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 simple model of intra-household allocation between spouses to show that when the quantity of resources available to the household is not perfectly observed by both spouses, hiding of income can occur even when revelation of the additional resources increases bargaining power. From the model, a test to identify income hiding empirically is derived. For the empirical application, a household survey conducted in Southern Ghana is used. I 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. For identification, the wife's clan and the husband's bride-wealth payments upon marriage are used as instruments for asymmetric information. My findings indicate that allocations are suggestive of men hiding farm sales income in the form of gifts to extended family members, which are not closely monitored. It is unclear whether hiding has negative consequences in the long run because hiding occurs in the form of gifts, instead of expenditure in alcohol or tobacco. 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. The wife's response is also suggestive of hiding. As information asymmetries increase, she reduces her expenditure in non-essential items, such as prepared foods and oil, but increases personal spending. Expenditure in oil is one of the main sources of calories among poor households in the region.

Key words: incomplete information, income hiding, non-cooperative family bargaining.

JEL Classification: D13, D82, J12.

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1. Introduction

Models of household bargaining generally treat the household as a single decision-making unit, or assume household members are able to make binding commitments and have full information. These models predict as a result that intra-household allocation of resources will be efficient. Even when households are unable to commit to binding agreements, it is often argued that, because families involve long-term, repeated interaction and caring, household members will realize there are opportunities for Pareto improvement and therefore cooperation will evolve over time (Browning and Chiappori, (1998); Manser and Brown, (1980); McElroy and Horney, (1981)). Furthermore, because bargaining power is partially determined by each spouse's relative amount of resources, hiding of income can be argued to be unlikely.

Recent empirical evidence, however, has documented inefficient allocations (Udry, (1996)) and non-cooperative behavior as a result of asymmetric information (Chen (2009); de Laat (2009); Ashraf, (2009)). Migration introduces information asymmetries between household members as the migrant spouse cannot perfectly monitor her spouse's behavior, and this can lead to inefficient allocation of resources. Chen (2009), drawing data from the China Health and Nutrition Survey, finds that after the father migrates, girl's household labor increases, though child schooling and health, which are easily monitored, are unaffected by migration. De Laat (2008), using a survey conducted among households living in two Nairobi slums, finds that efficiency losses exist as a result of migrants' need to invest in monitoring.

However, households living under the same roof can be subject to information asymmetries as well (Pahl (1983; 1990); Boozer et al. (2009); Bursztyn and Coffman, (2010)), and the literature on the response of household members to having informational advantages over own income is scarce. Ashraf (2009) conducts field experiments in the Philippines to examine the effect of the information environment on savings decisions among married couples. She finds that when husbands have private information over their own resources, they deposit the money into their private accounts, while committing the money to consumption (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. Generally, child human capital investments, such as education and nutrition, are 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.

I first derive a test to formally identify hiding of income empirically through a simple theoretical model. 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). In deciding to reveal or hide income, the husband faces a trade-off between increasing his own discretionary spending and increasing his bargaining power. If he hides the unobservable income, the husband may spend the entire amount without influence from his spouse. But, public goods are observable by both spouses. Therefore, if the husband is to successfully hide his additional income, he can spend it only on private consumption, which is unobservable. Conversely, if he reveals, he can increase his influence over intra-household allocation decisions, but his income will effectively be taxed via the bargaining process. 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.

To determine whether the information asymmetries that exist between spouses over farm income result in hiding, a household survey conducted in 4 villages in Southern Ghana between 1996 and 1998 is used. 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, making Ghana an excellent place to examine spousal behavior in the presence of asymmetric information. Additionally, the extended kin group in Ghana is the institution around which social organization revolves, and for matrilineal groups, "an individual's allegiance to the lineage often overrides any other loyalty and, as such, conjugal ties are considered less important than lineal *blood* ties" (Takyi and Gyimah, (2007)).

For the empirical application, 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. Hiding further requires for the husband to have expenditure alternatives that are also not monitored by his wife. In this study, I examine the effect of asymmetric information over 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 child nutrition because asymmetric information 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 in Southern Ghana

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, seemed to be shared by both husbands and wives, while the majority maintains separate financial arrangements of spending, owning and saving (Oppong, (1974)). Oppong (1974) observed that husbands and wives do not own, manage or inherit property together[2]. She finds 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.

Men and women tend to have separate income and expenditure streams, often with a traditional gender-based division of responsibilities for different type of expenditures (Chao, (1998)).

[2] Hill (1963) documented that among the Ewe husbands and wives seldom compose a unified production unit, while Ashanti women commonly earn their living and inherit property (Guyer, 1981). 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)).

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).

The extended kin group in Ghana is the institution around which social organization revolves. The main forms of kinship are the matrilineal and patrilineal clan systems. Under the patrilineal system, property and inheritance rights are passed through the father's line, whereas under matriliny, such rights are transferred through the mother's line (Takyi and Gyimah, (2007)). For matrilineal groups, "an individual's allegiance to the lineage often overrides any other loyalty and, as such, conjugal ties are considered less important than lineal *blood* ties" (Takyi and Gyimah, (2007))[3]. Consistent with this belief, under the matrilineal family system, married couples rarely pool their resources together for the benefit of the conjugal family unit (Clark, 1999). The practice of maintaining separate marital accounts coupled with the allegiance of the wife to her own maternal family could undermine the authority of the husband (Takyi and Gyimah, (2007)).

Bride-wealth is the term used to refer to the gifts given by the groom's family to that of the bride upon marriage. It represents each family's approval of the other and its acceptance formalizes the marriage contract (Saml and Falola, (2002)). In Ghana, relocation after marriage is mostly virilocal (Ogbu, (1978)), bride-wealth is thus paid, in part, because marriage effectively involves loss of labor 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, the bride's parents keep it (Goody, (1973)), and upon divorce bride-wealth will generally have to be returned (Tambiah et al. (1989)).

[3] Robertson (1984) states that in Accra, Ghana a woman's most important affective relationships are usually with her mother and her children; her siblings rank next in importance, and her husband in a poor third (pg 182).

The relationship between bride-wealth on intra-household decision making differs by lineage or clan. Among non-matrilineal groups, divorce is harder to achieve, bride-wealth payments tend to be higher, and these are more likely to be returned upon divorce, relative to matrilineal groups (Ogbu, (1978))[4]. Furthermore, under the matrilineal system of descent, 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)).

3. Intra-Household Decision-Making under Asymmetric Information

Consider a model with two family members, *f* and *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 household member *m* receives two forms of income, Y_m which is common knowledge to both spouses and T which is not observed by household member *f*, while household member f receives Y_f which is also common knowledge. For the husband, we can think about this as being a result of the allocation of labor hours towards two different productive activities, such as farming two different plots of land, or selling prepared foods early in the morning and farming later in the day. Household member *m* distributes the total number of hours he allocates towards productive activities between working in a plot whose yields can be easily monitored by his wife, such as plots they farm jointly or that are owned by her family,

[4] 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)).

and a plot where income is not easily monitored, such as plots farmed by the husband alone, as well as profit from a small or informal business.

Household member *m* 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 *f* cannot observe *m's* private consumption choices, nor does she invest in monitoring *m's* income[5], though *f* can perfectly 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:

$$x_f + x_m + pQ = Y_f + Y_m + T \qquad (1)$$

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:

$$x_i + pQ_i = Y_i + T_i \qquad \textit{for } i = f,m \qquad (2)$$

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:

[5] 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.

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

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.

Separate Spheres Bargaining in Ghanaian Households

As noted previously, in Ghanaian households men and women hold separate economies, such that 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, there can be incentives to hide unobservable resources.

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[6]. Thus, upon marriage the husband makes a binding commitment to pay for school fees, and these are fixed. This assumption is not unrealistic given that the households in the sample live in very small villages and it is unlikely that they have many schooling choices. The housekeeping allowance (or chop money), *s*, however, is chosen by the husband. The marital contract stipulates that he must provide for his wife, though it does not specify the amount. 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 other schooling expenses, 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,

$$\max_{Q\geq 0;\, x_f\geq 0} U_f = v(Q) + u(x_f) \quad s.t. \quad x_f \leq Y_f + s - pQ \tag{4}$$ [7]

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

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

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[6] 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)).

[7] 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.

Conducting comparative statics on the above condition yields,

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

So, 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:

$$\max_{s\geq 0;\, x_m \geq 0; Q\geq 0} U_m = v(Q) + u(x_m)$$

$$s.t. \quad x_m \leq Y_m + T - s;\;\; v'(Q) - pu'\big(Y_f + s - pQ\big) = 0 \qquad (7)$$

The Lagrangian is:

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

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

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

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

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

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

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* $(0, Y_f)$ *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 $Y_m + T \leq \overline{Y_m} \in (0, Y_f)$, 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 $Y_m + T \leq \overline{Y_m} \in (0, Y_f)$, $s = 0$ *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 $Y_m + T \leq \overline{Y_m} \in (0, Y_f)$, 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[8]. 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. Thus in this case there could be incentives to hide income. 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 they manage their resources independently, the husband does not 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 (in Castilla, (2010)).

Collective Bargaining

[8] 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.

But what happens if household bargaining is cooperative? If household allocations are fully cooperative, differences in the observability of 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:

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

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[9].

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

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

$$\frac{\partial C}{\partial Q} = v'(Q) - (1-\mu)pu'(Y_f + Y_m + T - x_m - pQ) \leq 0$$

$$\frac{\partial C}{\partial x_m} = \mu u'(x_m) - (1-\mu)u'(Y_f + Y_m + T - x_m - pQ) \leq 0$$

$$Q\left[\frac{\partial C}{\partial Q}\right] = 0;\ x_m\left[\frac{\partial C}{\partial x_m}\right] = 0;\ Q, x_f \geq 0 \qquad (13)$$

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.

[9] 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).

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 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*

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

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.

4. 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 Proposition 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 requiring less data.

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 $\frac{\partial x_m}{\partial T} \neq 0$, and $\frac{\partial Q}{\partial T} = \frac{\partial x_f}{\partial T} = 0$.

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.

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)[10] were randomly selected to be interviewed, except in village 3 where all households were interviewed. Single headed households were

[10] Some of these households are polygamous.

excluded from the sample. Enumerators interviewed the male and female respondents privately. Each person was interviewed 15 times during the course of 2 years (Udry and Goldstein, (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)[11]. 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 round 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.

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.

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

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.

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 1), though relying solely on farm sales would not be taking advantage of the full extent of asymmetric information[12]. 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. Expenditure is then estimated as a function of the information asymmetry 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*, $x_{i,v}^{g}$, is given by:

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

[12] Robustness estimates including farm sales reported by the husband are presented in Appendix III.

Where $\sum_{v=1}^{4} \alpha_v$ corresponds to village dummy variables; 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 information asymmetries[13]. 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.

$$Asym_i^m = \frac{abs\left(FarmSales_i^{m,m} - FarmSales_i^{m,f}\right)}{\frac{1}{N}\sum_{i=1}^{N} FarmSales_i^{m,m}} \tag{16}$$

However, there exists the possibility that there is a certain norm of acceptable information asymmetry between spouses in Ghanaian societies. To account for this, I use the standardized asymmetry in the empirical analysis, though in Appendix III results on the normalized asymmetry are also presented.

$$StdAsym_i^m = \frac{Asym_i^m - \overline{Asym_i^m}}{\frac{1}{N}\sum\left(Asym_i^m - \overline{Asym_i^m}\right)^2} \tag{17}$$

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

[13] 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.

previous bargaining outcomes. To address this I instrument for asymmetry using clan membership, the amount of bride-wealth payments, and interaction of the two.

$$StdAsym_i^m = \beta_1 BW_i^h + \beta_2 Clan_i^f + \beta_3 BW_i^h * Clan_i^f + \tau D_i^h + \varphi C_i^f + \delta C_i^m + \sum_{v=1}^{4} \alpha_v + \upsilon_i \quad (18)$$

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 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% speak Akwapim or Twi, while the rest speak Ewe (12.5%), Akan (19.5%) or other (10%). 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 Appendix II.

In Ghana, clan membership influences information asymmetries 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. 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. 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 (Schneider, (1964) in Takyi and Gyimah, (2007)), but it is also a significant transfer of wealth between families. 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. 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.

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 true significance of the instruments will be underestimated.

Descriptive Statistics

Table 1 and Table 2 include descriptive statistics of household and spouse's monthly attributable expenditures. Average monthly expenditure in child clothing and utilities is very similar representing between 2 and 3 percent of total expenditure, while schooling fees correspond to close to 6 percent.

These households devote almost half of their expenditure to food, spending 14 percent in protein. Non-essential food items such as oil and prepared food (or fufu) represent 1.7 and 5.5 percent respectively of household expenditure. In what follows some of these items will be important in evaluating whether the wife's expenditure choices are consistent with the reporting of her beliefs about her husband's farm income.

Table 1:
Descriptive Statistics on Household Expenditure

Variable	Mean	Std. Dev	% of HH Income
Household Expenditures			
Schooling	1.87	4.52	0.95
Child Clothes	0.86	1.32	0.44
Utilities	0.70	0.96	0.36
Oil	0.56	1.07	0.28
Protein	4.59	4.02	2.34
Food Expenditure			
Total Prep Food	1.81	2.40	0.92
Wife Prep. Food	1.02	1.71	0.52
Husb. Prep. Food	0.794	1.465	0.405
Total Food	15.38	10.99	7.84
Total Expenditure	32.75	27.03	16.70

Note: Monthly expenditure in thousands of Cedis.
% of total expenditure excluding own farm consumption.

The information on chop money is only used as a reference for comparison. The average chop money amount given from husband's to wives 59 thousand Cedis. The husband's attributable expenditure considered throughout the paper correspond to public transportation, clothing and gifts to his family (excluding children and his wife, or previous wives), while for the wife I consider personal expenses instead of gifts. In all cases, these expenditures are reported by the person disbursing the money. On average, men spend almost 4 times as much on public transportation than women, which is consistent with men being the main economic support of the household, contributing on average almost 75% of household income. Clothing expenditure however is very similar, with each spouse spending on average almost as much on herself as on children's clothing. The wife's personal expenses are not very significant, accounting for less than 1% of household expenditure. The husband's gifts to his family however are significantly large, ranging from zero to 270 thousand Cedis per month. To put this in perspective, those gifts are almost equivalent to the monthly amount of chop money that he gives his wife. The way these gifts are defined indicates they are not funeral expenses, nor weddings, and they are not loans either, such that these gifts will not be returned.

Table 2:
Descriptive Statistics on Spousal Attributable Expenditure

Variable	Mean	Std. Dev	% of HH Income
Husband's Attributable Expenditure			
Husb. Public Transp.	1.446	4.166	0.737
Husb. Clothes	0.779	1.227	0.397
Chop Money	59.099	52.115	30.136
Husb. Gifts	53.935	64.801	27.502
Wife's Attributable Expenditure			
Wife Personal Exp.	0.134	0.196	0.068
Wife Public Transportation	0.387	0.657	0.198
Wife Clothes	0.614	1.082	0.313

Note: Monthly expenditure in thousands of Cedis.
% of total expenditure excluding own farm consumption.

Table 3 contains information of the amount of the husband's farm sales and his wife's reporting of these. The average of farm sales income reported by the husband is twice as large as the average sales reported by his wife, suggesting a very significant degree of asymmetric information. The mean absolute difference is even larger because 27 wives overestimate their husband's farm income. The difference in cross-reporting accounts for 14% of total household income, and 18% of the husband's income.

Table 3:
Descriptive Statistics on Spousal Attributable Expenditure

Variable	Mean	Std. Dev	% of HH Income
Farm Sales and Asymmetric Information			
Abs (Hus - Wife)	28.74	56.85	14.65
Wife's Report of Husband's Sales	15.09	37.39	7.70
Husband's Report of Husb. Sales	31.63	63.04	16.13
Total HH Sales	33.43	63.26	17.05
Spousal Income			
Husb. Income	160.24	287.25	81.71
Wife Income	35.87	68.52	18.29
Husband's Share of Income	0.74	0.31	-
Total HH Income	196.11	316.36	100.00

Note: Monthly expenditure in thousands of Cedis.
% of total income including own farm consumption.

Table 4 contains information of farm sales by clan. Most of the households in the survey are of matrilineal (Akwapim) descent (57%). Consistent with the literature, average bride-wealth payments in households where the wife is of matrilineal descent are almost one fourth of the amounts paid for non-matrilineal wives. While husband's of wives of matrilineal or non-matrilineal descent report similar amounts of monthly farm sales, the wife's beliefs of her husband's farm income in matrilineal clans are almost half of what the wives in non-matrilineal clans report on average. However, the absolute difference in reporting of the husband's farm sales across clan membership is very similar[14].

[14] The number of wives that overestimate their husband's farm sales is evenly distributed across clans.

Table 4:
Descriptive Statistics Farm Sales and Bridewealth by Wife's Clan

Variable	Other			Matrilineal		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Bride-wealth (Millions *of Cedis*)	45	8,794.39	29,737.70	62	2,717.75	7,584.24
Abs Diff. Husband Sales (*thousands of Cedis*)	45	28.76	59.24	62	28.72	55.54
Standarized Abs. Diff. Husband Sales	45	-0.03	1.01	62	-0.03	0.95
Household Total Sales (*thousands of Cedis*)	45	36.50	66.92	62	31.20	60.93
Husband Total Sales (*thousands of Cedis*)	45	34.97	66.96	62	29.20	60.47
Wife's Belief Husband Sales (*thousands of Cedis*)	45	20.51	49.14	62	11.17	25.49

Note: Monthly sales in thousands of Cedis.

5. Econometric Results

The data indicates that information asymmetries over farm income exist within spouses among the households in the survey. However, incomplete information will not always result in hiding. Implication 1 indicates that hiding can be identified empirically if the asymmetric information over farm sales 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 will also provide information about her beliefs regarding their availability of resources.

For the husband, commuting and clothing expenditures are considered, as well as the gifts granted to his family members other than his children, wife or previous wives[15]. Both commuting and clothing are considered to be 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 5 contains the results.

The first column corresponds to the estimation results for equation (18). These results are consistent with the arguments presented earlier. The degree of asymmetric information over the husband's farm income is decreasing in bride-wealth among households with wives of non-matrilineal descent, while it is increasing in bride-wealth for households with wives of matrilineal clans. The instruments are statistically significant individually, except for the case of the dummy variable indicating clan membership, and they are all jointly significant at the 95% confidence level. 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 endogeneity tests are used. 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

[15] 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.

the second stage being equal to zero is also reported. Additionally, most of the equations being estimated are Tobits, in which case the use of maximum likelihood ameliorates the consequences of weak instruments, even in small samples.

Table 5
Results for the Effect of Asymmetric Information on Household Expenditure

Variable	First Stage	Husband Assignable Expenditure			Wife's Assignable Expenditure		
		Husband Pub. Transp.	Husband Clothes	Gifts Husband Family	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*	0.323	0.169	0.119**
(*Std. Dev. from Mean*)		(1.572)	(0.731)	(27.98)	(0.773)	(0.458)	(0.053)
No. Plots of Husband Harvested by Husband	0.070	0.236	0.016	1.710	0.090	0.186**	0.011
	(0.055)	(0.226)	(0.115)	(4.647)	(0.060)	(0.094)	(0.013)
No. Plots of Wife Harvested by Wife	-0.268**	-1.406*	-0.428	16.56*	0.002	0.137	0.032
	(0.109)	(0.794)	(0.288)	(9.659)	(0.167)	(0.175)	(0.028)
Weak Instruments F-test	3.96**	-	-	-	-	-	-
LM-Test (WI Robust)	-	2.49	0.01	2.68*	0.21	2.38	0.08
J-Test (WI Robust)	-	0.33	0.33	1.27	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 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

It can be observed in Table 5 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% 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 also 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 owns 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, these results are not robust to the weak instruments LM test.

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 6.

Table 6:
Results for the Effect of Asymmetric Information on Household Expenditure

Variable	First Stage	Household Public Goods			Food Expenditures			
		Tot. School	Child Clothing	Utilities	Oil	Protein	Wife's Prep. Food	Tot. Prep. Food
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)*	-	-1.189 (2.684)	-0.395 (0.452)	0.193 (0.367)	-1.160** (0.579)	-0.666 (1.229)	-2.086** (0.943)	-2.774** (1.357)
No. Plots of Husband Harvested by Husband	0.070 (0.055)	-0.200 (0.343)	0.262** (0.112)	0.068 (0.057)	0.118 (0.113)	0.354 (0.242)	0.027 (0.165)	-0.042 (0.212)
No. Plots of Wife Harvested by Wife	-0.268** (0.109)	-0.565 (0.810)	0.158 (0.206)	-0.111 (0.163)	-0.192 (0.184)	-0.053 (0.447)	-0.661** (0.313)	-0.975** (0.423)
Weak Instruments F-test	3.96**	-	-	-	-	-	-	-
LM-Test (WI Robust)	-	0.3	0.36	0.2	4.91**	0.24	6.65**	6.96**
J-Test (WI Robust)	-	2.32	0.95	1.55	2.19	1.1	1.37	1.43
N	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

The degree of asymmetric information has no significant effect on household goods that are easily monitored, such as child clothing and utilities[16]. The magnitude is also 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% 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 II). 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.

[16] In Appendix III 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.

Robustness:

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 households where this difference is either zero (indicating perfect information) or positive, whereas 27 are negative. The absolute value of the 27 negative observations does not affect the range or the distribution of the indicator of asymmetric information, as shown in Figure 1. Nonetheless, the concern remains that these observations could be driving the afore-presented results, in which case it would not make sense to say that the wife, for instance, reduces the expenditure in oil and prepared foods because she believes they have less money. For this reason, in Table 7 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 remain unaffected. Husband's expenditure in public transportation is no longer significant, though this could be due to the loss in degrees of freedom when further restricting an already small sample.

In further robustness checks, results using the husband's farm sales, as well as the absolute differences in cross-reporting of the husband's farm sales (normalized by the average difference) to identify income-hiding were obtained. The estimates on prepared food and oil expenditure, as well as the wife's personal expenses and gifts to the husband's family are robust. This suggests the above-presented results are not being driven by households in which the wife is overestimating her husband's farm income, nor by the preferred indicator of asymmetric information. Further, the husband's farm sales do not significantly impact all of the husband's expenditures, and they have a significant effect on expenditures of the wife. This is inconsistent with spouses behaving completely non-cooperatively, in which case the wife's expenditures would not be affected by husband's income, and all of husband's expenditures would be responsive to farm income.

Table 7:
Results for the Effect of Asymmetric Information on Household Expenditure (*non-negative differences*)

Variable	First Stage	Household Expenditure			Husband			Wife		
		Child Clothing	Oil	Wife's Prep. Food	Husband Pub. Transp.	Husband Clothes	Gifts Husband Family	Wife Public Transp.	Wife Clothes	Wife Personal Exp.
Clan (*=1 if Matrilineal Clan*)	-0.508 (0.404)	-	-	-	-	-	-	-	-	-
Bridewealth (*Millions of 1998 Cedis*)	-0.005** (0.002)	-	-	-	-	-	-	-	-	-
Clan * Bridewealth (*Millions of 1998 Cedis*)	0.050** (0.021)	-	-	-	-	-	-	-	-	-
Asymmetry Husband's Farm Y (*Std. Dev. from Mean*)	-	-0.640 (0.421)	-1.478* (0.756)	-1.785* (1.041)	-1.271 (0.963)	0.623 (0.768)	63.39* (34.93)	0.500 (0.695)	0.592 (0.508)	0.177** (0.066)
No. Plots of Husband Harvested by Husband	0.085 (0.061)	0.255** (0.113)	0.164 (0.134)	-0.033 (0.189)	0.116 (0.156)	-0.028 (0.134)	0.549 (5.970)	0.056 (0.075)	0.173 (0.114)	-0.001 (0.011)
No. Plots of Wife Harvested by Wife	-0.328** (0.127)	-0.203 (0.176)	-0.319 (0.278)	-0.729* (0.433)	-0.298 (0.416)	0.157 (0.334)	26.73* (14.81)	0.084 (0.252)	0.234 (0.268)	0.073** (0.037)
Weak Instruments F-test	3.34**									
N	80	80	80	80	80	80	80	80	80	80

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

Even though I conducted weak instrument robust tests for over-identifying restrictions that fail to reject the null of all of the instruments being exogenous, it is possible that bride-wealth and clan could influence household allocations. Both bride-wealth payments, as well as lineage are related to the threat of divorce. A wife of matrilineal descent has a greater support network, in which case the repayment of bride-wealth upon divorce is not as strong of a reason to stay in a troubled marriage. Further, among matrilineal clans the wife is able to file for divorce and contingent on the husband being proven guilty, bride-wealth repayment could be forfeited or significantly reduced.

In what follows I present evidence to support that the channel of influence of these instruments on allocations is through the incentives to hide income. To do so, I estimate the reduced-form demand equations presented above as a function of the standardized indicator of asymmetric information without instrumentation. I then obtain the residuals from these equations and regress them on the indicator of clan, bride-wealth and the interaction of the two. This is not a formal test for exogeneity given that it relies on the choice of functional form, but it does provide additional evidence that conditional on asymmetric information over farm income, these variables are not correlated with the unexplained variation in expenditure. The results in Table 8 indicate that the instruments are uncorrelated with the residuals obtained from the expenditure equation in all cases (except for the expenditure on prepared foods). While clan is significantly correlated with the unexplained variation in prepared foods expenditure, bride-wealth and the interaction between them is not, and the F-statistic is small and insignificant, suggesting that there is at least one instrument that is exogenous.

Table 8:
Results, Residuals of Expenditure as a function of Instruments

Variable	Clan	Bride-wealth	Clan*Bride-wealth	F-statistic	Adj. R-squred
Schooling	0.842 (0.682)	-0.004 (0.016)	0.016 (0.063)	0.68	-0.009
Children's Clothes	-0.016 (0.227)	-0.001 (0.005)	-0.003 (0.021)	0.04	-0.029
Utilities	0.231 (0.178)	-0.000 (0.004)	0.010 (0.016)	0.89	-0.003
Wife's Prepared Food	0.493* (0.241)	0.005 (0.005)	-0.029 (0.020)	1.69	0.019
Wife's Personal Exp.	0.036 (0.031)	-0.000 (0.000)	0.002 (0.002)	0.91	-0.003
Wife's Public Transp.	0.209* (0.109)	-0.000 (0.002)	0.005 (0.009)	1.71	0.020
Wife's Clothing	0.128 (0.171)	0.001 (0.004)	-0.002 (0.014)	0.19	-0.024
Husband's Pub. Transp	0.605 (0.616)	0.000 (0.015)	0.022 (0.057)	0.48	-0.016
Husband's Clothing	0.066 (0.230)	-0.001 (0.005)	0.006 (0.021)	0.09	-0.027
Husband's Gifts	-8.902 (10.90)	-0.288 (0.268)	0.387 (0.932)	0.51	-0.014

Note: Robust Standard errors in parentheses.
Montly expenditures in thousands of cedis. Bride-wealth in millions of Cedis.
*** p-value<0.001, ** p-value<0.05, * p-value<0.1

6. Conclusions

I presented a model of intra-household allocation between spouses to show that income-hiding can occur in equilibrium when the change in bargaining power associated with revelation of resources is not significant enough to overcome the loss in discretionary expenditure. From the model 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 considered 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. The wife's response is consistent with either hiding being a credible threat, or with retaliation on her part as a response to the expectation that her husband will allocate a significant (though unknown) amount of resources towards these gifts. 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. 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 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.

<u>Appendix I</u>: Proofs

<u>Non-Cooperative Bargaining (Separate Spheres):</u>

<u>Proof of Proposition 1:</u>

Let Q=0, then (5) implies:

$$v'(0) < pu'(Y_f + s) \qquad (P1.1)$$

But by assumption $v'(0) = \infty$, so (5) binds and Q>0.

Equation (9) implies that *s=0* for some Q>0 as long as:

$$\lambda pu''(Y_f - pQ) < u'(Y_m) \qquad (P1.2)$$

Which only holds *iff* $\lambda < 0$. We have shown that (5) binds, therefore the constraint on *m's* problem binds as well, so $\lambda \neq 0$. Since Q>0, from (8) we know:

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

given the concavity assumption, is only possible if $\lambda < 0$.
If $Y_m + T = 0$, (*P3.2*) holds because $u'(0) = \infty$.

$$\lambda pu''(Y_f - pQ) < u'(0) \qquad (P1.4)$$

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

$$pu'(Y_f - pQ) = v'(Q) = \lambda[p^2u''(Y_f - pQ) + v''(Q)] \qquad (P1.5)$$

So,

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

So, following from (9), and multiplying (*P3.4*) by *p* on both sides:

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

when $\lambda v''(Q) \to 0$, *(P1.7)* will generally won't hold, though there exists the possibility of a small interval where (*P1.7*) holds.

<u>Proof of Proposition 2:</u>

Case (i) If $Y_m + T \leq \overline{Y_m} \in (0, Y_f)$, $s = 0$, such that the value of Q is obtained from (5)

$$v'(Q) - pu'(Y_f - pQ) \leq 0 \qquad (P2.1)$$

Differentiating *(P2.1)* and *f's* budget constraint with respect to Y_f *and* T yields the results stated in the proposition.

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

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

$$\frac{\partial x_f}{\partial Y_f} = \frac{\partial x_f}{\partial T} = \frac{v''(Q)}{v''(Q)+p^2u''(x_f)} > 0 \qquad (P2.4)$$

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

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

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

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

Solving (8) and (9) for λ and substituting in, yields the following system for *s* and *Q:*

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

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

Totally differentiating the system in (*P2.8*):

$$\begin{bmatrix} -p^3u'(x_m)u'''(x_f) + u'(x_m)v'''(Q) - pv''(Q)u''(x_f) + p^2v'(Q)u'''(x_f) & -p^2u''(x_m)u''(x_f) + p^2u'(x_m)u'''(x_f) - u''(x_m)v''(Q) - pv'(Q)u'''(x_f) \\ v''(Q) + p^2u''(x_f) & -pu''(x_f) \end{bmatrix} \begin{bmatrix} dQ \\ ds \end{bmatrix}$$

$$= \begin{bmatrix} pv'(Q)u'''(x_f) - p^2u'(x_m)u'''(x_f) & -p^2u''(x_m)u''(x_f) - u''(x_m)v''(Q) & -p^2u''(x_m)u''(x_f) - u''(x_m)v''(Q) \\ pu''(x_f) & 0 & 0 \end{bmatrix} \begin{bmatrix} dY_f \\ dY_m \\ dT \end{bmatrix}$$

Let *D* denote determinant of the Hessian which is equal to:

$$D = det \begin{bmatrix} -p^3u'(x_m)u'''(x_f) + u'(x_m)v'''(Q) - pv''(Q)u''(x_f) + p^2v'(Q)u'''(x_f) & -p^2u''(x_m)u''(x_f) + p^2u'(x_m)u'''(x_f) - u''(x_m)v''(Q) - pv'(Q)u'''(x_f) \\ v''(Q) + p^2u''(x_f) & -pu''(x_f) \end{bmatrix}$$

$$= u''(x_m)\left[p^2u''(x_f) + v''(Q)\right]^2 + p\lambda v''(Q)u'''(x_f)v''(Q) - pu'(x_m)u''(x_f)v'''(Q) + p^2v''(Q)u''(x_f)^2 < 0 \qquad (P2.9)$$

Recall from FOC's: $v'(Q) - pu'(x_m) = \lambda v''(Q)$

So, the comparative statics are,

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

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

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

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

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

Proof of Proposition 3:

Assumptions:

- *(i)* Spouse *f* can observe T with probability zero.
- *(ii)* Spouse *m's* private consumption, or discretionary expenditure, is not monitored by *f*.

If *m* chooses to reveal T and $Y_m > \overline{Y_m}$ the change in utility per unit change in T is given by:

$$\left.\frac{\partial U_f}{\partial T}\right|_R = \frac{\partial v}{\partial Q}\frac{\partial Q}{\partial T} + \frac{\partial u}{\partial x_f}\frac{\partial x_f}{\partial T} \qquad (P3.1)$$

$$= \frac{v\prime(Q^R)}{D}\left[p^3 u''(x_m^R)u''(x_f^R)^2 + pu''(x_m^R)u''(x_f^R)v''(Q^R)\right] + \frac{u\prime(x_m^R)}{D}\left[-pu'(x_m^R)u''(x_f^R)v'''(Q^R) + p\lambda v''(Q^R)u'''(x_f^R)v''(Q^R) + p^2 v''(Q^R)u''(x_f^R)^2\right]$$

Substituting in *f's* FOC $pu'(x_f^R) = v'(Q^R) = \lambda[p^2 u''(x_f^R) + v''(Q^R)]$, and $u'(x_m^R) = \lambda pu''(x_f^R)$

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

since

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

If *m* decides to hide then *m* spends all the unobservable income on private consumption. Thus, the change in utility per unit change in the transfer is give by:

$$\left.\frac{\partial U_m}{\partial T}\right|_H = u'(x_m^H) \qquad (P3.2)$$

where x_m^H is the allocation when T is hidden, and x_m^R is the allocation when T is revealed. Note that $x_m^H > x_m^R$.

Spouse *m* hides money from *f* if and only if

$$\left.\frac{\partial U_m}{\partial T}\right|_R = u'(x_m^R) < u'(x_m^H) = \left.\frac{\partial U_m}{\partial T}\right|_H \qquad (P3.3)$$

Which is never true due to the concavity assumption. Thus in a non-cooperative outcome, even when the husband makes positive transfers to his wife, he never hides.

Collective Bargaining

Proof of Proposition 4:

Totally differentiating the equations in (13) yields the following system of equations:

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

Let the determinant of the Hessian be denoted by *D*, where

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

Comparative statics reveal that,

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

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

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

Proof of Proposition 5:

Assumptions:

(i) Spouse *f* can observe T with probability zero.

(ii) If revealed, the unobservable income changes bargaining power.

(iii) Spouse *m's* private consumption is not monitored by spouse *f*.

Spouse *f* hides money from *m* if and only if

$$\left.\frac{\partial U_m}{\partial T}\right|_R < \left.\frac{\partial U_m}{\partial T}\right|_H \qquad (P5.1)$$

If *m* reveals the demands are obtained by solving (12) for *T>0*: Thus, the change in Q, x_f, x_m per unit change in *T* are equivalent to those corresponding to changes in Y_f described in Proposition 4. The change in utility per unit change in T is given by:

$$\left.\frac{\partial U_m}{\partial T}\right|_R = \frac{\partial v}{\partial Q}\left[\frac{\partial Q}{\partial T} + \frac{\partial Q}{\partial \mu}\frac{\partial \mu}{\partial T}\right] + \frac{\partial u}{\partial x_m}\left[\frac{\partial x_m}{\partial T} + \frac{\partial x_m}{\partial \mu}\frac{\partial \mu}{\partial T}\right] \qquad (P5.2)$$

$$= \frac{v'(Q^R)}{D}\left\{p\mu(1-\mu)u''(x_f^R)u''(x_m^R) + \left[p(1-\mu)u'(x_m^R)u''(x_f^R) + p\mu u'(x_f^R)u''(x_m^R)\right]\mu'(T)\right\} + \frac{u'(x_m^R)}{D}\left\{(1-\mu)v''(Q^R)u''(x_f^R) - \left[u'(x_f^R)v''(Q^R) + u'(x_m^R)v''(Q^R) + p^2(1-\mu)u'(x_m^R)u''(x_f^R)\right]\mu'(T)\right\}$$

Taking into account FOC's $p\mu u'(x_f^R) = v'(Q)$, *and rearranging terms*

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

If *m* hides then he allocates T towards private consumption and neither household good consumption nor *f's* private consumption depend on T. Thus, the change in utility per unit change in T is give by:

$$\left.\frac{\partial U_m}{\partial T}\right|_H = u'(x_m^H) \qquad (P5.3)$$

where x_m is the optimal bargained private consumption allocation when T is hidden, and x_m^R is the optimal private consumption allocation if it is revealed.

Simplifying the above expression yields the condition that must be met for *m* to hide T

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

Where,

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

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

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

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

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

Taking the limit as μ approaches 1:

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

implying that whether the threshold is strictly positive depends on initial level of bargaining power.

Appendix II
Definition of Variables

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.

<u>Appendix III:</u> Descriptive Statistics and Results

Table 9:
Descriptive Statistics on Household Demographics

Variable	Obs	Demographics		Variable	Income and Farming	
		Mean	Std. Dev		Mean	Std. Dev
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

Figure 1:

Distribution of the Information Asymmetry in Husband's Farm Sales

Full-sample	Restricted Sample only to Non-negative values

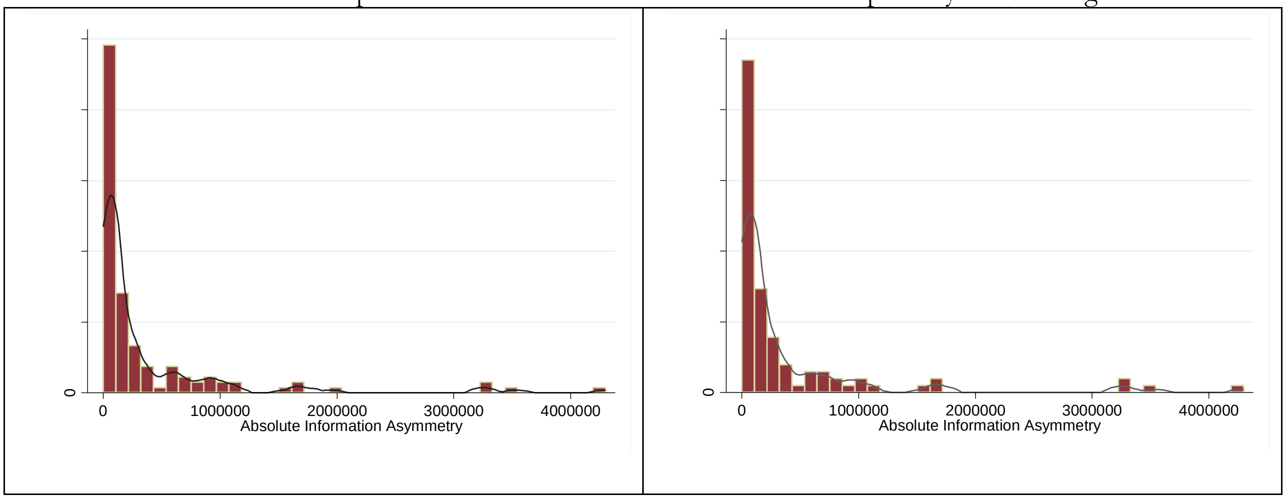

Table 10:
Results for the Effect of Asymmetric Information on Household Expenditure

Variable	First Stage	Household Public Goods: Tot. School	Household Public Goods: Child Clothing	Household Public Goods: Utilities	Food Expenditure: Oil	Food Expenditure: Protein	Food Expenditure: Wife's Prep. Food	Food Expenditure: Husband's Prep. Food	Food Expenditure: 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

Table 11:
Results for the Effect of Asymmetric Information on Household 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

Table 12:
Results for the Effect of Asymmetric Information on Household Expenditure

		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

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