and in personal items are robust.

5 Concluding remarks

I presented two models of intra-household allocation between spouses to show that income-hiding can occur in equilibrium when household bargaining is cooperative and the change in bargaining power associated with revelation of resources is not significant enough to overcome the loss in discretionary expenditure. From the models a test to identify hiding empirically was developed. Among the households in the survey, there exist significant information asymmetries over the husband's farm income; however, asymmetric information will not necessarily result in hiding. To empirically identify income-hiding, I exploited the variation in the differences in reporting of the husband's farm income by himself and his wife as an indicator of asymmetric information. For identification, clan and bride wealth were used as instruments for asymmetric information.

Findings indicate the allocation of resources in the Ghanaian households in the sample is suggestive of income-hiding. The husband's threat of hiding farm sales income in the form of gifts to extended family members, which are not closely monitored, is credible because of the strength of the kinship ties. Asymmetric information has no effect on adult clothing or public transportation. The wife's response is also consistent with hiding. As the degree of asymmetric information increases, the wife reduces her expenditure in prepared foods and oil, but increases personal spending. The results on husband's gifts, the wife's prepared food, oil, and personal expenditure are robust to restricting the sample to households where the wife underestimates her husband's farm income, as well as considering farm income instead of the differences in observability of farm income.

There are several models that would be consistent with the results. The simple model of cooperative bargaining provides one of them, where the husband gives up some bargaining power in hiding, which is reflected by the decrease in his expenditure in public transportation and the increase in the wife's personal spending. Alternatively, results also align with a model where hiding is a credible threat, where the wife retaliates in response to the expectation that her husband will allocate a significant (though unknown) amount of resources towards gifts to his extended family. Nonetheless, the results are not consistent with other forms of non-cooperative behavior since the husband makes strictly positive transfers to his wife, as well as because some of the allocations in the wife's realm of responsibility respond to the unobservable resources.

The results are consistent with the anthropology literature in the sense that the husband's allegiance to his kin overrides conjugal ties, as the effect of asymmetric information over farm sales is significant statistically and in magnitude. Further, it is unclear whether hiding has negative consequences in the long run. If the gifts represent a form of risk-sharing, then these gifts will be compensated by other gifts or transfers in the future and hiding is not necessarily inefficient. This is consistent with findings from microfinance programs, where in this case, the wives put money aside in ROSCAS as a mechanism to keep control over how resources will be allocated (Anderson and Baland 2002). However, if these gifts are motivated by social pressure then hiding can result on poverty traps caused by the kin system.

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Appendix 1: Proofs

Non-cooperative bargaining (separate spheres)

Proof of Proposition 1:

By assumption $v'(0) = \infty$, implying (5) binds and $Q > 0$. Equation (9) implies that $s=0$ for some $Q > 0$ as long as $\lambda p u''(Y_f - pQ) < u'(Y_m)$ which only holds *iff* $\lambda < 0$. $\lambda \neq 0$. Since $Q > 0$ and $\lambda < 0$ from (8) we know:

$$v'(Q) = \lambda\left[p^2 u''\left(Y_f - pQ\right) + v''(Q)\right] \qquad \text{(P1.3)}$$

given the concavity assumption, is only possible if $\lambda < 0$.

If $Y_m + T = 0$,

$$\lambda p u''\left(Y_f - pQ\right) < u'(0) \qquad \text{(P1.4)}$$

If $Y_m + T = Y_f$, due to the concavity assumption we know that $u'\left(Y_f - pQ\right) > u'\left(Y_f\right)$, and from (5) and (8) we know that:

$$pu'\left(Y_f\right) < pu'\left(Y_f - pQ\right) = \lambda\left[p^2 u''\left(Y_f - pQ\right) + v''(Q)\right] \qquad \text{(P1.6)}$$

Thus,

$$\lambda p^2 u''\left(Y_f - pQ\right) < pu'\left(Y_f\right) < \lambda\left[p^2 u''\left(Y_f - pQ\right) + v''(Q)\right] \qquad \text{(P1.7)}$$

Which holds only over a small interval.

Proof of Proposition 2:

Case (i) If $Y_m + T \leq \overline{Y_m} \in \left(0, Y_f\right)$, $s = 0$, such that

$$v'(Q) - pu'\left(Y_f - pQ\right) = 0 \qquad \text{(P2.1)}$$

Comparative statics are:

$$\frac{\partial Q}{\partial Y_f} = \frac{pu''(x_f)}{v''(Q)+p^2u''(x_f)} > 0 \qquad \text{(P2.2)}$$

$$\frac{\partial Q}{\partial Y_m} = \frac{\partial Q}{\partial T} = 0 \qquad \text{(P2.3)}$$

$$\frac{\partial x_f}{\partial Y_f} = \frac{v''(Q)}{v''(Q)+p^2u''(x_f)} > 0 \qquad \text{(P2.4)}$$

$$\frac{\partial x_f}{\partial Y_m} = \frac{\partial x_f}{\partial T} = 0 \qquad \text{(P2.5)}$$

$$\frac{\partial x_m}{\partial Y_f} = \frac{\partial x_m}{\partial T} = 0 \qquad \text{(P2.6)}$$

$$\frac{\partial x_m}{\partial Y_m} = \frac{\partial x_m}{\partial T} = 1 \qquad \text{(P2.7)}$$

Case (ii) If $Y_m + T > \overline{Y_m}$,. $s, Q > 0$ implying*:*

$$u'(Y_m + T - s)\left[p^2 u''\left(Y_f + s - pQ\right) + v''(Q)\right] - pv'(Q)u''\left(Y_f + s - pQ\right) = 0 \qquad \text{(P2.8)}$$

$$pu'\left(Y_f + s - pQ\right) - v'(Q) = 0$$

Where

$$D = \det\begin{bmatrix} -p^3u'(x_m)u'''(x_f) + u'(x_m)v'''(Q) - pv''(Q)u''(x_f) + p^2v'(Q)u'''(x_f) & -p^2u''(x_m)u''(x_f) + p^2u'(x_m)u'''(x_f) - u''(x_m)v''(Q) - pv'(Q)u'''(x_f) \\ v''(Q) + p^2u''(x_f) & -pu''(x_f) \end{bmatrix} < 0 \qquad \text{(P2.9)}$$

Comparative statics are:

$$\frac{\partial Q}{\partial Y_m} = \frac{\partial Q}{\partial T} = \frac{\partial Q}{\partial Y_f} = \frac{p^3u''(x_m)u''(x_f)^2 + pu''(x_m)u''(x_f)v''(Q)}{D} > 0 \qquad \text{(P2.11)}$$

$$\frac{\partial x_f}{\partial Y_f} = \frac{\partial x_f}{\partial Y_m} = \frac{\partial x_f}{\partial T} = \frac{u''(x_m)v''(Q)^2 + p^2u''(x_m)u''(x_f)v''(Q)}{D} > 0 \qquad \text{(P2.12)}$$

$$\frac{\partial s}{\partial Y_f} = \frac{pu'(x_m)u''(x_f)v'''(Q) - p\lambda v''(Q)u'''(x_f)v''(Q) - p^2v''(Q)u''(x_f)^2}{D} < 0 \quad \text{if} \quad pu'(x_m)u''(x_f)v'''(Q) > p\lambda v''(Q)u'''(x_f)v''(Q) + p^2v''(Q)u''(x_f)^2 \qquad \text{(P2.13)}$$

$$\frac{\partial s}{\partial Y_m} = \frac{\partial s}{\partial T} = \frac{u''(x_m)\left[p^2u''(x_f) + v''(Q)\right]^2}{D} > 0 \qquad \text{(P2.15)}$$

$$\frac{\partial x_m}{\partial Y_m} = \frac{\partial x_m}{\partial T} = \frac{\partial x_m}{\partial Y_f} = \frac{-pu'(x_m)u''(x_f)v'''(Q) + p\lambda v''(Q)u'''(x_f)v''(Q) + p^2v''(Q)u''(x_f)^2}{D} > 0 \qquad \text{(P2.16)}$$

Proof of Proposition 3:

Spouse *m* hides the transfer from *f* if and only if

$$\left.\frac{\partial U_f}{\partial T}\right|_R \equiv \frac{v'(Q^R)}{D}\left[p^3u''(x_m^R)u''(x_f^R)^2 + pu''(x_m^R)u''(x_f^R)v''(Q^R)\right] + \frac{u'(x_m^R)}{D}\left[-pu'(x_m^R)u''(x_f^R)v'''(Q^R) + p\lambda v''(Q^R)u'''(x_f^R)v''(Q^R) + p^2v''(Q^R)u''(x_f^R)^2\right] = u'(x_m^R) < u'(x_m^H) = \left.\frac{\partial U_m}{\partial T}\right|_H$$

Where $D = u''(x_m^R)\left[p^2u''(x_f^R) + v''(Q^R)\right]^2 - pu'(x_m^R)u''(x_f^R)v'''(Q^R) + p\lambda v''(Q^R)u'''(x_f^R)v''(Q^R) + p^2v''(Q^R)u''(x_f^R)^2$

Simplifying the above expression yields

$$u'(x_m^R) < u'(x_m^H)$$

Which is never true due to the concavity assumption.

Cooperative bargaining

Proof of Proposition 4:

Totally differentiating (13) yields the following system:

$$\begin{bmatrix} v''(Q) + p^2(1-\mu)u''(x_f) & p(1-\mu)u''(x_f) \\ p(1-\mu)u''(x_f) & \mu u''(x_m) + (1-\mu)u''(x_f) \end{bmatrix}\begin{bmatrix} dQ \\ dx_m \end{bmatrix}$$
$$= \begin{bmatrix} p(1-\mu)u''(x_f) - pu'(x_f)\mu'(T) & p(1-\mu)u''(x_f) - pu'(x_f)\mu'(T) & p(1-\mu)u''(x_f) - pu'(x_f)\mu'(T) \\ (1-\mu)u''(x_f) - \mu'(T)\left[u'(x_f) + u'(x_m)\right] & (1-\mu)u''(x_f) - \mu'(T)\left[u'(x_f) + u'(x_m)\right] & (1-\mu)u''(x_f) - \mu'(T)\left[u'(x_f) + u'(x_m)\right] \end{bmatrix}\begin{bmatrix} dY_f \\ dY_m \\ dT \end{bmatrix}$$

Where the determinant is given by:

$$\mathrm{D} = p^2\mu(1-\mu)u''(x_f)u''(x_m) + \mu v''(Q)u''(x_m) + (1-\mu)v''(Q)u''(x_f) > 0 \qquad \text{(P4.1)}$$

Comparative statics are:

$$\frac{\partial Q}{\partial Y_f}=\frac{\partial Q}{\partial Y_m}=\frac{\partial Q}{\partial T}=\frac{p\mu(1-\mu)u''(x_f)u''(x_m)-p\mu'(T)\left[\mu u'(x_f)u''(x_m)+(1-\mu)u'(x_m)u''(x_f)\right]}{D}>0 \qquad \text{(P4.2)}$$

$$\frac{\partial x_m}{\partial Y_f}=\frac{\partial x_m}{\partial Y_m}=\frac{\partial x_m}{\partial T}=\frac{(1-\mu)v''(Q)u''(x_f)-\mu'(T)v''(Q)\left[u'(x_f)+u'(x_m)\right]-p^2(1-\mu)\mu'(T)u'(x_m)u''(x_f)}{D}>0 \qquad \text{(P4.3)}$$

$$\frac{\partial x_f}{\partial Y_f}=\frac{\partial x_f}{\partial Y_m}=\frac{\partial x_f}{\partial T}=\frac{\mu v''(Q)u''(x_m)+\mu'(T)v''(Q)\left[u'(x_f)+u'(x_m)\right]+p^2\mu\mu'(T)u'(x_f)u''(x_m)}{D}<0 \quad if \quad \mu v''(Q)u''(x_m)<\mu'(T)\{v''(Q)\left[u'(x_f)+u'(x_m)\right]+p^2\mu u'(x_f)u''(x_m)\} \qquad \text{(P4.4)}$$

Proof of Proposition 5:

Spouse *m* hides the transfer from *f* if and only if

$$\left.\frac{\partial U_m}{\partial T}\right|_R=\frac{v'(Q^R)}{D}\{p\mu(1-\mu)u''(x_f^R)u''(x_m^R)+\left[p(1-\mu)u'(x_m^R)u''(x_f^R)+p\mu u'(x_f^R)u''(x_m^R)\right]\mu'(T)\}+\frac{u'(x_m^R)}{D}\{(1-\mu)v''(Q^R)u''(x_f^R)-\left[u'(x_f^R)v''(Q^R)+u'(x_m^R)v''(Q^R)+p^2(1-\mu)u'(x_m^R)u''(x_f^R)\right]\mu'(T)\}<u'(x_m^H)=\left.\frac{\partial U_m}{\partial T}\right|_H$$

Where D $=p^2\mu(1-\mu)u''(x_f^R)u''(x_m^R)+\mu v''(Q^R)u''(x_m^R)+(1-\mu)v''(Q^R)u''(x_f^R)>0$

Simplifying the above expression yields

$$\mu'(T)<\frac{1}{M}\{u'(x_f^H)[p\mu v''(Q^R)u''(x_f^R)+p^2\mu(1-\mu)u''(x_f^R)u''(x_m^R)+(1-\mu)v''(Q^R)u''(x_m^R)]$$
$$-(1-\mu)u'(x_f^R)v''(Q^R)u''(x_m^R)-p\mu^2(1-\mu)u'(x_f^R)u''(x_f^R)u''(x_m^R)\}\equiv\overline{\Delta\mu}$$ where $M>0$.

$$\frac{\partial\mu}{\partial T}<\frac{1}{M}\{\mu u'(x_m^H)v''(Q^R)u''(x_m^R)+p^2\mu(1-\mu)u''(x_f^R)u''(x_m^R)[u'(x_m^H)-\mu u'(x_m^R)]+(1-\mu)v''(Q^R)u''(x_f^R)[u'(x_m^H)-u'(x_m^R)]\}\equiv\overline{\Delta\mu} \qquad \text{(P5.4)}$$

Where, $M=-u'(x_m^R)\{v''(Q^R)\left[u'(x_f^R)+u'(x_m^R)\right]+p^2(1-\mu)u'(x_m^R)u''(x_f^R)+p^2\mu(1-\mu)u'(x_m^R)u''(x_f^R)+p^2\mu^2u'(x_f^R)u''(x_m^R)\}>0$

A strictly positive threshold change in bargaining power such that *m* hides exists if,

$$\mu u'(x_m^H)v''(Q^R)u''(x_m^R)+p^2\mu(1-\mu)u''(x_f^R)u''(x_m^R)\left[u'(x_m^H)-\mu u'(x_m^R)\right]+(1-\mu)v''(Q^R)u''(x_f^R)\left[u'(x_m^H)-u'(x_m^R)\right]>0 \qquad \text{(P5.5)}$$

Proof of Corollary 1:

Taking limit $\mu\to 0$ approaches zero:

$$\lim_{\mu\to 0}\overline{\Delta\mu}=\frac{v''(Q^R)u''(x_f^R)[u'(x_m^H)-u'(x_m^R)]}{-v''(Q^R)\left[u'(x_f^R)+u'(x_m^R)\right]-p^2u'(x_m^R)u''(x_f^R)}<0 \qquad \text{(P5.6)}$$

Taking the limit as $\mu\to 1$:

$$\lim_{\mu\to 1}\overline{\Delta\mu}=\frac{u'(x_m^H)v''(Q^R)u''(x_m^R)}{-v''(Q^R)\left[u'(\widetilde{x}_f)+u'(x_m^R)\right]-p^2u'(\widetilde{x}_f)u''(x_m^R)}>0. \qquad \text{(P5.7)}$$

Appendix 2: Descriptive statistics and results

Table 2.1: Variable definitions

Variable	Definition
Clan	Dicotomous variable equal to 1 if the wife speaks Akwapim Twi, and zero otherwise
Bride-wealth	Monetary value in Cedis of the gifts given from the husband's family to the wife's family upon marriage, deflated using the consumer price index (CPI) of the year of marriage reported by the wife. CPI used was obtained from the World Bank Development Indicators. For marriages before 1964, the 1964 CPI was used.
Asymmetric Information Husband's Farm Income	Husband's annual farm sales reported by the Husband - Husband's annual farm sales reported by the Wife.
No. Plots of Husband, Harvested by Husband	Number of plots harvested by the husband alone out of the plots farmed by the husband during the year of 1998.
No. Plots of Wife Harvested by Wife	Number of plots harvested by the wife alone out of the plots farmed by the wife during the year of 1998.
Wife's School Level	Dicotomous variable equal to 1 if the wife's school level is secondary or higher, zero if illiterate or elementary.
Husband's School Level	Categorical variable equal to 1 if illiterate, 2 if elementary, 3 if secondary, 4 if highschool or higher.
Number of Household Members	Number of household members.
Number of Girls	Number of girls living in the household.
Number of Boys	Number of boys living in the household.
No. Age <5	Number of members under 5 years of age.
No. 5 < age < 15	Number of members between 5 and 14 years old.
No. 14 < age < 60	Number of members between 15 and 59 yeard old.
No. age > 59	Number of members over 60 years of age.
Years of marriage	Number of years spouses have been married.
Wife's Age	Age of the wife in years.
Husband's Age	Age of the husband in years.
Husband's Share of HH Y	Husband's Income divided by the sum of husband's and wife's total income.
Total HH Income	Sum of husband's and wife's total income. This includes farm sales, profit from business, wages of work for pay, spouse's sales from own farms, and value of produce from farms used for household consumption.
No. Crops farmed	Total number of crops farmed during the year. Considers husband's and wife's crops.
Outside Y	Dicotomous variable equal to 1 if either husband or wife own a business or work for pay.
Pineapple	Dicotomous variable equal to 1 if husband farms pineapple.
Total Area of HH Plots	Sum of total area of wife's and husband's plots.
Village 1	Dicotomous variable equal to 1 if household lives in village 1.
Village 2	Dicotomous variable equal to 1 if household lives in village 2.
Village 3	Dicotomous variable equal to 1 if household lives in village 3.

Source: author's estimation.

Table 2.2: Descriptive statistics on household demographics

Variable	Obs	Mean	Std. Dev	Variable	Mean	Std. Dev
Demographics				*Income and Farming*		
Household Members	107	4.80	1.98	No. Crops	3.81	1.62
No. Girls	107	1.93	1.42	No. Plots of Husb. Farmed by Husb.	1.78	1.63
No. Boys	107	2.22	1.64	No. Plots of Wife Farmed by Wife	0.38	0.82
No. HH members less than 5	107	1.15	0.95	Total Area HH Plots	26.77	25.10
No. HH members age 6 to 14	107	1.20	1.24	Husb. Income	160.24	287.25
No. HH members over 60	107	0.16	0.48	Wife Income	35.87	68.52
Years Married	107	12.46	9.67	Husband's Share of Income	0.74	0.31
Wife's Age	107	34.75	11.04	Total HH Income	196.11	316.36
Husband's Age	107	40.99	11.21	Bride-wealth	5,273.34	20,230.31
Household Expenditures				*Husband's Attributable Expenditure*		
Schooling	107	1.87	4.52	Husb. Public Transp.	1.446	4.166
Child Clothes	107	0.86	1.32	Husb. Clothes	0.779	1.227
Utilities	107	0.70	0.96	Chop Money	59.099	52.115
Oil	107	0.56	1.07	Husb. Gifts	53.935	64.801
Protein	107	4.59	4.02	*Wife's Attributable Expenditure*		
Total Prep Food	107	1.81	2.40	Wife Personal Exp.	0.134	0.196
Wife Prep. Food	107	1.02	1.71	Wife Public	0.387	0.657
Husb. Prep. Food	107	0.794	1.465	Wife Clothes	0.614	1.082
Total Food	107	15.38	10.99	Total Expenditure	32.75	27.03

Note: Household expenditure and income in thousands of Cedis.

Source: author’s estimation.

Table 2.3: Full results on the effect of asymmetric information on household expenditure

Variable	First Stage	Household Public Goods			Food Expenditure				
		Tot. School	Child Clothing	Utilities	Oil	Protein	Wife's Prep. Food	Husband's Prep. Food	Tot. Prep. Food
Clan	-0.366	-	-	-	-	-	-	-	-
(=1 *if Matrilineal Clan*)	(0.243)								
Bridewealth	-0.005**	-	-	-	-	-	-	-	-
(Millions of 1998 Cedis)	(0.002)								
Clan * Bridewealth	0.049**	-	-	-	-	-	-	-	-
(*Millions of 1998 Cedis*)	(0.019)								
Asymmetry Husband's Farm Y	-	-1.189	-0.395	0.193	-1.160**	-0.666	-2.086**	-3.154	-2.774**
(*Std. Dev. from Mean*)		(2.684)	(0.452)	(0.367)	(0.579)	(1.229)	(0.943)	(3.430)	(1.357)
No. Plots of Husband Harvested	0.070	-0.200	0.262**	0.068	0.118	0.354	0.027	-0.113	-0.042
by Husband	(0.055)	(0.343)	(0.112)	(0.057)	(0.113)	(0.242)	(0.165)	(0.300)	(0.212)
No. Plots of Wife Harvested by	-0.268**	-0.565	0.158	-0.111	-0.192	-0.053	-0.661**	-0.902	-0.975**
Wife	(0.109)	(0.810)	(0.206)	(0.163)	(0.184)	(0.447)	(0.313)	(0.855)	(0.423)
Wife School Level	-0.274	1.129	0.459*	-0.090	-0.025	0.237	-1.189**	-0.834	-1.412*
(=1 *if Secondary or Higher*)	(0.210)	(1.086)	(0.260)	(0.198)	(0.257)	(0.781)	(0.561)	(0.927)	(0.738)
Husband School Level	-0.700*	0.025	-0.939	0.197	-1.532*	2.132	-2.894**	-2.821	-3.449**
(=1 *if Primary or Illiterate*)	(0.412)	(2.720)	(0.609)	(0.439)	(0.830)	(1.793)	(1.203)	(2.734)	(1.547)
Husband School Level	-0.476	0.354	-0.972	0.314	-1.170*	2.336	-1.594*	-1.367	-1.730
(=1 if Secondary)	(0.358)	(2.248)	(0.642)	(0.453)	(0.703)	(1.510)	(0.861)	(2.091)	(1.185)
No. Household Members	0.091	1.259*	0.220*	0.039	0.135	0.729	-0.318	0.470	-0.069
	(0.112)	(0.760)	(0.121)	(0.180)	(0.160)	(0.570)	(0.290)	(0.556)	(0.446)
No. Girls	-0.221**	-1.061	-0.088	0.022	-0.158	-0.793*	-0.415	-0.717	-0.680*
	(0.098)	(0.783)	(0.151)	(0.101)	(0.183)	(0.464)	(0.257)	(0.797)	(0.382)
No. Boys	-0.108	-1.646**	0.035	-0.100	-0.102	-1.032**	-0.133	-0.430	-0.279
	(0.100)	(0.704)	(0.096)	(0.085)	(0.150)	(0.470)	(0.225)	(0.387)	(0.328)
No. Age < 5	0.101	0.023	-0.403**	-0.124	0.005	-0.052	1.412**	0.313	1.363**
	(0.155)	(0.860)	(0.184)	(0.157)	(0.277)	(0.711)	(0.503)	(0.603)	(0.582)
No. 5 < Age < 14	0.244	0.342	-0.087	0.059	0.274	0.723	0.753*	0.322	0.762
	(0.198)	(0.900)	(0.176)	(0.248)	(0.266)	(0.636)	(0.419)	(0.851)	(0.595)
No. Over Age 60	0.311	-0.303	-0.674	0.088	0.160	-0.176	0.516	0.474	0.233
	(0.196)	(1.432)	(0.435)	(0.246)	(0.361)	(0.994)	(0.666)	(1.484)	(0.917)
Years Married	-0.017	-0.113	-0.022	-0.013	0.015	-0.050	0.007	-0.002	0.021
	(0.012)	(0.087)	(0.022)	(0.010)	(0.020)	(0.051)	(0.030)	(0.066)	(0.045)
Wife's Age	0.027	0.257*	-0.000	0.004	0.032	0.214**	0.121*	0.060	0.144*
	(0.018)	(0.139)	(0.031)	(0.019)	(0.034)	(0.091)	(0.065)	(0.096)	(0.085)
Husband's Age	0.000	0.041	0.008	-0.004	-0.020	-0.046	-0.001	0.029	-0.000
	(0.012)	(0.092)	(0.019)	(0.009)	(0.022)	(0.054)	(0.034)	(0.047)	(0.044)
Husband's Share of HH Y	0.105	0.632	-0.814**	0.035	-0.312	-0.578	0.046	1.454	0.684
	(0.204)	(1.386)	(0.391)	(0.200)	(0.411)	(1.257)	(0.644)	(1.134)	(0.948)
Total HH Y	0.000*	0.000**	0.000*	3.953	0.000*	0.000*	0.000	0.000	0.000**
(*Thousands of 1998 Cedis*)	(0.000)	(0.000)	(0.000)	(3.868)	(6.111)	(0.000)	(0.000)	(0.000)	(0.000)
No. of Crops Farmed	0.003	0.253	0.010	0.047	0.064	-0.169	0.530**	0.023	0.501*
	(0.057)	(0.311)	(0.131)	(0.067)	(0.119)	(0.280)	(0.266)	(0.234)	(0.287)
Outside Y	-0.499*	-0.930	-0.943**	0.095	-0.282	-0.460	-0.964	-0.938	-0.995
(=1 *if Business or Work for Pay*)	(0.287)	(1.577)	(0.473)	(0.226)	(0.354)	(0.781)	(0.660)	(1.580)	(0.939)
Pineapple	-0.119	0.860	0.399	-0.371	-0.241	0.396	-1.597**	0.524	-1.074
(=1 *if farms pineapple*)	(0.187)	(1.350)	(0.363)	(0.247)	(0.371)	(1.016)	(0.706)	(0.887)	(0.832)
Total Area of HH Plots	0.006	0.091**	0.002	0.003	0.003	0.038*	-0.007	0.023	0.001
	(0.005)	(0.042)	(0.007)	(0.005)	(0.008)	(0.023)	(0.015)	(0.035)	(0.021)
Village 1	-0.448	-1.390	-0.659	-0.712*	0.118	0.590	-1.618*	-1.788	-2.784**
	(0.333)	(1.471)	(0.478)	(0.377)	(0.470)	(1.196)	(0.916)	(1.229)	(1.204)
Village 2	0.068	-0.201	-1.337**	-0.659*	1.425**	1.940	1.182	-2.843*	-0.945
	(0.334)	(1.616)	(0.549)	(0.368)	(0.547)	(1.458)	(0.977)	(1.455)	(1.329)
Village 3	-0.330	-2.436	-0.764	-0.215	1.550**	2.673*	-0.654	-2.485	-2.546*
	(0.274)	(2.123)	(0.561)	(0.338)	(0.610)	(1.521)	(0.985)	(1.826)	(1.434)
Constant	-0.060	-12.47**	1.825*	0.759	-0.564	-5.419	-1.467	-1.934	-1.022
	(1.034)	(5.736)	(1.014)	(0.763)	(1.243)	(4.032)	(2.204)	(3.682)	(3.260)
N	107	107	107	107	107	107	107	107	107

Source: author’s estimation.

Table 2.4: Full results on the effect of asymmetric information on spousal expenditure

Variable	First Stage	Husband Assignable Expenditure				Wife's Assignable Expenditure		
		Husband Pub. Transp.	Husband Clothes	Gifts Husband Family	Chop Money	Wife Public Transp.	Wife Clothes	Wife Personal Exp.
Clan	-0.366	-	-	-	-	-	-	-
(=*1 if Matrilineal Clan*)	(0.243)							
Bridewealth	-0.005**	-	-	-	-	-	-	-
(*Millions of 1998 Cedis*)	(0.002)							
Clan * Bridewealth	0.049**	-	-	-	-	-	-	-
(*Millions of 1998 Cedis*)	(0.019)							
Asymmetry Husband's Farm Y	-	-2.635*	-0.057	48.65*	6.367	0.323	0.169	0.119**
(*Std. Dev. from Mean*)		(1.572)	(0.731)	(27.98)	(10.36)	(0.773)	(0.458)	(0.053)
No. Plots of Husband Harvested	0.070	0.236	0.016	1.710	-7.545**	0.090	0.186**	0.011
by Husband	(0.055)	(0.226)	(0.115)	(4.647)	(3.422)	(0.060)	(0.094)	(0.013)
No. Plots of Wife Harvested by	-0.268**	-1.406*	-0.428	16.56*	6.029	0.002	0.137	0.032
Wife	(0.109)	(0.794)	(0.288)	(9.659)	(9.079)	(0.167)	(0.175)	(0.028)
Wife School Level	-0.274	0.257	0.127	2.384	17.10	0.279	0.581	0.086
(=*1 if Secondary or Higher*)	(0.210)	(0.713)	(0.438)	(19.89)	(11.64)	(0.229)	(0.400)	(0.057)
Husband School Level	-0.700*	-3.829	0.649	4.429	0.000	0.318	0.221	0.090
(=*1 if Primary or Illiterate*)	(0.412)	(2.456)	(0.716)	(36.77)	(19.49)	(0.617)	(0.520)	(0.079)
Husband School Level	-0.476	-1.528	0.418	-35.30	8.602	0.560	0.146	0.101
(=1 if Secondary)	(0.358)	(1.595)	(0.562)	(30.84)	(13.77)	(0.548)	(0.375)	(0.077)
No. Household Members	0.091	1.107**	-0.198	-6.416	0.314	-0.000	-0.304	-0.001
	(0.112)	(0.505)	(0.229)	(12.43)	(6.416)	(0.126)	(0.299)	(0.016)
No. Girls	-0.221**	0.216	-0.070	-16.16*	-4.742	0.079	0.020	-0.011
	(0.098)	(0.485)	(0.210)	(9.252)	(5.413)	(0.182)	(0.139)	(0.018)
No. Boys	-0.108	0.323	-0.155	-4.564	-7.767	-0.040	-0.025	-0.011
	(0.100)	(0.419)	(0.160)	(9.369)	(4.864)	(0.086)	(0.128)	(0.016)
No. Age < 5	0.101	-1.759*	0.204	33.79*	10.20	-0.078	0.547	0.034
	(0.155)	(0.989)	(0.396)	(17.66)	(8.483)	(0.124)	(0.406)	(0.032)
No. 5 < Age < 14	0.244	-0.818	0.400	8.422	3.095	0.040	0.024	-0.000
	(0.198)	(0.714)	(0.320)	(15.99)	(9.038)	(0.134)	(0.319)	(0.029)
No. Over Age 60	0.311	0.507	0.466	-37.81*	-28.06**	0.151	-0.231	-0.073*
	(0.196)	(0.935)	(0.518)	(21.20)	(13.84)	(0.302)	(0.329)	(0.043)
Years Married	-0.017	-0.027	-0.019	1.510	0.566	0.000	0.023	0.001
	(0.012)	(0.037)	(0.023)	(1.056)	(0.727)	(0.009)	(0.015)	(0.002)
Wife's Age	0.027	-0.005	0.028	0.021	1.900**	-0.010	-0.034*	0.004
	(0.018)	(0.091)	(0.043)	(2.101)	(0.870)	(0.020)	(0.019)	(0.005)
Husband's Age	0.000	-0.100*	-0.011	1.359	0.010	0.003	0.035	-0.004
	(0.012)	(0.058)	(0.028)	(1.244)	(0.772)	(0.011)	(0.027)	(0.003)
Husband's Share of HH Y	0.105	-1.866	0.068	-38.27	-20.18	-0.254	-0.376	-0.092
	(0.204)	(1.307)	(0.524)	(25.84)	(20.98)	(0.256)	(0.436)	(0.059)
Total HH Y	0.000*	0.000**	0.000*	-0.001	-3.333	-2.109	0.000	-0.000
(*Thousands of 1998 Cedis*)	(0.000)	(0.000)	(6.760)	(0.002)	(0.000)	(5.523)	(3.498)	(6.183)
No. of Crops Farmed	0.003	-0.119	-0.133	10.58	0.000	0.005	-0.083	-0.031**
	(0.057)	(0.255)	(0.119)	(6.601)	(7.666)	(0.057)	(0.086)	(0.012)
Outside Y	-0.499*	-1.480	0.474	-25.48	5.971	-0.090	0.102	0.012
(=*1 if Business or Work for Pay*)	(0.287)	(1.002)	(0.506)	(22.78)	(3.786)	(0.283)	(0.289)	(0.049)
Pineapple	-0.119	0.244	0.981**	26.66	1.754	-0.237	0.225	-0.041
(=*1 if farms pineapple*)	(0.187)	(0.904)	(0.445)	(22.75)	(14.46)	(0.199)	(0.485)	(0.051)
Total Area of HH Plots	0.006	0.062*	0.003	-0.790*	-26.82**	0.010	-0.002	0.000
	(0.005)	(0.035)	(0.011)	(0.438)	(9.046)	(0.007)	(0.006)	(0.001)
Village 1	-0.448	-0.760	0.430	-26.03	-0.310	0.239	-4.136***	-0.145**
	(0.333)	(1.071)	(0.473)	(28.16)	(0.280)	(0.327)	(0.813)	(0.055)
Village 2	0.068	-1.557	-1.180	-30.93	0.000	0.459	-2.639***	-1.358***
	(0.334)	(1.371)	(0.731)	(34.33)	(2.195)	(0.366)	(0.733)	(0.177)
Village 3	-0.330	-1.992	0.400	-67.52**	48.31***	0.342	-1.029	0.028
	(0.274)	(1.232)	(0.642)	(34.03)	(13.52)	(0.445)	(0.675)	(0.089)
Constant	-0.060	4.331	-0.464	58.38		-0.420	1.518*	0.277*
	(1.034)	(3.494)	(1.457)	(80.53)		(0.756)	(0.892)	(0.142)
N	107	107	107	107	107	107	107	107

Source: author's estimation.

Table 2.5: Restricted sample results on effect of asymmetric information on household and spousal expenditures

		Household	Food Expenditures			Husband Expenditure			Wife's Expenditure		
Variable	First Stage	Child Clothing	Oil	Protein	Wife's Prep. Food	Husband Pub. Transp.	Husband Clothes	Gifts Husband Family	Wife Public Transp.	Wife Clothes	Wife Personal Exp.
Clan	-0.508	-	-	-	-	-	-	-	-	-	-
(=*1 if Matrilineal Clan*)	(0.404)										
Bridewealth	-0.005**	-	-	-	-	-	-	-	-	-	-
(*Millions of 1998 Cedis*)	(0.002)										
Clan * Bridewealth	0.050**	-	-	-	-	-	-	-	-	-	-
(*Millions of 1998 Cedis*)	(0.021)										
Asymmetry Husband's Farm Y	-	-0.640	-1.478*	-2.206	-1.785*	-1.271	0.623	63.39*	0.500	0.592	0.177**
(*Std. Dev. from Mean*)		(0.421)	(0.756)	(1.628)	(1.041)	(0.963)	(0.768)	(34.93)	(0.695)	(0.508)	(0.066)
No. Plots of Husband Harvested	0.085	0.255**	0.164	0.421	-0.033	0.116	-0.028	0.549	0.056	0.173	-0.001
by Husband	(0.061)	(0.113)	(0.134)	(0.323)	(0.189)	(0.156)	(0.134)	(5.970)	(0.075)	(0.114)	(0.011)
No. Plots of Wife Harvested by	-0.328**	-0.203	-0.319	-0.685	-0.729*	-0.298	0.157	26.73*	0.084	0.234	0.073**
Wife	(0.127)	(0.176)	(0.278)	(0.771)	(0.433)	(0.416)	(0.334)	(14.81)	(0.252)	(0.268)	(0.037)
Wife School Level	-0.224	0.415*	-0.110	0.705	-0.995	0.256	0.391	-3.231	0.337	1.061*	0.051
(=*1 if Secondary or Higher*)	(0.211)	(0.238)	(0.282)	(1.029)	(0.622)	(0.385)	(0.488)	(25.52)	(0.244)	(0.595)	(0.038)
Husband School Level	-1.092**	-0.481	-3.127**	-0.066	-3.099*	-0.962	0.247	10.73	0.906	0.660	0.209**
(=*1 if Primary or Illiterate*)	(0.507)	(0.520)	(1.134)	(2.342)	(1.631)	(1.248)	(1.022)	(50.30)	(0.805)	(0.829)	(0.105)
Husband School Level	-0.922*	-0.409	-2.772**	1.327	-1.957	-0.649	0.007	-22.54	1.009	0.419	0.155
(=1 if Secondary)	(0.495)	(0.451)	(1.057)	(2.314)	(1.269)	(1.063)	(0.876)	(47.84)	(0.721)	(0.693)	(0.096)
No. Household Members	0.094	0.192*	0.223	1.093	-0.282	0.517*	-0.489*	-17.62	-0.036	-0.434	-0.017
	(0.143)	(0.115)	(0.243)	(0.871)	(0.301)	(0.302)	(0.257)	(17.98)	(0.166)	(0.357)	(0.022)
No. Girls	-0.156	-0.179	-0.060	-1.069	-0.482	-0.538*	-0.023	-14.15	0.196	0.103	-0.000
	(0.128)	(0.151)	(0.235)	(0.725)	(0.305)	(0.276)	(0.200)	(13.38)	(0.164)	(0.206)	(0.018)
No. Boys	-0.075	0.039	0.039	-0.779	-0.242	-0.300	0.008	-7.468	0.024	-0.002	-0.007
	(0.125)	(0.095)	(0.197)	(0.723)	(0.296)	(0.245)	(0.166)	(14.59)	(0.105)	(0.154)	(0.020)
No. Age < 5	0.058	-0.330**	-0.398	-0.756	1.515**	-0.094	0.526	56.54**	-0.088	0.678	0.038
	(0.158)	(0.160)	(0.331)	(0.907)	(0.508)	(0.345)	(0.372)	(21.68)	(0.179)	(0.543)	(0.025)
No. 5 < Age < 14	0.239	-0.030	0.096	0.504	0.662	0.064	0.507	13.39	0.084	0.017	0.014
	(0.217)	(0.173)	(0.288)	(0.810)	(0.407)	(0.330)	(0.318)	(17.78)	(0.159)	(0.409)	(0.028)
No. Over Age 60	0.087	0.110	-0.334	0.665	-0.495	0.152	0.182	-73.25**	0.160	-0.798*	-0.037
	(0.235)	(0.289)	(0.463)	(1.426)	(0.701)	(0.564)	(0.558)	(33.43)	(0.248)	(0.447)	(0.046)
Years Married	-0.019	-0.019	0.008	-0.014	0.009	-0.017	-0.002	0.956	-0.005	0.041**	0.002
	(0.015)	(0.015)	(0.022)	(0.061)	(0.033)	(0.025)	(0.025)	(1.320)	(0.012)	(0.018)	(0.002)
Wife's Age	0.027	-0.032*	0.012	0.192	0.164**	0.095*	0.052	1.974	-0.010	-0.047*	-0.000
	(0.023)	(0.018)	(0.040)	(0.133)	(0.080)	(0.056)	(0.037)	(3.020)	(0.023)	(0.024)	(0.004)
Husband's Age	0.003	0.036*	-0.041	-0.067	0.016	-0.022	-0.010	1.199	-0.016	0.067*	-0.000
	(0.014)	(0.022)	(0.025)	(0.081)	(0.040)	(0.029)	(0.029)	(1.795)	(0.014)	(0.038)	(0.003)
Husband's Share of HH Y	0.062	-0.342	-0.727	-0.587	-0.360	-0.052	0.065	-56.29*	-0.128	-0.780	-0.010
	(0.215)	(0.353)	(0.476)	(1.477)	(0.695)	(0.539)	(0.540)	(30.44)	(0.328)	(0.561)	(0.050)
Total HH Y	0.000**	0.000**	0.000*	0.000**	0.000	0.000**	0.000	-0.005	-0.000	-2.466	-1.613*
(*Thousands of 1998 Cedis*)	(0.000)	(0.000)	(8.865)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(7.031)	(9.308)
No. of Crops Farmed	-0.053	0.082	-0.070	-0.299	0.452*	-0.072	-0.329**	11.74	-0.040	-0.198*	-0.027**
	(0.079)	(0.126)	(0.163)	(0.414)	(0.264)	(0.172)	(0.127)	(9.535)	(0.059)	(0.117)	(0.013)
Outside Y	-0.473	-0.682*	0.106	0.072	-1.399*	-0.195	1.336**	-10.98	-0.028	0.354	0.090*
(=*1 if Business or Work for Pay*)	(0.287)	(0.374)	(0.459)	(1.207)	(0.758)	(0.588)	(0.521)	(30.84)	(0.329)	(0.498)	(0.055)
Pineapple	-0.269	0.338	-0.526	0.088	-1.890**	-0.114	1.383**	30.18	0.027	0.308	0.071
(=*1 if farms pineapple*)	(0.270)	(0.381)	(0.594)	(1.676)	(0.944)	(0.898)	(0.586)	(35.51)	(0.352)	(0.685)	(0.047)
Total Area of HH Plots	0.006	0.001	0.018*	0.076**	-0.021	0.023**	0.022*	-0.612	0.014*	-0.006	0.002*
	(0.007)	(0.008)	(0.009)	(0.033)	(0.018)	(0.011)	(0.013)	(0.787)	(0.008)	(0.011)	(0.001)
Village 1	-0.534	-0.318	0.120	1.256	-1.663*	-1.400**	1.548**	-23.71	0.136	-4.021***	-0.084
	(0.431)	(0.413)	(0.636)	(1.633)	(0.990)	(0.709)	(0.625)	(40.15)	(0.389)	(0.877)	(0.052)
Village 2	0.079	-0.995**	1.321**	2.210	1.008	-1.328*	-0.746	-39.21	0.340	-2.768**	-0.996***
	(0.356)	(0.497)	(0.612)	(1.795)	(0.921)	(0.758)	(0.765)	(40.75)	(0.403)	(0.900)	(0.121)
Village 3	-0.511	-0.240	1.214*	2.805	-0.650	-1.858**	-0.183	-73.96	-0.015	-0.786	-0.140**
	(0.368)	(0.566)	(0.686)	(2.031)	(1.088)	(0.894)	(0.761)	(45.80)	(0.511)	(0.876)	(0.071)
Constant	0.477	0.173	2.614*	-5.316	-1.509	-1.009	-1.372	23.40	-0.202	0.872	0.035
	(1.380)	(1.071)	(1.585)	(5.422)	(2.409)	(1.778)	(1.724)	(111.5)	(1.053)	(1.848)	(0.177)
N	80	80	80	80	80	80	80	80	80	80	80

Source: author's estimation.

Table 2.6: OLS results

Variable	Household Public Goods			Food Expenditures				Husband's Expenditure			Wife's Expenditure		
	Tot. School	Child Clothing	Utilities	Oil	Protein	Wife's Prep. Food	Tot. Prep. Food	Public Transp.	Clothes	Gifts Husband Family	Public Transp.	Clothes	Wife Personal Exp.
Asymmetry Husband's Farm Y	0.772	-0.301**	0.176	-0.148	0.712	-0.297	-0.107	-1.607*	0.191	7.045	-0.043	0.107	0.040**
(*Std. Dev. from Mean*)	(0.725)	(0.151)	(0.136)	(0.117)	(0.632)	(0.243)	(0.207)	(0.956)	(0.198)	(8.986)	(0.064)	(0.133)	(0.019)
No. Plots of Husband Harvested	-0.309	0.256**	0.069	0.067	0.283	-0.082	-0.195	0.173	0.003	3.874	0.109**	0.187*	0.014
by Husband	(0.289)	(0.112)	(0.051)	(0.098)	(0.235)	(0.129)	(0.147)	(0.204)	(0.110)	(4.275)	(0.051)	(0.095)	(0.012)
No. Plots of Wife Harvested by	-0.119	0.179	-0.115	0.021	0.241	-0.257	-0.375*	-1.179	-0.375	7.202	-0.075	0.124	0.015
Wife	(0.473)	(0.184)	(0.129)	(0.116)	(0.378)	(0.177)	(0.214)	(0.754)	(0.233)	(9.220)	(0.076)	(0.215)	(0.023)
Wife School Level	1.497	0.475*	-0.093	0.163	0.478	-0.854*	-0.913	0.444	0.169	-5.406	0.212	0.571	0.075
(=*1 if Secondary or Higher*)	(0.979)	(0.257)	(0.207)	(0.234)	(0.825)	(0.460)	(0.552)	(0.606)	(0.421)	(18.52)	(0.171)	(0.383)	(0.056)
Husband School Level	1.508	-0.872*	0.186	-0.805	3.096*	-1.594**	-1.504*	-3.084	0.825	-25.79	0.058	0.182	0.037
(=*1 if Primary or Illiterate*)	(1.782)	(0.517)	(0.363)	(0.601)	(1.571)	(0.739)	(0.759)	(2.287)	(0.567)	(27.48)	(0.282)	(0.425)	(0.064)
Husband School Level	1.400	-0.922	0.305	-0.596	3.083**	-0.666	-0.296	-0.974	0.559	-56.50**	0.358	0.114	0.057
(=1 if Secondary)	(1.511)	(0.595)	(0.399)	(0.530)	(1.282)	(0.441)	(0.564)	(1.337)	(0.434)	(21.77)	(0.245)	(0.329)	(0.066)
No. Household Members	1.100*	0.213*	0.040	0.037	0.601	-0.477*	-0.295	1.019**	-0.218	-2.766	0.032	-0.297	0.006
	(0.605)	(0.116)	(0.186)	(0.097)	(0.470)	(0.245)	(0.282)	(0.482)	(0.215)	(10.22)	(0.072)	(0.267)	(0.014)
No. Girls	-0.635	-0.067	0.018	0.074	-0.487	-0.004	-0.089	0.445	-0.016	-24.87**	0.000	0.007	-0.028**
	(0.430)	(0.120)	(0.078)	(0.123)	(0.316)	(0.164)	(0.223)	(0.418)	(0.130)	(7.956)	(0.058)	(0.174)	(0.014)
No. Boys	-1.538**	0.040	-0.101	-0.027	-0.946**	-0.009	-0.119	0.383	-0.144	-7.090	-0.060	-0.030	-0.016
	(0.573)	(0.094)	(0.086)	(0.106)	(0.385)	(0.180)	(0.210)	(0.417)	(0.151)	(7.747)	(0.065)	(0.116)	(0.014)
No. Age < 5	-0.068	-0.409**	-0.123	-0.064	-0.116	1.314**	1.210**	-1.822*	0.189	35.63**	-0.064	0.551	0.037
	(0.741)	(0.185)	(0.153)	(0.231)	(0.658)	(0.464)	(0.458)	(1.012)	(0.389)	(16.74)	(0.113)	(0.425)	(0.030)
No. 5 < Age < 14	-0.050	-0.106	0.061	0.100	0.482	0.378	0.238	-1.018	0.358	16.21	0.098	0.034	0.010
	(0.640)	(0.157)	(0.234)	(0.174)	(0.576)	(0.273)	(0.357)	(0.673)	(0.291)	(13.60)	(0.124)	(0.366)	(0.026)
No. Over Age 60	-1.120	-0.713*	0.094	-0.151	-0.671	-0.267	-0.860	0.089	0.382	-21.29	0.266	-0.209	-0.047
	(1.163)	(0.398)	(0.232)	(0.311)	(0.959)	(0.537)	(0.721)	(0.796)	(0.445)	(20.55)	(0.198)	(0.284)	(0.036)
Years Married	-0.093	-0.022	-0.013	0.019	-0.043	0.025	0.045	-0.018	-0.017	1.158	-0.000	0.024	0.001
	(0.077)	(0.022)	(0.010)	(0.019)	(0.049)	(0.026)	(0.034)	(0.033)	(0.022)	(0.989)	(0.009)	(0.015)	(0.002)
Wife's Age	0.213**	-0.002	0.005	0.006	0.184**	0.079	0.086	-0.028	0.023	0.984	-0.002	-0.032*	0.005
	(0.099)	(0.030)	(0.018)	(0.028)	(0.079)	(0.053)	(0.062)	(0.084)	(0.041)	(1.700)	(0.012)	(0.019)	(0.004)
Husband's Age	0.050	0.008	-0.004	-0.015	-0.041	0.008	0.010	-0.095	-0.010	1.155	0.001	0.035	-0.004
	(0.094)	(0.019)	(0.009)	(0.018)	(0.052)	(0.026)	(0.032)	(0.058)	(0.028)	(1.114)	(0.010)	(0.025)	(0.002)
Husband's Share of HH Y	0.414	-0.824**	0.037	-0.402	-0.733	-0.145	0.398	-1.970	0.046	-32.68	-0.218	-0.366	-0.084
	(1.312)	(0.392)	(0.197)	(0.346)	(1.218)	(0.531)	(0.791)	(1.328)	(0.521)	(25.75)	(0.226)	(0.407)	(0.058)
Total HH Y	0.000**	8.385*	4.056	0.000	0.000	3.893	0.000**	0.000*	0.000**	0.001	1.933	3.719	-0.000
(*Thousands of 1998 Cedis*)	(0.000)	(0.000)	(0.000)	(2.655)	(0.000)	(4.563)	(4.704)	(0.000)	(4.354)	(0.002)	(2.148)	(2.726)	(0.000)
No. of Crops Farmed	0.231	0.010	0.047	0.065	-0.176	0.510**	0.481*	-0.125	-0.133	10.93*	0.008	-0.082	-0.031**
	(0.281)	(0.129)	(0.067)	(0.095)	(0.258)	(0.228)	(0.269)	(0.236)	(0.114)	(6.250)	(0.055)	(0.084)	(0.011)
Outside Y	-0.185	-0.906**	0.089	0.065	0.029	-0.266	0.042	-1.076	0.564	-40.90**	-0.224	0.083	-0.009
(=*1 if Business or Work for Pay*)	(1.118)	(0.438)	(0.209)	(0.279)	(0.836)	(0.422)	(0.496)	(0.831)	(0.460)	(20.37)	(0.195)	(0.328)	(0.047)
Pineapple	0.936	0.402	-0.371	-0.246	0.400	-1.520**	-0.979	0.290	0.974**	24.14	-0.239	0.226	-0.037
(=*1 if farms pineapple*)	(1.348)	(0.357)	(0.246)	(0.291)	(0.975)	(0.624)	(0.706)	(0.864)	(0.446)	(21.72)	(0.203)	(0.483)	(0.050)
Total Area of HH Plots	0.073**	0.001	0.003	-0.004	0.027	-0.024**	-0.022**	0.053	0.000	-0.411	0.013**	-0.002	0.001
	(0.033)	(0.006)	(0.004)	(0.006)	(0.017)	(0.010)	(0.011)	(0.036)	(0.009)	(0.380)	(0.005)	(0.004)	(0.000)
Village 1	-0.945	-0.637	-0.716**	0.321	0.919	-1.190*	-2.176**	-0.531	0.495	-34.92	0.144	-4.142***	-0.162**
	(1.271)	(0.465)	(0.359)	(0.312)	(1.037)	(0.632)	(0.886)	(0.974)	(0.470)	(27.08)	(0.216)	(0.807)	(0.050)
Village 2	-0.398	-1.345**	-0.658*	1.322**	1.832	1.027	-1.185	-1.670	-1.187	-25.33	0.481	-2.634***	-
	(1.558)	(0.540)	(0.372)	(0.409)	(1.417)	(0.699)	(1.018)	(1.314)	(0.728)	(32.87)	(0.349)	(0.742)	
Village 3	-1.855	-0.736	-0.220	1.825***	3.091**	-0.140	-1.737	-1.695	0.495	-78.22**	0.225	-1.048*	0.002
	(1.790)	(0.563)	(0.315)	(0.542)	(1.440)	(0.757)	(1.060)	(1.128)	(0.621)	(32.24)	(0.313)	(0.623)	(0.086)
Constant	-12.14**	1.847*	0.756	-0.219	-5.097	-1.100	-0.496	4.524	-0.420	46.89	-0.481	1.491	0.253
	(5.128)	(1.021)	(0.779)	(0.838)	(3.562)	(1.729)	(2.056)	(3.406)	(1.428)	(65.79)	(0.638)	(0.920)	(0.125)
N	107	107	107	107	107	107	107	107	107	107	107	107	107

Source: author's estimation.