Gender Roles and Asymmetric Information:

Non-Cooperative Behavior on Intra-Household Allocation

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Abstract:

We present a model of intra-household bargaining under asymmetric information in rural Ghana, a context in which men and women hold separate economies and husbands make regular transfers to their wives to pay for household expenses. The model predicts that spouses have an incentive to hide unobservable windfalls from each other when the windfall is small relative to the transfer, and that this incentive may differ by gender. We test these hypotheses using data from a field experiment in Ghana, in which husbands and wives in four small communities both had an independent chance to win lottery prizes of cash and livestock. Half of the prizes were awarded publicly, the other half privately. In line with the model's predictions, the effect of prize-winning on expenditure varies significantly depending on the publicity of the prize and the gender of the winning spouse. We also find evidence that the information asymmetry has an effect on intertemporal allocations of the prize-winnings. Our findings imply that in a marital setting, the publicity of windfalls may matter as much or more than the gender of the recipient, and that provision of formal savings mechanisms may strengthen wives' ability to control unanticipated income.

Key words: incomplete information, income hiding, non-cooperative bargaining.
JEL Classification: D13, D82, J12.

Introduction

The allocation of resources within the household has historically been viewed as either the decision of a single household member (unitary or common preference model, Becker (1981)) or the result of a cooperative decision among the collective of household members (Browning and Chiappori, 1998; Manser and Brown, 1980; McElroy and Horney, 1981). It is often argued that, because of caring and long-term, repeated interactions within families, households recognize opportunities for Pareto improvement by acting cooperatively in equilibrium. However, it is well established that intra-household decision making may also be sustained in a non-cooperative situation; often one where asymmetric information exists between spouses. This situation is common in developing countries. Recent empirical evidence has documented many instances of inefficient allocations and non-cooperative behavior as a result of asymmetric information within the household in a variety of country settings (Udry, 1996; Chen, 2009; Ashraf, 2009; Robinson, 2012; Schaner, 2013; Castilla and Walker, 2013).

In the unitary model, or in a collective household model, transfers are of little interest because the redistribution of resources between spouses has no effect on consumption decisions. However, when household bargaining is non-cooperative, spousal roles differ and there is asymmetric information, there are incentives to hide unobservable resources. These incentives differ depending on the role each spouse plays within the marital contract. For example, Ashraf (2009) conducted 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 about their own resources, they deposit more money into their private accounts. This suggests that men in the Philippines use asymmetric information to indirectly exert control over household decision making.

This paper extends our understanding of this issue by reporting results from a year-long field experiment in southern Ghana that tested the effect of unanticipated windfalls on actual expenditure. Southern Ghana is an ideal setting for analyzing intra-household resource allocation because of the extent to which the marital contract deviates from the standard unitary model. In the tradition of the local Akan, men and women maintain separate economies, such that no spouse has control over all of the household's resources, and spending patterns differ by gender (Goldstein, 2004). Nonetheless, it is common for spouses to exchange resources formally through intra-household transfers called 'chop money' (usually flowing from husband to wife). Chop money is not a gift, but the husband's contribution towards food and household public goods purchased by the wife (Ogbu, 1978).

We first develop a model of intra-household allocation to show that, when the quantity of resources available to each household member is not perfectly observed, there may be incentives to hide income. Further, we show that these incentives differ between spouses. The husband has no incentive to hide unanticipated windfalls, because through the chop money allowance he can indirectly determine the household public good allocation. Thus, in the situation where the husband receives an unanticipated windfall, the allocation of resources is Pareto efficient. In contrast, since the chop money allowance is decreasing in the wife's income, she has an incentive to hide unanticipated windfalls, and this can induce Pareto inefficiency in resource allocation.

We show how, in response to this incentive, the husband can induce the wife to reveal private windfalls by defining a contingent contract over the chop money allowance. The contract consists of different chop money allowances depending on whether the wife wins or loses a lottery prize. This contract is successful in inducing revelation only if the wife's private windfall is sufficiently large. If the windfall is small, the wife will hide her winnings by spending the entire amount on private consumption. Two testable hypotheses derive from the model: (1) the spouse responsible for household public good provision has an incentive to hide windfalls, while the spouse in charge of deciding the chop money allowance does not; and (2) hiding of money occurs when the unobservable income windfall is small relative to the chop money allowance.

We test these predictions using data from a field experiment in which households from four Ghanaian villages participated in four free lotteries over a nine-month period in 2009. The lottery was a two-by-two design, with half of the prizes awarded in public (in front of the entire village), and half awarded in private. Half of the prizes were cash, and the other half were livestock (chickens and goats) of equivalent value. Husbands and wives from each household had an equal and independent probability of winning a prize, which allows us to compare spouses' response to prize-winning by gender. Using baseline household survey data collected before the experiments were conducted, and follow-up data collected after each lottery, we test the effect of asymmetric information on individual expenditure, as well as aggregate household expenditure on specific items (some of which are assignable).

In line with the model's predictions, we find that the chop money allowance given to wives decreases only when the wife wins a large cash prize. When the prize is small, our results are consistent with a pooling equilibrium where the husband offers the same chop money allowance independent of lottery outcome. Spending patterns in response to prize winning also differ by gender and by the publicity of the prize. Husbands' public prizes were spent on goods that are highly visible, such as assets, health and ceremonies. Meanwhile, private prizes were invested in relatively more concealable goods such as in-kind gifts, but still more easily observable than cash gifts. Wives' public prizes were spent on ceremonies and loans, while private prizes were allocated to cash gifts.

We also find evidence of a different form of control over windfalls: inter-temporal substitution through informal savings. Both husbands and wives invested some of their prize winnings in the social network, in the form of gifts or loans. Inter-household transfers responded more strongly to private prizes, indicating that sharing was voluntary rather than induced by social pressure. The investment of prize money in the social network – especially in the form of interest-free loans – can be interpreted as a form of saving that keeps the money out of the hands of the other spouse while not affecting the chop money contract. In the Ghanaian context, inter-household transfers are usually reciprocated at a later date based on need, thus this result may indicate that women use gifts and loans as a means of storing their winnings for future emergencies.

I. The Model: Intra-Household Decision-Making under Asymmetric Information

In Ghanaian households, it is not the norm for men and women to pool resources (Chao, 1998; Clark, 1999). Husbands and wives maintain separate financial arrangements for spending, saving and asset ownership. As a result of the Akan matrilineal inheritance system, husbands and wives rarely own, manage or inherit property together.[2] Oppong (1974) found 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. Although these observations are dated, our 2009 survey data confirm that asset ownership and inheritance patterns remain distinctly separate between spouses. Similar to the observations of Duflo and Udry (2004) from Cote d'Ivoire, men and women tend to have separate income

[2] Most of the respondents were of Akan heritage, although a small number are immigrants with a different clan heritage (e.g. the patrilineal Ewe).

streams, and there is often a traditional gender-based division of responsibilities for different types of expenditure (Chao, 1998). Women bear primary responsibility for childrearing, cooking, washing and collecting fuel, wood and water. Men make contributions of produce from their farms and cash transfers called ‘chop money’, out of which their wives purchase the household’s food and other public goods and services (Chao, 1998; Udry and Goldstein, 1999).

It seems reasonable to model the intra-household allocation of resources in such households as a marital contract in which spouses operate in separate spheres of responsibility, and where each spouse controls his/her own resources. In this non-cooperative equilibrium within marriage, the husband nevertheless continues to make positive transfers to his wife for the purchase of household public goods. In the unitary model, or in a collective household model, transfers are of little interest because the redistribution of resources between spouses is fully offset by adjusting private consumption. However, when household bargaining is non-cooperative and strictly positive transfers continue to take place between spouses, there can be incentives to hide unobservable resources.[3]

We develop a model to reflect a non-cooperative marital contract with the aforementioned features. Consider a household with two family members, a wife (*f*) and a husband (m), each of whom has preferences over consumption of a private (or personal) good, denoted x_i, $i \in \{f, m\}$, and a non-rival household public good, Q, whose quantity is chosen by the wife. This framework draws on the separate spheres model of Lundberg and Pollak (1993). Consistent with observations of Ghanaian household behavior, the marital contract stipulates that the husband must provide for his wife.[4] Upon marriage, spouses contract on a

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[3] Since some Ghanaians continue to practice polygamy, there are a small number of households in our sample with more than one wife. We exclude these households because the intra-household resource management contract in this case is likely to be different.

[4] Among the Akan, the wife can divorce on the basis of lack of economic support by her husband (Ogbu, 1978).

chop money allowance, s, the husband must give his wife. The wife, on the other hand, chooses the household public good allocation. The public good can be thought of as expenditures on children, such as clothing and food, shared household goods, and common meals.[5] We assume that spouses do not commit to any binding agreement regarding the amount of the chop money transfer and household expenditures.

The timing of the household consumption and transfer decisions is as follows. In the first stage, the husband and wife receive incomes Y_m and Y_f respectively, both of which are common knowledge. Both spouses then enter a lottery in which each has an independent probability of winning a cash prize[6] T. In the experimental design, the prize is awarded in public with 50% probability and in private with 50% probability. When the prize is public asymmetric information is trivial, thus in the model we focus on the case where a spouse enters a lottery where she can win a private prize.[7] Assume the probability of winning a private prize is π. The prize winner can either be truthful and reveal the prize, or choose to hide the prize. We assume that when one spouse wins, the other spouse expects she will be truthful with probability θ and will lie with probability $(1-\theta)$. It is assumed that private consumption choices, x, are unobservable, while the public good allocation, Q, is perfectly observable. Thus hiding implies that the winner must spend the entire prize amount on private consumption. In the second stage, each household member makes consumption

[5] It excludes school fees, however, as there is evidence that husbands are usually responsible for these large outlays (Chao, 1998). However, in Ghana, public school is free and only a minority of households pay for private school fees.

[6] In the experimental design there were livestock prizes as well. We do not incorporate differences in fungibility across sources of prizes and/or income in the model as our goal is to examine the effect of asymmetric information and livestock prizes are observable. However, in the empirical results we do examine the effect of livestock prizes on expenditure.

[7] It is worth noting that households who receive the lottery prize could adjust effort, in which case total income from all sources would rise by less than the prize amount. We do not consider this explicitly in our model, but the effect would be a downward bias of our estimated coefficients.

choices conditional on the amount of the lottery prize that is revealed: the husband chooses the chop money allowance, and the amount he will keep for private consumption. Then the wife decides how much to spend on public and private consumption conditional on *s*.

Preferences over own consumption are represented by a money-metric utility function, U_i. Utility depends on the aggregate level of consumption of household public goods, Q, and private expenditure, x_i, and is assumed to be separable in both[8]:

$$U_i = U_i(Q, x_i) = v(Q) + u_i(x_i) \qquad \text{for } i \in \{f, m\} \qquad (1)$$

The functions $u(\cdot)$ and $v(\cdot)$ satisfy the standard Inada conditions: $u^{'} > 0$, $v^{'} > 0$, $u^{''} < 0$, $v^{''} < 0$. For simplicity, both spouses have the same preferences over household goods, but different preferences over private expenditure.

Separate Spheres Bargaining in Ghanaian Households: Perfect Information Benchmark

We first consider the case when the husband wins a lottery prize, *T*, and also receives his regular income, Y_m. When the lottery prize is public information, the choice to reveal or hide is immaterial. Therefore, the non-cooperative bargaining game consists of two stages. First, the husband chooses the chop money allowance, *s*, then the wife decides the public good provision, *Q*, conditional on both *T* and *s*. The model is solved by backwards induction. The wife solves the following optimization problem:

$$\max_{Q \geq 0;\, x_f \geq 0} U_f = v(Q) + u(x_f) \quad s.t. \quad x_f \leq Y_f + s - Q \qquad (2)$$

where prices are normalized to 1 such that all allocations are expressed in monetary terms. The first-order condition for *Q* is

[8] The results can easily be generalized to non-separable utility and will be left for further research.

$$v'(Q) - u'(Y_f + s - Q) \leq 0 \quad (3)$$

The optimum allocation of Q is strictly positive and increasing in the chop money allowance, s: $\frac{\partial Q}{\partial s} = \frac{u''(Y_f+s-Q)}{v''(Q)+u''(Y_f+s-Q)} > 0$. The chop money allowance is the husband's way to increase his household public good consumption, but the correspondence is not one-to-one because it depends on the wife's preferences, such that $0 < \frac{\partial Q}{\partial s} < 1$.

Taking the wife's first-order condition as given, the husband solves:

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

$$s.t. \quad x_m \leq Y_m + T - s; \;\; Q(s) > 0 \; [9] \quad (4)$$

The first-order condition for Q is

$$v'(Q)Q'(s) - u'(Y_m + T - s) \leq 0 \quad (5)$$

Proposition 1 specifies the conditions that must be met for an equilibrium with a strictly positive chop money 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 $Q > 0$ exists.*

Proof: See Appendix A ■

Proposition 2 states the properties of the equilibrium with respect to changes of income for both cases, and provides the justification for why, when household bargaining is non-cooperative, there are no incentives for the husband to hide income.

[9] This is equivalent to setting the optimization problem in the following way:
$\max_{s\geq 0;\, x_m \geq 0; Q\geq 0} U_m = v(Q) + u(x_m) \;\; s.t. \; x_m \leq Y_m - s; \;\; v'(Q) - u'(Y_f + s - Q) = 0$
And then using equation (3) in the first-order conditions to substitute for $\frac{\partial Q}{\partial s}$.

<u>Proposition 2:</u> *Comparative statics when all sources of income are observed:*

If the husband wins a cash lottery prize:

Case (i): If $Y_m \leq \overline{Y_m} \in (0, Y_f)$, $s = 0$ *and* $Q > 0$, *then* $\frac{\partial x_f}{\partial Y_f} > 0; \frac{\partial Q}{\partial Y_f} > 0; \frac{\partial s}{\partial Y_f} = \frac{\partial x_m}{\partial Y_f} = 0,$ *while* $\frac{\partial x_m}{\partial Y_m} = \frac{\partial x_m}{\partial T} > 0; \frac{\partial s}{\partial Y_m} = \frac{\partial s}{\partial T} = 0; \frac{\partial Q}{\partial Y_m} = \frac{\partial Q}{\partial T} = \frac{\partial x_f}{\partial Y_m} = \frac{\partial x_f}{\partial T} = 0.$

Case (ii) If $Y_m - t > \overline{Y_m}$, $s, Q > 0$, *then* $\frac{\partial x_f}{\partial Y_f} > 0; \frac{\partial Q}{\partial Y_f} > 0; \frac{\partial x_m}{\partial Y_f} > 0; \frac{\partial s}{\partial Y_f} < 0$ *while* $\frac{\partial x_m}{\partial Y_m} = \frac{\partial x_m}{\partial T} > 0; \frac{\partial s}{\partial Y_m} = \frac{\partial s}{\partial T} > 0; \frac{\partial Q}{\partial Y_m} = \frac{\partial Q}{\partial T} > 0; \frac{\partial x_f}{\partial Y_m} = \frac{\partial x_f}{\partial T} > 0.$

If the wife wins the cash lottery prize:

Case (iii): If $Y_m - t \leq \overline{Y_m} \in (0, Y_f + t)$ *then* $s = 0$, $\frac{\partial x_f}{\partial Y_f} = \frac{\partial x_f}{\partial T} > 0; \frac{\partial Q_f}{\partial Y_f} = \frac{\partial Q_f}{\partial T} > 0; \frac{\partial s}{\partial Y_f} = \frac{\partial s}{\partial T} = \frac{\partial x_m}{\partial Y_f} = \frac{\partial x_m}{\partial T} = 0,$ *while* $\frac{\partial x_m}{\partial Y_m} > 0; \frac{\partial s}{\partial Y_m} = 0; \frac{\partial Q}{\partial Y_m} = \frac{\partial x_f}{\partial Y_m} = 0.$

Case (iv): If $Y_m - t > \overline{Y_m}$*.thus* $s, Q > 0$, *then* $\frac{\partial x_f}{\partial Y_f} = \frac{\partial x_f}{\partial T} > 0; \frac{\partial Q_f}{\partial Y_f} = \frac{\partial Q_f}{\partial T} > 0; \frac{\partial x_m}{\partial Y_f} = \frac{\partial x_m}{\partial T} > 0; \frac{\partial s}{\partial Y_f} = \frac{\partial s}{\partial T} < 0,$ *while* $\frac{\partial x_f}{\partial Y_m} > 0; \frac{\partial Q_f}{\partial Y_m} > 0; \frac{\partial x_m}{\partial Y_m} > 0; \frac{\partial s}{\partial Y_m} > 0.$

Proof: See Appendix A ■

If the husband is not giving a positive chop money allowance to his wife (case (i)), changes in the husband's resources have no inframarginal impact on the wife's allocations, and information over income is irrelevant. This is intuitive, because in this equilibrium there is no cooperation between spouses. When $Y_m > \overline{Y_m}$, it is the husband's best response to give a strictly positive chop money allowance to his wife in order to increase his public good consumption. In this case, an increase in the husband's resources increases both his discretionary expenditure and his chop money allowance, and therefore the provision of the public good. For this reason, if the husband is making a strictly positive chop money allowance to his wife, he has no incentive to hide income and the first-best solution can be attained.

In contrast, if the wife wins a private prize she has an incentive to hide the prize winning from her husband. Her income will rise to $Y_f + T$, and if this is known to her husband, he can reduce the chop money allowance. The wife's private consumption will accordingly not rise by the full amount of the prize. (See specifics in Appendix A.) If she hides the information about her lottery prize, however, she can keep her public good consumption unchanged, and increase her private consumption by the amount of the prize. Depending on the value of the prize and her utility function, the consumption allocation achieved from hiding may yield higher welfare than that obtained if she discloses the prize. In Proposition 3 we show that when the lottery prize is small, the wife has an incentive to hide.

Proposition 3: *Given Y_f, Y_m when $Y_m > \overline{Y_m}$, there exists a threshold level of lottery prize, $\bar{T}$, such that for any $T < \bar{T}$, the wife has an incentive to hide.*

Proof: See Appendix A ■

The condition that must be met for the wife to be better off hiding than revealing is the same condition required for the husband to decrease the chop money allowance when the wife's income increases. Therefore, whenever the husband's transfer is decreasing in the wife's prize ($\frac{\partial s}{\partial T} < 0$), the wife has an incentive to hide. In what follows, we model the household problem when the wife has private information over her lottery prize winnings.

Consider the case where the wife wins a cash lottery prize that is unobserved by her husband. In the field experiment, care was taken to guarantee that in one of the treatments lottery winnings were kept private from both the winner's family and the rest of the village. In this case, she must decide whether to reveal the prize to her husband or to hide it. If she hides the prize, her set of feasible allocations is constrained only to those her husband does not observe (in this case, her private consumption). The husband can only detect that she won a prize if she adjusts the perfectly observable household good allocation.

Since the wife's decision to hide results in an allocation that is not utility maximizing to either party, we now explore whether it is possible for the husband to induce revelation of the prize through a contingent contract over the chop money allowance. The husband knows his wife has probability π of winning a private cash prize T. In the case that she wins, the husband expects she will be truthful with probability θ and will lie with probability $(1-\theta)$.

Definition 1: In the case the wife wins a prize, her action space is contingent upon the choice to reveal or hide the lottery prize. If she reveals, the action space includes private expenditure $x_f \in \left[0, Y_f + T + s\right]$ and household good expenditure $Q \in \left[0, Y_f + T + s\right]$, where $T > 0$ with probability π, and $T = 0$ with probability $(1-\pi)$. Hiding restricts the action space to $x_f = x_f\left(Y_f + T + s\right)$ and $Q = Q\left(Y_f + s\right)$. The uninformed spouse's (husband's) action space includes private expenditure $x_m \in [0, Y_m - s]$ and the chop money allowance $s \in [0, Y_m]$. The husband offers a contingent contract in which the chop money allowance is $\overline{s}$ if the wife does not win, and $\underline{s}$ if she wins, where $\overline{s} > \underline{s}$. (Proposition 2 indicates the husband's chop money allowance is decreasing in the wife's resources).

The game then proceeds as follows. First, the husband offers a contingent contract to his wife that specifies the chop money allowance and all intra-household allocations. Both spouses then choose allocations corresponding to their respective sphere of responsibilities. To examine whether a contract that induces truthful revelation is feasible, we must solve the husband's contract design problem:

$$max_{\bar{s}\geq 0;\, \underline{s}\geq 0}\, EU_m = \pi\theta\left[v\left(Q(\underline{s},T)\right)+u(Y_m-\underline{s})\right]+[\pi(1-\theta)+(1-\pi)]\left[v\left(Q(\bar{s},0)\right)+u(Y_m-\bar{s})\right]$$

$$s.t.\;\; Q(s)>0$$

$$v\left(Q(\underline{s},T)\right)+u\left(Y_f+T+\underline{s}-Q(\underline{s},T)\right)\geq v\left(Q(\bar{s},0)\right)+u\left(Y_f+T+\bar{s}-Q(\bar{s},0)\right) \quad \text{(IC1)}$$

$$v\left(Q(\bar{s},0)\right)+u\left(Y_f+\bar{s}-Q(\bar{s},0)\right)\geq v\left(Q(\underline{s},T)\right)+u\left(Y_f+T+\underline{s}-Q(\underline{s},T)\right) \quad \text{(IC2)}$$

$$v\left(Q(\underline{s},T)\right)+u\left(Y_f+T+\underline{s}-Q(\underline{s},T)\right)\geq v\left(Q(0,T)\right)+u\left(Y_f+T-Q(0,T)\right) \quad \text{(IR1)}$$

$$v\left(Q(\bar{s},0)\right)+u\left(Y_f+\bar{s}-Q(\bar{s},0)\right)\geq v\left(Q(0,0)\right)+u\left(Y_f-Q(0,0)\right) \quad \text{(IR2)}$$

As discussed earlier, when all sources of cooperation fail, asymmetric information is irrelevant. For this reason and to be consistent with the data, we focus the analysis on the equilibria where the husband offers a strictly positive chop money allowance (Corner solutions are provided in Appendix A). Under perfect information, the husband would offer a contingent contract $\bar{s}^{FB}$ if the wife does not win and $\underline{s}^{FB}$ if she wins, where $\bar{s}^{FB}>\underline{s}^{FB}$.

<u>Definition 2</u>: Given $Y_m>\overline{Y}_m\in\left(0,Y_f\right)$, by Proposition 1 and 2, $\bar{s}>\underline{s}\geq 0$, and $0<\frac{\partial Q}{\partial s}=\frac{\partial Q}{\partial T}<1$ it is always the case that $v\left(Q(0,T)\right)+u\left(Y_f+T-Q(0,T)\right)>v\left(Q(0,0)\right)+u\left(Y_f-Q(0,0)\right)$ and $v\left(Q(\bar{s},0)\right)+u\left(Y_f+\bar{s}-Q(\bar{s},0)\right)\geq v\left(Q(0,0)\right)+u\left(Y_f-Q(0,0)\right)$, and $v\left(Q(0,T)\right)+u>v\left(Q(0,0)\right)+u(Y_m)$ and $v\left(Q(\bar{s},0)\right)+u(Y_m-\bar{s})>v\left(Q(0,0)\right)+u(Y_m)$.

Given the concavity of the utility function and the assumption that both household and private consumption are normal goods, it is easy to show that (IC2) does not bind. The wife has no incentive to act as if she had won when she did not because the chop money transfer would be reduced. Whenever the husband has relatively more income than his wife, a strictly positive chop money allowance makes both household members strictly better off relative to a non-positive allowance. For this reason (IR1) and (IR2) do not bind. Further, a contract where the husband is able to offer a chop money allowance that induces revelation exists if IC1 does not bind. If it binds, then the wife is indifferent between hiding and revealing, so she can randomize between the two strategies (play mixed strategies).

<u>Proposition 4</u>: *If* $T > \left(\overline{s}^{FB} - \underline{s}^{FB}\right) \geq 0$ *a separating equilibrium such that* $\overline{s}^{FB} = \overline{s} > \underline{s} = \underline{s}^{FB} \geq 0$ *exists where the contracted supplementary allowances yield efficient allocations.*

Case (i): If $Y_m > \overline{Y}_m \in \left(0, Y_f + T\right)$ *then the equilibrium is such that* $\overline{s}^{FB} = \overline{s} > \underline{s} = \underline{s}^{FB}$ *where the husband provides a positive chop money allowance regardless of the lottery outcome.*

Case (ii): If $Y_f + T > Y_m > \overline{Y}_m \in \left(0, Y_f\right)$ *then the equilibrium is such that* $\overline{s}^{FB} = \overline{s} > \underline{s} = \underline{s}^{FB} = 0$ *where the husband's chop money allowance when the wife wins the lottery is a corner solution.*

Proof: See Appendix A ■

<u>Proposition 5</u>: *If* $\left(\overline{s}^{FB} - \underline{s}^{FB}\right) \geq T$ *a pooling equilibrium such that* $\overline{s}^{FB} > \overline{s} = \underline{s} = s^P > \underline{s}^{FB} \geq 0$ *exists with* $s^P \in (0, T)$ *and there are efficiency losses.*

Proof: See Appendix A ■

In the field experiment the size of the lottery prize was common knowledge to all lottery participants. The husband then can compare the lottery prize T to the allocations under perfect information $\left(\overline{s}^{FB} - \underline{s}^{FB}\right)$ in order to offer his wife the appropriate contract. If the lottery prize is sufficiently large, the husband offers a contingent contract $\left(\overline{s}^{FB}, \underline{s}^{FB}\right)$ which is accepted by the wife and the first best is attained. However, if the lottery prize is small, the best the husband can do is to offer the chop money allowance s^P independently of the lottery outcome that makes the wife indifferent between revealing truthfully and hiding. In that case, she may still play mixed strategies. If the husband punishes her by reneging on the contracted chop money transfer, he makes himself (and her) strictly worse off than if she hides, therefore punishment of $s^P = 0$ ex-post (in the following round) is not a credible threat.

A natural extension would be to account for potential labor supply and/or work effort adjustments. A spouse who wins the private lottery prize could adjust effort and consume her private windfall without her husband finding out she won. She could adjust effort so that her income after winning equals her income without adjusting effort minus the prize: $Y_{f,1} \geq Y_{f,0} - T$, in which case total income from all sources would rise by less than the prize amount. We do not consider this explicitly in our model for the following reasons. It is unclear whether labor supply is unmonitored by spouses. Among rural households, there is great variation on whether spouses work on the same plots or on separate plots. Second, if wives adjust their labor supply downwards, the effect would be a downward bias of our estimated coefficients of the effect of private lottery windfalls on concealable expenses.

II. Survey and Experimental Design

A. Survey Description:

The field experiments were conducted between March and October 2009 in conjunction with a year-long household survey in four communities in Akwapim South district of Ghana's Eastern Region. This district lies 40 miles north of the nation's capital, Accra. Further details on the survey are provided in Walker (2011). The sample consists of approximately 70 monogamous and polygamous households from each of the four communities.[10] Slightly more than half of these 70 households were part of the initial 1997-98 sample, and the rest were recruited in January 2009 using stratified random sampling.[11] In the original sample, and in the 2009 re-sampling, households were selected only if headed by a resident married couple.[12] In some households from the 1997-98 sample, only one of the spouses remained. These 'single-headed households' account for between 7 and 12 households in each community. The sample of individuals included in the experiment was around 150 individuals in each of the four communities (Table 1).

Each respondent was interviewed five times during 2009, once every two months between February and November. Each survey round took approximately three weeks to complete, with the two survey teams each alternating between two villages. The survey covered a wide range of subjects including personal income, farming and non-farm business activities, gifts, transfers and loans, and household

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[10] We only include monogamous households in the empirical analysis as bargaining in polygamous households is different. This amounts to dropping 16 out of the 280 total households. In the robustness checks however, we include them in the analysis to find there are no significant differences in our results.

[11] New sample members were selected randomly from the subset of households in the community headed by a married couple. The sample was stratified by age of the head into three categories: 18-29, 30-64 and 65+, so that the shares of households whose head was in each of these categories corresponded to the community's shares.

[12] Some men in the sample have two or three wives, all of whom were excluded from the main analysis.

consumption expenditures. Each round, both the husband and wife in each household were interviewed separately on all of these topics. The expenditure module obtained detailed information on the quantities and values purchased of a variety of items. Referring to the month prior to the interview, each spouse was asked about his or her own expenditures, those of their partner, and about expenditures for the household as a whole. In the gifts and transfers module, respondents were asked to report any gifts (cash or kind) given and received during the past two months, obtaining information on the counterparty's location and relationship to the respondent, and the nature and value of the gift.

Table 1. Sample summary

	Village				
	1	**2**	**3**	**4**	**Total**
Husbands	67	64	67	68	266
Wives	67	65	67	70	269
Males Polygamous	3	4	3	0	10
Wives Polygamous	9	9	6	2	26
Single males	4	4	1	4	13
Single females	7	5	6	8	26
Total	157	151	150	152	610

B. Experimental Design:

A field experiment was conducted during the panel survey fieldwork, to simulate unanticipated cash and in-kind windfalls. Every two months, a lottery was held in each community and 20 prizes of varying values were awarded randomly. Over the four lottery rounds, a total of 320 prizes were distributed in the four communities. The intervention was a two-by-two design: in each round, ten cash prizes and ten livestock prizes (chickens and goats) were awarded to every community. Half of these prizes (five cash, five livestock) were awarded at a public lottery, the other half in a private lucky-dip. The private lucky dips were conducted in a closed room, and the cash prizes given immediately so that the winner's identity was unknown even to their spouse.[13] We treat the privately-won livestock prizes as public, since they were distributed to the winner's household a day later and it is unlikely that they were concealed. Over the four lotteries, approximately 42 per cent of individuals and 62 per cent of households won at least one prize. The values of the cash prizes were GH¢10, GH¢20, GH¢35, GH¢50 and GH¢70, which are of substantial size relative to the mean monthly per capita expenditure of GH¢65.[14]

The livestock prizes were purchased by the survey team in Accra on the morning of the lottery and transported to the community. The chickens were of a type intended for eating, and were chosen because their price was essentially stable at GH¢10 throughout the year. The goats were bought individually by the team directly from traders at the main market near Accra. On the first visit, the size and quality of goats available was established for the three price points (GH¢35, GH¢50 and GH¢70). On every subsequent visit, the team endeavored to obtain goats of similar size and quality, subject to market price and supply fluctuations.[15] Female goats were preferred because of their utility for breeding.

The first round of the survey was designed as a baseline, therefore no lottery took place in that round. One week before each subsequent round, the lotteries and lucky dips took place. A village meeting was held in the community, and all respondents were invited to attend. Small amounts of food and drink were

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[13] The winner of course had the choice to disclose private windfalls to family or community members; what is important is that this design provided them the *opportunity* to conceal them.
[14] One Ghana cedi (GH¢) was worth about 70 US cents in mid 2009.
[15] There was little price movement in the goat market throughout the year, though the price of chickens slowly appreciated, rising perhaps 20 per cent over 2009. The additional cost of the broiler chickens was absorbed to maintain consistency of the prizes across rounds. The quality of goats varied slightly between rounds in line with supply and climatic conditions, but a concerted effort was made to keep the quality and size of the animals close to constant within rounds.

provided to encourage attendance. Generally around 100 people came to each meeting; roughly half of the respondents were present for the actual lottery draw.[16] There were usually a number of non-respondents at these meetings as well, including many children. At each gathering, the respondents were thanked for their continued participation in the survey. The team explained that respondents had a chance to win one of 20 prizes that day, framing the prizes as a gratuity for their participation in the survey.[17] Great care was taken to make clear to participants that the allocation of prizes was random, and that each respondent had an equal chance of winning in each round. Winners for the ten public prizes were then drawn (without replacement) from a bucket containing the names of the survey respondents. A village member not in the sample was chosen by the villagers to do the draw, so as to emphasize that the outcomes were random. Each winner was announced, and asked to come forward to receive their prize. The prizes were announced and displayed before being awarded. Respondents who were absent at the time of drawing were called to pick up their prize in person. Spouses or close family members were allowed to receive the public livestock prizes (but not cash prizes) on the winner's behalf. Unclaimed prizes were delivered in person to the winner after the lottery.[18]

The lucky dip took place immediately after the lottery. Respondents were asked to identify themselves to an enumerator, who took their thumbprint or signature and issued them with a ticket displaying their name and identification number. The respondents then waited to enter a closed school room, one at a time, where another enumerator invited them to draw a bottle cap without replacement

[16] Around 125 of the 150 respondents in each community appeared for the private lucky dip, some of them arriving before or after the public meeting.

[17] At the start of the survey, respondents signed an informed consent form that explained how they would be remunerated for their participation in the survey. In addition to having the chance to win a prize, every respondent was given a small amount of cash after each survey round, at least one week before the lotteries.

[18] We have data on these cases, including the dates on which the prizes were claimed and the identity of the recipient (if not the winner).

from a bag.[19] There was one bottle cap for each of the n respondents in the community. Of these, n-10 were non-winning tokens (red colored), and 10 were winning tokens, marked distinctively to indicate one of the ten prizes.[20] Those who drew winning tokens were informed immediately that they had won a prize, and were told that they did not have to tell anyone else that they had won. The survey team made clear that they would not divulge the identities of the lucky dip prize winners. Cash prizes were given to the winners immediately. Livestock prizes were delivered one or two days later to the winner in person, or to another household member if they were absent.[21,22]

Testable Hypothesis 1:

Propositions 3 and 4 state the equilibrium depends on the size of the lottery prize relative to the chop money allowance. Let $\bar{T}_{Pu}$ and $\underline{T}_{Pu}$ be the public cash prizes, $\bar{T}_{Pr}$ and $\underline{T}_{Pr}$ be the private cash prizes, and s be the chop money allowance; where $\bar{T}$ is a large prize and $\underline{T}$ indicates it is small relative to $s_{0,Pu}$, which is the chop money allowance when there is no lottery (or the husband knows the wife did not win).

[19] Care was taken to shuffle the bottle caps after each draw, and to prevent respondents from seeing into the bag. If a respondent inadvertently drew more than one bottle cap, those caps were shuffled and the respondent was asked to blindly select one of them.

[20] Respondents were shown a sheet relating the tokens to the prizes; this sheet was used to explain what prize (if any) the respondent had won based on the token they drew.

[21] If anyone received the prize on behalf of the winner, the survey team made clear who the animal was intended for. In the follow-up survey, each winner was interviewed privately about their prize, and established that all of them ultimately received their prizes. At the conclusion of the day, tokens which had not been drawn were counted and the remaining prizes allocated randomly among the non-attending respondents using a computer. There were usually 25-30 non-attendees and less than three prizes remaining.

[22] Clearly there was no way of keeping the livestock prizes completely secret. It should be assumed that members of the winner's household were all aware of those prizes. However, the delivery of the lucky dip livestock prizes was kept as low-key as possible. Thus there is a strong difference in publicity between the lottery and lucky dip prizes, at least with respect to non-household members.

Case (i): If T is small $(\underline{T})$, a pooling equilibrium exists if $\underline{s}_{TPu} = \underline{s}_{TPr} = s_{0Pu}$, which implies that the husband offers the same chop money allowance independently of the lottery outcome.

Case (ii): If T is large $(\overline{T})$, a separating equilibrium exists if $\overline{s}_{TPu} = \overline{s}_{TPr} > s_{0Pu}$, which implies that the husband is able to induce revelation by offering a contingent contract. The chop money allowance when the wife wins is lower than the chop money allowance when she does not win, independent of the degree of observability of the prize.

Testable Hypothesis 2:

Proposition 2 implies that the spouse in charge of deciding the chop money allowance, the husband in this case, has no incentive to hide when he has an information advantage over lottery windfalls. However, the wife does have an incentive to hide when the lottery prize is small relative to the chop money allowance. Hiding occurs if private prizes increase private expenditure, but not public expenditure, while public prizes have effects on both. Let T_{Pu} be the public cash prize and T_{Pr} be the private cash prize, x_m^{Pu} and x_f^{Pu} the husband and wife's public expenditures (including household public goods) respectively, x_m^{Pr} and x_f^{Pr} their private expenditures respectively.

Case (i): If the wife wins a prize, she hides from her husband if $\frac{\partial x_f^{Pr}}{\partial T_{Pu}} \neq 0$; $\frac{\partial x_f^{Pu}}{\partial T_{Pu}} \neq 0$; $\frac{\partial x_m^{Pu}}{\partial T_{Pu}} \neq 0$; $\frac{\partial x_m^{Pr}}{\partial T_{Pu}} \neq 0$ and $\frac{\partial x_f^{Pr}}{\partial T_{Pr}} = \frac{\partial x_f^{Pu}}{\partial T_{Pr}} = \frac{\partial x_m^{Pr}}{\partial T_{Pr}} = 0$; $\frac{\partial x_f^{Pr}}{\partial T_{Pr}} \neq 0$.

Case (ii): If the husband wins a prize, he hides from his wife if $\frac{\partial x_f^{Pr}}{\partial T_{Pu}} \neq 0$; $\frac{\partial x_f^{Pu}}{\partial T_{Pu}} \neq 0$; $\frac{\partial x_m^{Pr}}{\partial T_{Pu}} \neq 0$; $\frac{\partial x_m^{Pu}}{\partial T_{Pu}} \neq 0$ and $\frac{\partial x_f^{Pr}}{\partial T_{Pr}} = \frac{\partial x_f^{Pu}}{\partial T_{Pr}} = \frac{\partial x_m^{Pu}}{\partial T_{Pr}} = 0$; $\frac{\partial x_m^{Pr}}{\partial T_{Pr}} \neq 0$.

C. Descriptive Statistics

The interviews commenced one week after the lottery to allow winners to receive their prize and do something with it. The interviews took place in no specified order throughout the following three weeks. Table 2 presents a summary of the balance of treatment. There are no differences on average expenditure in assets, health and food between households that won lottery prizes relative to the control group whether household expenditure is reported by the husband or the wife. Likewise, private expenditure of each spouse in personal items, clothing, ceremonies, inter-household (gifts and loans) and intra-household transfers (chop money) was not statistically different across treatment and control groups. Some control variables differ. Liquid assets reported by the wife are larger in the treatment group. For this reason we control for baseline assets in all econometric specifications. Further, a larger percentage of wives in winning households get along and trust their husbands relative to non-winners.

[Table 2 here]

III. Estimation and Empirical Results

A. Is the husband able to induce revelation?

To test Hypothesis 1, we estimate the chop money allowance reported by each spouse as a function of the husband's and wife's lottery outcomes. The values of the lottery prizes were GH¢10, GH¢20, GH¢35, GH¢50 and GH¢70, while the monthly average chop money at baseline (Round 1) was GH¢15.9. To identify differences between large and small prizes, we construct an indicator variable equal to 1 if the lottery prize is greater than GH¢20, and interact it with the lottery outcome variables. A log-linear functional form is preferred, however, due the possibility of zero values, so we use the Inverse Hyperbolic Sine Transformation (IHST) (Burbidge et al., 1988; McKinnon and Magee, 1990)[23]. After the transformation, there still exists a possibility that the chop money is zero, thus an unobserved random effects Tobit model is used. In Appendix B.1 we present robustness checks using fixed-effects excluding zero-chop-money households, results including controls and polygamous households.

For spouse i, in household h, village v, and round r, the chop money allowance can be expressed as:

$$f(s_{i,v,r}) = \sum_{j=0}^{1}\Big[\overline{T}_{i,v,r}\left(\delta_{1,j}^{\overline{T}}T_{i,v,r-j}^{Pu} + \delta_{2,j}^{\overline{T}}T_{i,v,r-j}^{Pr} + \delta_{3,j}^{\overline{T}}T_{i,v,r-j}^{Liv}\right) + \underline{T}_{i,v,r}\left(\delta_{1,j}^{\underline{T}}T_{i,v,r-j}^{Pu} + \delta_{2,j}^{\underline{T}}T_{i,v,r-j}^{Pr} + \delta_{3,j}^{\underline{T}}T_{i,v,r-j}^{Liv}\right)\Big] + \delta_0\overline{T}_{i,v,r} + \theta_1 lnA_{h,1}^{liq} + \theta_2 lnA_{h,1}^{ill} + \sum_{v=2}^{4}\alpha_v + \sum_{r=3}^{5}\sigma_r + \varepsilon_{i,v,r}$$

Where $f(s_i\ ) = ln\left[s_i + (s_i^2+1)^{\frac{1}{2}}\right]$; $T_{i,v,r-j}^{Pu}$, $T_{i,v,r-j}^{Pr}$ and $T_{i,v,r-j}^{Liv}$ are the values of the public and private cash prizes, and livestock prizes, respectively, won by spouse i; $\sum_{h=2}^{4}\alpha_v$ are village fixed effects; $\sum_{r=3}^{5}\sigma_r$ are round fixed effects; $\overline{T}_{i,v,r}$ is an indicator variable that takes the value of 1 when the lottery prize is greater than GH¢20, and 0 otherwise; $\underline{T}_{i,v,r} = 1 - \overline{T}_{i,v,r}$; and $A_{h,1}^{liq}$ and $A_{h,1}^{ill}$ are household liquid and illiquid assets in round 1 respectively. We use assets rather than income (as in the usual Engel specification) because the income data proved too noisy to reliably capture households' living standards. The results are presented in Table 3 for the intent to treat effects of private, public cash prizes, and livestock prizes on chop money, and the robustness checks on Appendix B.1.

[23] The Inverse Hyperbolic Sine Transformation (IHST) is as follows: $ln\left[y_i + (y_i^2+1)^{\frac{1}{2}}\right]$ (Burbidge et al. (1988); McKinnon and Magee, (1990)). We also used another transformation that consists of adding GH¢1 to all chop money allowances, and then using natural logarithm. Results are consistent with the IHST specification and are available upon request from the authors.

Hypothesis 1:

If T is small: A pooling equilibrium exists if $\delta^{\underline{T}}_{1,0} = \delta^{\underline{T}}_{2,0} = 0$ and $\delta^{\underline{T}}_{1,1} = \delta^{\underline{T}}_{2,1} = 0$.

If T is large: A separating equilibrium exists if $\delta^{\overline{T}}_{1,0} = \delta^{\overline{T}}_{2,0} \neq \delta_0$ and $\delta^{\overline{T}}_{1,1} = \delta^{\overline{T}}_{2,1} \neq \delta_0$.

The left panel of Table 3 contains results on the intent to treat effects of lottery prizes on chop money reported by the husband, while the right panel contains results on the chop money reported by the wife.[24] The effect of wives' prize-winning on chop money is discussed first. As predicted by the model, the wife winning a large lottery prize reduces the chop money transfer, while winning a small prize has a positive effect. Consistent with Hypothesis 1, when the prize is small (less than GH¢20), there is no significant difference between the effect of winning public cash prize, a private cash prize, or no prize at all. This result suggests a pooling equilibrium where the husband offers the same chop money allowance to his wife independently of the lottery outcome, which is likely to result in efficiency losses. When the prize is large, there are no differences between winning a public or private cash prize. However, consistent with a separating equilibrium, the chop money allowance is significantly smaller when the wife wins a lottery prize than when she does not win. Results are consistent for both current and lagged lottery outcomes.

As discussed in Section 2, the response of the chop money allowance to the husband winning a lottery prize should not depend on the publicity of the prize. The results indicate that cash prizes have a positive effect on chop money when they are small, and zero (or a negative) effect when they are large. The lack of lagged prize effects is further evidence that for the husband information is irrelevant and decisions are made when the money becomes available. For the wife, however, there seems to be a discovery or revelation process (specially with

[24] These both capture the net transfer from husband to wife, and should be identical.

large prizes) where prizes won in previous rounds have a much larger lagged effect on consumption. However, this is only evident when examining the wife's reporting of chop money transfers. Small livestock prizes (chickens) increase chop money allowances, but the more valuable goat prizes have a zero (or even negative) effect, independently of the gender of the lottery winner.

[Table 3 here]

B. How are the lottery prizes being spent?

Hypothesis 2 suggests that hiding can be identified empirically if an unobservable cash prize has no effect on observable expenditure, while it has a significant effect on expenditure that is unobservable. In the experiment there is random variation between private and public prizes, thus these hypotheses can be tested as follows. Let $x_{f,hr}^{g,Pr}$ indicate expenditure on item *g* which is only observable to the wife (*f*), and $x_{f,hr}^{g,Pu}$ indicate expenditure on item *g* which is observable to both *f* and *m*. Likewise for the husband, let $x_{m,hr}^{g,Pr}$ indicate expenditure on item *g* which is only observable to the husband (*m*), and $x_{m,hr}^{g,Pu}$ indicate expenditure on item *g* which is observable to both *f* and *m*. We then estimate reduced-form Engel equations for expenditure on observable household public goods such as food, health and children's clothing, as well as observable private expenditures attributable to either the husband or the wife. Observable private expenditures include adult clothing, personal care and ceremonies.[25] Finally, we consider money allocated towards gifts and loans as concealable private expenses. As before, we use the

[25] In Castilla and Walker (2013) we present results on home expenses and assets for household public goods, and for private spousal expenditure we examined public transportation and personal items. The results are consistent with those presented here.

IHST and a Random Effects Tobit model. In Appendix B.2 we present linear results, and in Appendices B.4a and B.4b results with controls are included.

For spouse i, in household h, village v, and round r, the demand for good $x^g_{i,v,r}$ can be expressed as:

$$f\left(x^g_{i,h,v,r}\right) = \sum_{j=0}^{1}\left[\delta^g_{1,j}T^{Pu}_{i,v,r-j} + \delta^g_{2,j}T^{Pr}_{i,v,r-j} + \delta^g_{3,j}T^{Liv}_{i,v,r-j}\right] + \theta_1 lnA^{liq}_{h,1}$$

$$+\theta_2 lnA^{ill}_{h,1} + \textstyle\sum_{v=2}^{4}\alpha_v + \sum_{r=3}^{5}\sigma_r + \varepsilon_{i,v,r}$$

Where $f(x^g_{i,h,v,r}) = ln\left[x^g_{i,h,v,r_i} + \left({x^g}^2_{i,h,v,r} + 1\right)^{\frac{1}{2}}\right]$.

<u>Hypothesis 2</u>:

The following table summarizes the testable hypotheses for the effect of lottery prizes on household and private expenditure by gender.

Table 4: Testable Hypotheses on the Effect of Income on Expenditure by Observability

Expenditure Categories	Husband			Wife		
	Public Cash	Private Cash		Public Cash	Private Cash	
		No Hiding	Hiding		No Hiding	Hiding
Household Public Goods	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} = 0$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} = 0$
Wife's Private Expenditure						
Observable	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} = 0$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} = 0$
Concealable	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} = 0$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} > 0$
Husband's Private Expenditure						
Observable	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} = 0$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} = 0$
Concealable	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} > 0$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} = \delta^g_{2,j}$	$\delta^g_{1,j} > 0, \delta^g_{2,j} = 0$

For both the husband and the wife, clothing, personal care and ceremony expenditures are considered, as well as the gifts and loans to each spouse's own social network. Clothing, personal care and ceremony expenses are clearly observable. The gifts to each social network, as well as loans, are much harder to monitor; arguably, the recipients have an incentive to keep the gifts or loans private to avoid crowding out other sources of support. For household public goods we consider health, food, and children clothing expenditures which we assume are easily observable by both spouses.

The intent to treat effects of private and public cash prizes on household public goods are presented in Table 5. The first notable aspect of these results is the lack of any significant response of public good spending to private prizes (current or lagged) of husbands or wives. Interestingly, only expenditures on health and assets respond to public cash prizes and livestock. The second observation is that the responses of spending to public prizes are clearly gender-differentiated. Husbands' public cash prizes are spent on assets and equipment, as well as home goods (utilities, household items, etc.) and health expenditure. Wives' prizes have no effect on household goods expenditure. Livestock prizes won by the husband have a negative effect on health expenditure. This may reflect the non-discretionary nature of the expense.

In Table 6 we present the results for regressions where the dependent variable is expenditure on private, observable goods. Since the survey asked each spouse separately about their private goods spending, we present results based on the reports of the spouse who incurred the expense. Expenditure on assignable private goods responds to both public and private prize winning, but in different ways. Both spouses spend public prize money on ceremonies. This may reflect the fact that these prizes were common knowledge to the whole community. Adult clothing responds significantly to private windfalls, which is suggestive of partial revelation. The theoretical model allows private prize winners to choose to reveal only part of the prize, and still hide some of it; recall the theoretical results imply the wife randomizes between revealing and hiding when the prize is small. Interestingly, partial revelation occurs in the form of clothing which could be a result of inter-spousal presents/gifts in an attempt to compensate for other hidden windfalls.

In Table 7, we present the results for regressions where gifts and loans are the dependent variable. While both spouses responded to prize-winning by increasing gifts or loans, the response varies by type of prize. Husbands' concealable expenditure is unaffected by public cash prize wins, both current and lagged. Livestock prizes won by the husband increase his in-kind gifts and decrease in-kind gifts of the wife almost in the same proportion. Interestingly, private cash prizes increase husbands' expenditure on alcohol and in-kind gifts in the same round. As the model suggests, the spouse in charge of providing the chop money allowance has no incentive to differentiate allocation of prizes by degree of publicity unless it is utility maximizing. In this case, it is possible that husbands are not making conscious efforts to conceal their expenditure, and just acting in their best interest.

Wives' private prizes increase cash gifts in the immediate round. Recall that follow up surveys were conducted a week after the lotteries, suggesting the wife commits the prize towards an allocation that is both difficult to monitor and cannot be easily recovered if the husband were to find out she won. Public prizes won by wives significantly increase loans in the immediate round, and both cash and in-kind gifts in the subsequent round. The differences in the timing of committing the private prizes towards cash gifts, and lagged public prizes towards both kinds of gifts, is consistent with differing motives. The wife commits the private prize to cash gifts immediately. On the other hand, she shares (probably what is left from) public prizes from previous rounds. The effect on cash gifts is larger than the effect on in-kind gifts, further strengthening the argument of an intention to conceal from her husband, as in-kind gifts are easier to monitor. Furthermore, wives made gifts out of lagged public prizes more than two months following their win. This suggests the gifts were made voluntarily.

Loans may be a form of concealment, or at least an effort by wives to keep their prize money out of their husbands' reach. Collins et al. (2009) find evidence that spouses lend money to agents called 'money guards', who offer the chance to hold the money aside until it is needed for expenditures not sanctioned by the other spouse, or for transfers to the spouse's family. This interpretation is also consistent with Udry's (1990) definition of loans in West Africa as a form of contingent claim; loans are almost universally interest-free and with flexible repayment terms, thus lending serves the creditor as a relatively costless store of value and future insurance. Given wives have less regular and reliable flows of income than their husbands, loans may be an attractive short-term investment option in a situation where formal savings products are not readily available. Overall, we find that wives tended to save more out of private prizes in the form of gifts and loans. These results are consistent with Ashraf (2009), who found higher rates of saving out of private windfalls among women in a lab experiment. This difference in inter-temporal allocation induced by the form of the prize suggests that providing women with access to formal savings could improve the welfare impact of public transfers.

In summary, our results lend support to the model's second hypothesis that spouses conceal private windfalls from each other in the form of less visible spending, savings or gifts and loans to other households. Public prizes, on the contrary, are spent in visible ways: on health, physical assets and ceremonies. This behavior was observed among both husbands and wives. However, the other hypothesis had less support; we find evidence that men, too, conceal private prizes. This suggests that in the marital contract men are bound in some way to share their windfalls in terms of increased chop money allowance.

[Table 5 here]

[Table 6 here]

IV. Alternative Marital Contracts and Robustness Checks

One possible counterfactual to our results is the set of allocations chosen by the household under a cooperative marital contract. In a contract where spouses bargain over expenditure and there is no hiding, there should be no differences in the treatment effect of public and private cash prizes for each spouse. Any additional resources, public or private, would increase expenditure on items preferred by the beneficiary as a result of her increase bargaining power. In order to increase bargaining power, private prizes would have to be revealed. The results provide evidence to reject the cooperative contract, as allocations are not consistent with a shift in bargaining power, and there are differences in the treatment of public and private cash prizes. While public cash prizes increase expenditure on health, assets, wife's personal care and ceremonies, there is no effect of private prizes on any of the visible expenditures. The effect of lottery prizes on assets and health, meanwhile, depends on the gender of the recipient.

An alternative counterfactual is the set of allocations that would result under a separate-spheres contract in the absence of hiding. In this case, there would be no differential effect between public and private lottery prizes, and prizes would only influence allocations in the winning spouse's realm of responsibilities. Both of these predictions are contrary to the evidence. Lottery winnings by the wife (public or private) have no effect on most categories of expenditure of the husband, and likewise for the husband. However, each spouse allocates private prizes towards the others' clothing. Further, 85% of husbands in our sample make strictly positive chop money transfers to their wives, and 81% of wives report receiving chop money transfers (at baseline), indicating that spouses do have financial interactions. In Appendix B.1 we restrict the sample to include only households where husbands make chop money transfers to their wives. The results indicate that the husband is unable to induce revelation even when the cash prize is large: there are no differences in chop money on average between lottery winners and non-winners, regardless of the size of the cash prize.[26] This implies that Pareto optimality is not attained even when the prize is large, and hiding is even more likely in this sample. We also present results including the 15 polygamous households. We excluded these 16 households in the main analysis because household bargaining in polygamous households is significantly different from two-spouse households. Nonetheless, the results are robust.

Robinson (2012) finds evidence of limited insurance within the household in Kenya through a field experiment in which he randomly allocates cash transfers. In his design, both spouses are informed of the transfers, thus there is no asymmetric information. We can also test for limited insurance in a similar fashion focusing the analysis on the public cash and livestock prizes. In Appendix B.3 we examine the effect of public lottery prizes on each spouse total and private expenditure, controlling for private prizes. The results are consistent with Robinson's, as husbands' winnings impact his own expenditure, but not his wife's. Likewise, wives' public cash winnings only impact their own total and private expenditure, the latter with a one-round lag. However, the wives' livestock winnings in the previous round decrease husbands' total and private expenditure. Interestingly, the wives' private winnings increase total expenditure (excluding food), through expenditure on household items (see Castilla and Walker, 2013) and private expenditure. Results in Tables 5 and 6 suggested the wives' lottery cash prizes had no effect on household goods. By aggregating we can see that wives' prizes do increase their contribution to household goods (excluding food purchases). This is not inconsistent with our previous results. The theoretical model allows private prize winners to choose to reveal only part of the prize, and still hide some of it; recall the theoretical results imply the wife randomizes

[26] In these results, we use spouse (i.e. household) fixed effects, as we are restricting the sample to only positive chop money.

between revealing and hiding when the prize is small. Further, the empirical effect of private prizes on the wives' cash gifts was not one-to-one.

It is possible that the non-cooperative behavior is observed among couples that have a poor marital relationship. If spouses do not trust each other, do not get along, or if one spouse considers she is not being treated fairly, they are more likely to diverge from Pareto optimal outcomes. A way to test for this is to examine whether the results are robust to including measures of intra-spousal trust, 'getting along' and fair treatment. We purposely excluded spousal reports of marital relationships in the main analysis as these reports could be endogenous. In Appendix B.4, we present results that include indicators of quality of marital relationships. We also include math scores as a proxy for education. There is no evidence that the results are driven by couples that have a poor marriage, and results are robust to variety of demographic controls.

V. Conclusions

We develop a model of intra-household allocation to illustrate that when the quantity of resources available to the household is not perfectly observed by all household members, the incentives to hide income depend on the role spouses have within the resource management contract. We draw from the Lundberg and Pollak (1993) separate spheres model in assuming that spouses do not commit to any binding agreements. The main focus is on the equilibrium where strictly positive intra-household transfers exist, as this is what we observed among almost all households in the survey. Two testable hypotheses were derived from the model: (1) the spouse in charge of deciding the chop money allowance has no incentive to hide, while the spouse responsible of the household public good provision does; and (2) hiding occurs when unobservable income is small relative to the chop money allowance. We test the model on data from a field experiment in Ghana. The field experiment was conducted between March and November 2009 in conjunction with a year-long household survey in four communities in Akwapim South district of Ghana's Eastern Region. In each community, lotteries were held to distribute prizes at random among survey participants. The prizes varied in value, publicity, and type (cash and livestock).

Consistent with the model predictions, when lottery prizes are small relative to the average chop money allowance at baseline, there is evidence of a pooling equilibrium. The husband offers the same chop money allowance to his wife independent of the lottery outcome, which results in hiding and efficiency losses. When lottery prizes are large, evidence indicates the husband is able to induce revelation through a contingent contract.

The model's predictions and the evidence from the field experiment both suggest that unanticipated windfalls can have differential effects on expenditure, not only depending on the gender of the recipient, but also on the observability of the windfall. In the experiment we find that public windfalls were spent publicly, on health, household assets and ceremonies. Meanwhile, we find evidence that husbands and wives both allocated private windfalls towards less visible goods and services. Interestingly, the marital contract appears to have an effect on the inter-temporal allocation of windfalls as well as the inter-good allocation. Especially among wives, gifts and loans to the social network were used as a form of 'hiding' prize-winnings, and thereby increasing control over future consumption. In Ghana, informal savings techniques such as these are used in lieu of access to formal mechanisms. In future research, it would be interesting to explore whether the provision of access to formal savings products could further increase women's ability to hide such windfalls, and thereby their control over spending within the household.

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Table 2. Balance of treatment: variables at baseline (Round 1) by lottery outcome

Expenditure	Husband		Wife		Control Variables	Husband		Wife	
	No Prize	Prize	No Prize	Prize		No Prize	Prize	No Prize	Prize
Household									
Assets	14.697	16.917	14.178	16.869	ln (Liquid Assets)	5.449	5.416	5.222	5.546*
	(3.158)	(8.052)	(3.138)	(7.588)		(0.120)	(0.137)	(0.116)	(0.143)
Health	14.734	21.282	14.818	20.234	ln (Illiquid Assets)	6.674	6.667	6.602	6.639
	(2.950)	(7.704)	(2.855)	(7.330)		(0.080)	(0.091)	(0.079)	(0.095)
Food	232.31	245.21	246.08	226.80	Household Size	4.968	4.703	4.840	5.196
	(13.50)	(21.55)	(16.51)	(15.64)		(0.174)	(0.162)	(0.163)	(0.176)
ln (Total Expenditure)	6.017	6.024	6.000	6.005	Land Area	7749.4	7883.4	1467.3	1888.8
	(0.049)	(0.054)	(0.046)	(0.057)		(764.7)	(846.7)	(233.6)	(334.7)
Spousal									
Personal Care	4.535	5.687	8.007	8.391	Get Along with Spouse	0.761	0.819	0.604	0.728***
	(0.500)	(1.826)	(0.402)	(0.555)	*(% of very well and well)*	(0.032)	(0.036)	(0.036)	(0.041)
Adult Clothing	4.536	3.517	3.368	2.720	Trust Spouse	0.797	0.864	0.655	0.754*
	(0.857)	(0.904)	(0.560)	(0.629)	*(% of completely or mostly)*	(0.031)	(0.032)	(0.035)	(0.039)
Ceremonies	11.601	7.622	3.718	3.460	Spouse treats you fairly	0.791	0.855	0.661	0.728
	(2.873)	(1.033)	(0.825)	(0.679)	*(% of completely or mostly)*	(0.031)	(0.033)	(0.035)	(0.041)
Cash Gifts	13.401	12.251	2.836	14.025	Age	44.396	46.037	41.313	40.333
	(3.250)	(3.331)	(0.771)	(10.40)		(1.015)	(1.378)	(1.157)	(1.260)
In-Kind Gifts	7.672	4.625	3.077	3.442	No. Children	1.900	1.648	1.834	1.848
	(2.574)	(0.769)	(0.679)	(0.881)		(0.114)	(0.131)	(0.112)	(0.130)
Loans	22.660	18.495	8.765	6.596	Math Score	6.164	5.903	4.528	4.732
	(9.788)	(8.074)	(2.982)	(1.835)	*(scale 1 - 8)*	(0.183)	(0.256)	(0.234)	(0.269)
Chop Money	17.327	19.141	15.512	16.5	No. Plots	1.621	0.497	1.567	0.584
	(0.881)	(1.288)	(0.842)	(1.037)		(0.088)	(0.061)	(0.093)	(0.074)

Note: Standard errors in parentheses.
*** p-value<0.001, ** p-value<0.05, * p-value<0.10

Table 3: Results on Chop Money, Testing for Pooling vs. Separating Equilibria

Lottery Outcome	Husband				Wife			
	Small Prize (< GH¢20)		Large Prize (> GH¢20)		Small Prize (< GH¢20)		Large Prize (> GH¢20)	
	Inverse Hyperbolic	Linear	Inverse Hyperbolic	Linear	Inverse Hyperbolic	Linear	Inverse Hyperbolic	Linear
Large Prize	-	-	-0.515*	-3.848**	-	-	-0.647**	-4.214**
(=1 if Prize > GH¢20)			(0.274)	(1.435)			(0.273)	(1.469)
Wife								
Public Cash Prize	0.085*	0.441*	-0.084*	-0.427*	0.052	0.398**	-0.055	-0.392**
	(0.048)	(0.249)	(0.048)	(0.253)	(0.035)	(0.189)	(0.036)	(0.194)
Private Cash Prize	0.034	0.179	-0.021	-0.082	0.046	0.342	-0.031	-0.242
	(0.043)	(0.223)	(0.043)	(0.226)	(0.044)	(0.238)	(0.045)	(0.242)
Livestock	0.043*	0.230*	-0.027	-0.135	0.074***	1.057***	-0.056**	-0.955***
	(0.025)	(0.133)	(0.026)	(0.138)	(0.019)	(0.103)	(0.020)	(0.108)
Public Cash Prize (Lag)	0.006	0.048	N/A	N/A	0.168*	0.905*	-0.162*	-0.865*
	(0.008)	(0.042)			(0.090)	(0.483)	(0.090)	(0.484)
Private Cash Prize (Lag)	0.044	0.220	-0.028	-0.128	0.070	0.451	-0.053	-0.361
	(0.056)	(0.294)	(0.057)	(0.297)	(0.058)	(0.313)	(0.059)	(0.316)
Livestock (Lag)	0.037*	0.441***	-0.028	-0.374***	0.053*	0.445**	-0.048	-0.395**
	(0.019)	(0.100)	(0.020)	(0.105)	(0.029)	(0.155)	(0.029)	(0.159)
Public = Private	0.61	0.61	0.92	1.03	0.01	0.03	0.17	0.24
Public = Private = No Prize	3.75	3.78	3.73	7.18**	3.23	6.50**	4.79*	6.92**
Public = Private (Lag)	0.45	0.34	N/A	N/A	0.84	0.63	1.02	0.76
Public = Private = No Prize (Lag)	1.19	1.85	3.91	7.55**	4.85*	5.52*	4.82*	6.61**
Husband								
Public Cash Prize	0.042	0.285**	-0.033	-0.238	0.044	0.313**	-0.025	-0.211
	(0.026)	(0.138)	(0.028)	(0.146)	(0.027)	(0.148)	(0.029)	(0.157)
Private Cash Prize	0.048*	0.399**	-0.045	-0.348**	0.021	0.113	-0.013	-0.061
	(0.026)	(0.136)	(0.027)	(0.144)	(0.028)	(0.151)	(0.030)	(0.160)
Livestock	0.059*	0.450**	-0.053	-0.391**	0.046*	0.651***	-0.032	-0.574***
	(0.035)	(0.185)	(0.036)	(0.189)	(0.026)	(0.143)	(0.027)	(0.148)
Public Cash Prize (Lag)	0.050	0.236	-0.035	-0.145	0.073	0.359	-0.058	-0.318
	(0.046)	(0.241)	(0.048)	(0.248)	(0.048)	(0.257)	(0.049)	(0.265)
Private Cash Prize (Lag)	0.030	0.180	-0.029	-0.117	0.004	-0.097	-0.013	0.066
	(0.029)	(0.155)	(0.031)	(0.164)	(0.037)	(0.198)	(0.039)	(0.208)
Livestock (Lag)	0.078**	0.458**	-0.064*	-0.376**	0.077**	0.583**	-0.059	-0.505**
	(0.034)	(0.177)	(0.035)	(0.181)	(0.035)	(0.189)	(0.036)	(0.193)
Public = Private	0.02	0.35	0.1	0.3	0.34	0.91	0.08	0.47
Public = Private = No Prize	5.82*	12.68**	2.95	6.09**	3.10	4.97*	5.10*	7.84**
Public = Private (Lag)	0.12	0.04	0.01	0.01	1.30	2.01	0.51	1.33
Public = Private = No Prize (Lag)	2.17	2.27	3.01	6.51**	2.34	2.22	5.43*	9.07**
Unsensored	880	880	-	-	863	863	-	-
N	1048	1048	-	-	1100	1100	-	-

Note: Results estimated using a RE Tobit Model, include controls for initial assets, village and round fixed effects. Standard errors in parentheses.
Ln (Expenditure) is computed using the Inverse Hyperbolic Sine Transformation.
*** p-value<0.001, ** p-value<0.05, * p-value<0.10

Table 5. Treatment Effects on Household Public Goods Expenditure

	Husband's Report			Wife's Report		
	Assets	Food	Health	Assets	Food	Health
Husband						
Public Cash Prize	0.063**	-0.000	0.027**	0.061**	0.001	0.028**
	(0.022)	(0.004)	(0.010)	(0.024)	(0.004)	(0.011)
Private Cash Prize	-0.041	0.003	0.011	-0.070**	0.005	0.003
	(0.028)	(0.004)	(0.011)	(0.034)	(0.004)	(0.012)
Livestock	-0.011	0.000	-0.019**	-0.000	0.002	-0.014*
	(0.018)	(0.002)	(0.008)	(0.017)	(0.002)	(0.007)
Public Cash Prize	0.052*	-0.001	0.014	0.058*	0.001	0.018
(Lag)	(0.030)	(0.005)	(0.014)	(0.031)	(0.005)	(0.014)
Private Cash Prize	-0.003	0.001	-0.000	-0.004	0.001	0.007
(Lag)	(0.029)	(0.005)	(0.014)	(0.033)	(0.005)	(0.015)
Livestock (Lag)	0.013	-0.003	-0.003	0.034*	0.000	0.001
	(0.020)	(0.003)	(0.009)	(0.018)	(0.003)	(0.008)
Wife						
Public Cash Prize	-0.040	-0.001	0.005	-0.030	-0.001	0.006
	(0.027)	(0.003)	(0.009)	(0.027)	(0.003)	(0.010)
Private Cash Prize	0.003	0.002	-0.005	0.013	0.002	0.004
	(0.025)	(0.004)	(0.012)	(0.025)	(0.004)	(0.011)
Livestock	-0.009	0.002	-0.001	-0.018	0.001	-0.005
	(0.017)	(0.002)	(0.007)	(0.018)	(0.002)	(0.007)
Public Cash Prize	-0.008	-0.000	0.006	-0.007	-0.000	0.005
(Lag)	(0.024)	(0.003)	(0.010)	(0.024)	(0.003)	(0.010)
Private Cash Prize	0.001	-0.000	0.002	0.025	-0.001	0.008
(Lag)	(0.028)	(0.004)	(0.013)	(0.027)	(0.004)	(0.012)
Livestock (Lag)	0.023	-0.000	-0.011	0.022	-0.002	-0.011
	(0.017)	(0.003)	(0.008)	(0.017)	(0.002)	(0.008)
Ln (Initial Illiquid	-0.344	0.206**	0.153	-0.557	0.206**	0.197
Assets)	(0.386)	(0.075)	(0.140)	(0.383)	(0.071)	(0.133)
Ln (Initial Liquid	-0.378	0.027	-0.005	-0.139	0.050	0.039
Assets)	(0.263)	(0.051)	(0.095)	(0.262)	(0.048)	(0.090)
Unsensored	339	1026	822	339	1069	851
N	1027	1027	1027	1070	1070	1070

Note: Estimated using a RE Tobit Model, include controls for village and round fixed effects. Standard errors in parentheses. Ln (Expenditure) is computed using the IHST.
*** p-value<0.001, ** p-value<0.05, * p-value<0.10

Table 6. Treatment Effects on Observable Private Expenditure

	Husband			Wife		
	Adult Clothing	Ceremony	Personal Care	Adult Clothing	Ceremony	Personal Care
Husband						
Public Cash	0.047	0.035**	-0.002	-0.001	-0.018	0.003
Prize	(0.029)	(0.013)	(0.006)	(0.024)	(0.015)	(0.005)
Private Cash	0.026	0.015	0.004	0.046**	-0.016	0.009*
Prize	(0.032)	(0.013)	(0.006)	(0.022)	(0.015)	(0.005)
Livestock	0.020	-0.000	-0.010**	0.002	0.002	-0.002
	(0.022)	(0.009)	(0.004)	(0.015)	(0.009)	(0.003)
Public Cash	0.008	0.008	-0.003	0.006	-0.003	-0.007
Prize (Lag)	(0.044)	(0.018)	(0.007)	(0.030)	(0.018)	(0.006)
Private Cash	-0.097	-0.005	-0.001	0.017	-0.026	0.002
Prize (Lag)	(0.066)	(0.017)	(0.007)	(0.031)	(0.020)	(0.006)
Livestock	0.005	-0.004	-0.003	0.013	0.002	-0.000
(Lag)	(0.029)	(0.011)	(0.005)	(0.017)	(0.010)	(0.003)
Wife						
Public Cash	-0.005	0.020*	0.002	-0.035	0.017	0.010**
Prize	(0.030)	(0.011)	(0.005)	(0.025)	(0.011)	(0.004)
Private Cash	0.063**	-0.018	-0.001	0.006	-0.005	0.005
Prize	(0.032)	(0.014)	(0.006)	(0.023)	(0.013)	(0.005)
Livestock	-0.010	0.000	-0.004	0.021	0.011	-0.001
	(0.023)	(0.009)	(0.004)	(0.014)	(0.008)	(0.003)
Public Cash	0.021	0.020	-0.000	0.002	0.015	0.013**
Prize (Lag)	(0.028)	(0.012)	(0.005)	(0.021)	(0.012)	(0.004)
Private Cash	-0.126	-0.010	0.000	0.011	-0.009	0.000
Prize (Lag)	(0.102)	(0.016)	(0.007)	(0.027)	(0.015)	(0.005)
Livestock	0.006	-0.003	-0.005	0.017	0.008	-0.001
(Lag)	(0.023)	(0.009)	(0.004)	(0.016)	(0.009)	(0.003)
Ln (Initial Illiquid	-0.433	0.504**	0.091	-0.380	0.304*	0.052
Assets)	(0.382)	(0.190)	(0.079)	(0.278)	(0.175)	(0.080)
Ln (Initial Liquid	0.270	0.003	-0.006	0.162	-0.099	0.058
Assets)	(0.269)	(0.131)	(0.053)	(0.188)	(0.120)	(0.054)
Unsensored	197	575	839	291	479	1009
N	1027	1027	1027	1070	1070	1070

Note: Results estimated using a RE Tobit Model, include village and round fixed effects.
Standard errors in parentheses.
Ln (Expenditure) is computed using the Inverse Hyperbolic Sine Transformation.
*** p-value<0.001, ** p-value<0.05, * p-value<0.10

Table 7. Treatment Effects of Asymmetric Information on Concealable Private Expenditure

	Husband			Wife		
	Cash Gifts	Inkind Gifts	Loans	Cash Gifts	Inkind Gifts	Loans
Husband						
Public Cash Prize	-0.002	-0.080	-0.024	-0.012	-0.029	0.065
	(0.028)	(0.051)	(0.101)	(0.041)	(0.024)	(0.058)
Private Cash Prize	-0.001	0.039**	-0.232	0.027	-0.008	0.065
	(0.027)	(0.020)	(0.207)	(0.035)	(0.024)	(0.061)
Livestock	0.003	0.035**	0.009	-0.010	-0.050**	-0.026
	(0.018)	(0.014)	(0.055)	(0.023)	(0.019)	(0.047)
Public Cash Prize (Lag)	-0.032	-0.020	-0.158	0.039	-0.004	-0.243
	(0.047)	(0.039)	(0.242)	(0.041)	(0.030)	(0.268)
Private Cash Prize (Lag)	-0.004	-0.011	0.074	-0.076	-0.070	0.063
	(0.036)	(0.031)	(0.102)	(0.072)	(0.050)	(0.087)
Livestock (Lag)	0.003	-0.008	0.056	0.011	-0.019	0.024
	(0.022)	(0.020)	(0.061)	(0.026)	(0.020)	(0.046)
Wife						
Public Cash Prize	-0.015	-0.009	0.086	0.009	0.026	0.096**
	(0.020)	(0.020)	(0.060)	(0.026)	(0.016)	(0.042)
Private Cash Prize	0.003	0.009	-0.074	0.060**	0.014	0.003
	(0.026)	(0.022)	(0.114)	(0.027)	(0.020)	(0.064)
Livestock	-0.007	0.013	0.072	-0.023	0.020	0.017
	(0.018)	(0.014)	(0.047)	(0.024)	(0.013)	(0.044)
Public Cash Prize (Lag)	-0.003	-0.008	0.004	0.076**	0.037**	-0.010
	(0.022)	(0.022)	(0.081)	(0.024)	(0.017)	(0.060)
Private Cash Prize (Lag)	0.005	0.005	-0.214	0.025	-0.076	0.077
	(0.029)	(0.026)	(0.237)	(0.037)	(0.049)	(0.059)
Livestock (Lag)	-0.011	0.020	0.013	0.021	-0.009	-0.003
	(0.020)	(0.016)	(0.055)	(0.022)	(0.017)	(0.051)
Ln (Initial Illiquid Assets)	0.073	0.204	1.248	0.533	0.388*	0.771
	(0.312)	(0.265)	(0.925)	(0.358)	(0.234)	(0.732)
Ln (Initial Liquid Assets)	0.703**	-0.070	0.722	0.465*	0.185	0.752
	(0.224)	(0.180)	(0.657)	(0.257)	(0.164)	(0.521)
Unsensored	332	267	97	176	288	116
N	1048	1048	1048	1100	1100	1100

Note: Estimated using a RE Tobit Model, include village and round fixed effects.
Standard errors in parentheses.
Ln (Expenditure) is computed using the Inverse Hyperbolic Sine Transformation.
*** p-value<0.001, ** p-value<0.05, * p-value<0.10, a/ p-value<0.13

SUPPLEMENTARY APPENDICES: FOR ONLINE PUBLICATION

APPENDIX A: Proofs

Proof of Proposition 1:

By assumption $v'(0) = \infty$, we know $Q > 0$. From (5), if $s=0$ for some $Q > 0$ then:

$$v'(Q)Q'(0) < u'(Y_m + T) \quad (1.1)$$

If $Y_m + T = 0$, (*1.1*) holds because $u'(0) = \infty$.

$$v'(Q)Q'(0) < u'(0) \quad (1.2)$$

If $Y_m = Y_f$, due to the concavity assumption we know that $u'(Y_f + T - Q) > u'(Y_f + T)$, and from (3) and (5) we know that:

$$u'(Y_f + T - Q)Q'(0) < u'(Y_f - Q)Q'(0) = v'(Q)Q'(0) < u'(Y_f + T) < u'(Y_f + T - Q) \quad (1.3)$$

Which is a contradiction. ■

Proof of Proposition 2:

If the husband wins a cash lottery prize, he solves:

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

$$s.t. \quad x_m \leq Y_m + T - s; \;\; v'(Q) - u'(Y_f + s - Q) = 0$$

The Lagrangian is:

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

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

$$\frac{\partial \mathcal{L}}{\partial Q} = v'(Q) - \lambda u''(Y_f + s - Q) - \lambda v''(Q) \leq 0 \quad (2.1)$$

$$\frac{\partial \mathcal{L}}{\partial s} = -u'(Y_m + T - s) + \lambda p u''(Y_f + s - Q) \leq 0 \quad (2.2)$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = p u'(Y_f + s - Q) - v'(Q) = 0 \quad (2.3)$$

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

Case (i) If $Y_m \leq \overline{Y_m} \in (0, Y_f)$, $s = 0$, such that the value of Q is obtained from (3)

$$v'(Q) - u'(Y_f - Q) \leq 0 \quad (2.4)$$

Differentiating (2.4) and *f's* budget constraint with respect to Y_f and T yields the results stated in the proposition.

$$\frac{\partial Q}{\partial Y_f} = \frac{u''(x_f)}{v''(Q) + u''(x_f)} > 0 \quad (2.5)$$

$$\frac{\partial Q}{\partial Y_m} = \frac{\partial Q}{\partial T} = 0 \quad (2.6)$$

$$\frac{\partial x_f}{\partial Y_f} = \frac{v''(Q)}{v''(Q)+u''(x_f)} > 0 \qquad (2.7)$$

$$\frac{\partial x_f}{\partial Y_m} = \frac{\partial x_f}{\partial T} = 0 \qquad (2.8)$$

$$\frac{\partial x_m}{\partial Y_f} = 0 \qquad (2.9)$$

$$\frac{\partial x_m}{\partial Y_m} = 1 \qquad (2.10)$$

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

Solving (2.1) and (2.2) for λ and substituting in, yields the following system for s and Q:

$$u'(Y_m + T - s)\left[u''(Y_f + s - Q) + v''(Q)\right] - v'(Q)u''(Y_f + s - Q) = 0 \qquad (2.11)$$

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

Totally differentiating the system in (2.11):

$$\begin{bmatrix} -u'(x_m)u'''(x_f) + u'(x_m)v'''(Q) - v''(Q)u''(x_f) + v'(Q)u'''(x_f) & -u''(x_m)u''(x_f) + u'(x_m)u'''(x_f) - u''(x_m)v''(Q) - v'(Q)u'''(x_f) \\ v''(Q) + u''(x_f) & -u''(x_f) \end{bmatrix} \begin{bmatrix} dQ \\ ds \end{bmatrix}$$

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

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

$$D = \det \begin{bmatrix} -u'(x_m)u'''(x_f) + u'(x_m)v'''(Q) - v''(Q)u''(x_f) + v'(Q)u'''(x_f) & -u''(x_m)u''(x_f) + u'(x_m)u'''(x_f) - u''(x_m)v''(Q) - v'(Q)u'''(x_f) \\ v''(Q) + u''(x_f) & -u''(x_f) \end{bmatrix}$$

$$D = u''(x_m)\left[u''(x_f) + v''(Q)\right]^2 + \lambda v''(Q)u'''(x_f)v''(Q) - u'(x_m)u''(x_f)v'''(Q) + v''(Q)u''(x_f)^2 < 0 \qquad (2.12)$$

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

$$= u''(x_m)\left[u''(x_f) + v''(Q)\right]^2 + \left[v'(Q) - pu'(x_m)\right]u'''(x_f)v''(Q) - u'(x_m)u''(x_f)v'''(Q) + v''(Q)u''(x_f)^2 < 0$$

So, the comparative statics are,

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

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

$$\frac{\partial s}{\partial Y_f} = \frac{u'(x_m)u''(x_f)v'''(Q) - \lambda v''(Q)u'''(x_f)v''(Q) - v''(Q)u''(x_f)^2}{D} < 0 \quad \textit{if}$$

$$u'(x_m)u''(x_f)v'''(Q) > \lambda v''(Q)u'''(x_f)v''(Q) + v''(Q)u''(x_f)^2$$

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

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

If the wife wins a cash lottery prize, the husband solves:

$$\max_{s\geq 0;\, x_m\geq 0; Q\geq 0} U_m = v(Q) + u(x_m)$$
$$s.t. \quad x_m \leq Y_m - s; \;\; v'(Q) - u'\big(Y_f + T + s - Q\big) = 0$$

Case (iii): If $Y_m \leq \overline{Y_m} \in \big(0, Y_f\big)$ thus $s = 0$, so the value of Q is obtained from

$$v'(Q) - u'\big(Y_f + T - Q\big) \leq 0 \tag{2.13}$$

Differentiating (2.13) and *f's* budget constraint with respect to Y_f and T yields the results stated in the proposition. Note that neither x_m nor s change with Y_f. In particular,

$$\frac{\partial Q}{\partial Y_f} = \frac{\partial Q}{\partial T} = \frac{u''(x_f)}{v''(Q) + u''(x_f)} > 0 \tag{2.14}$$

$$\frac{\partial Q}{\partial Y_m} = \frac{\partial x_f}{\partial Y_m} = \frac{\partial x_m}{\partial Y_f} = 0 \tag{2.15}$$

$$\frac{\partial x_f}{\partial Y_f} = \frac{\partial x_f}{\partial T} = \frac{v''(Q)}{v''(Q) + u''(x_f)} > 0 \tag{2.16}$$

Case (iv): If $Y_m > \overline{Y_m}$.thus $s, Q > 0$.

$$u'(Y_m - s)\big[u''\big(Y_f + s - Q\big) + v''(Q)\big] - v'(Q)u''\big(Y_f + s - Q\big) = 0 \tag{2.17}$$
$$u'\big(Y_f + s - Q\big) - v'(Q) = 0$$

Totally differentiating the system in (2.17):

$$\begin{bmatrix} -u'(x_m)u'''(x_f) + u'(x_m)v'''(Q) - v''(Q)u''(x_f) + v'(Q)u'''(x_f) & -u''(x_m)u''(x_f) + u'(x_m)u'''(x_f) - u''(x_m)v''(Q) - v'(Q)u'''(x_f) \\ v''(Q) + u''(x_f) & -u''(x_f) \end{bmatrix} \begin{bmatrix} dQ \\ ds \end{bmatrix}$$
$$= \begin{bmatrix} v'(Q)u'''(x_f) - u'(x_m)u'''(x_f) & v'(Q)u'''(x_f) - u'(x_m)u'''(x_f) & -u''(x_m)u''(x_f) - u''(x_m)v''(Q) \\ u''(x_f) & u''(x_f) & 0 \end{bmatrix} \begin{bmatrix} dY_f \\ dT \\ dY_m \end{bmatrix}$$

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

$$D = det \begin{bmatrix} -u'(x_m)u'''(x_f) + u'(x_m)v'''(Q) - v''(Q)u''(x_f) + v'(Q)u'''(x_f) & -u''(x_m)u''(x_f) + u'(x_m)u'''(x_f) - u''(x_m)v''(Q) - v'(Q)u'''(x_f) \\ v''(Q) + u''(x_f) & -u''(x_f) \end{bmatrix}$$

$$D = u''(x_m)\big[u''(x_f) + v''(Q)\big]^2 + \lambda v''(Q)u'''(x_f)v''(Q) - u'(x_m)u''(x_f)v'''(Q) + v''(Q)u''(x_f)^2 < 0 \tag{2.18}$$

So, the comparative statics are,

$$\frac{\partial Q}{\partial Y_f} = \frac{\partial Q}{\partial T} = \frac{u''(x_m)u''(x_f)^2 + u''(x_m)u''(x_f)v''(Q)}{D} > 0$$

$$\frac{\partial Q}{\partial Y_m} = \frac{u''(x_m)u''(x_f)^2 + u''(x_m)u''(x_f)v''(Q)}{D} > 0$$

$$\frac{\partial x_f}{\partial Y_f} = \frac{\partial x_f}{\partial T} = \frac{u''(x_m)v''(Q)^2 + u''(x_m)u''(x_f)v''(Q)}{D} > 0$$

$$\frac{\partial s}{\partial Y_f} = \frac{\partial s}{\partial T} = \frac{u'(x_m)u''(x_f)v'''(Q) - \lambda v''(Q)u'''(x_f)v''(Q) - v''(Q)u''(x_f)^2}{D} < 0$$ *if*

$$u'(x_m)u''(x_f)v'''(Q) > \lambda u'''(x_f)v''(Q)^2 + v''(Q)u''(x_f)^2$$

$$\frac{\partial x_m}{\partial Y_f} = \frac{u'(x_m)u''(x_f)v'''(Q) - \lambda v''(Q)u'''(x_f)v''(Q) - v''(Q)u''(x_f)^2}{D} > 0$$

$$\frac{\partial s}{\partial Y_m} = \frac{u''(x_m)[u''(x_f) + v''(Q)]^2}{D} > 0$$

$$\frac{\partial x_m}{\partial Y_m} = \frac{-u'(x_m)u''(x_f)v'''(Q) + \lambda v''(Q)u'''(x_f)v''(Q) + v''(Q)u''(x_f)^2}{D} > 0$$ ■

Proof of Proposition 3:

If *f* reveals the lottery prize and $Y_m > \overline{Y_m}$ the demands are obtained from solving the following system of equations:

$$u'(Y_m - s)[u''(Y_f + T + s - Q) + v''(Q)] - v'(Q)u''(Y_f + T + s - Q) = 0$$

$$u'(Y_f + T + s - Q) - v'(Q) = 0$$

The change in utility per unit change in the lottery prize is given by:

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

Which simplifies to:

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

If *f* hides the lottery prize then she spends all T on private consumption and the household good allocation equals the case where she does not win a prize. So it must be that $u(x_f) < u(x_f^R) < u(x_f^H)\ where\ x_f^H = x_f + T$ where x_f is the optimal private consumption allocation if the wife does not win.

The change in utility per unit change in the lottery prize when she hides is:

$$\left.\frac{\partial U_f}{\partial T}\right|_H = u'(x_f^H)$$

The wife has an incentive to hide if and only if:

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

Which simplifies to:

$$[u'(x_f^R) - u'(x_f^H)]u''(x_m^R)[u''(x_f^R) + v''(Q^R)]^2 < u'(x_f^H)\left[v''(Q^R)u'''(x_f^R)[v'(Q^R) - u'(x_m^R)] + v''(Q^R)u''(x_f^R)^2 - u'(x_m^R)u''(x_f^R)v'''(Q^R)\right]$$

Recall that,

$$\frac{\partial s}{\partial T} < 0 \;\; if \;\; u'(x_m^R)u''(x_f^R)v'''(Q^R) > v''(Q^R)u'''(x_f^R)[v'(Q^R) - u'(x_m^R)] + v''(Q^R)u''(x_f^R)^2$$

When $\frac{\partial s}{\partial Y_f} > 0$ the wife has no incentive to hide the lottery prize. However, when $\frac{\partial s}{\partial Y_f} < 0$ she has an incentive to hide.

Assume the wife reveals and allocates all of the lottery prize towards the household public good, such that $T = Q^R$. When $(T \to \infty)$, $\lim_{T\to\infty} u'(x_f^R) = \lim_{T\to\infty} u'(Y_f + T + s - Q^R) = \lim_{T\to\infty} u'(Y_f + T + s - T) = u'(Y_f + s)$. If she does hide, $\lim_{T\to\infty} u'(x_f^H) = \lim_{T\to\infty} u'(x_f + T) = u'(\infty) \to 0$. Thus the wife is better off revealing. Now assume the lottery prize tends to zero. If the wife reveals, $\lim_{T\to 0} u'(x_f^R) = \lim_{T\to 0} u'(Y_f + T + s - Q^R) = u'(x_f)$, if she hides $\lim_{T\to 0} u'(x_f^H) = \lim_{T\to 0} u'(x_f + T) = u'(x_f)$, thus the above condition simplifies to $0 > u'(x_f)$, which always holds and the wife is better off hiding. Thus there is a threshold level of lottery prize $(\bar{T})$ such that for any $T < \bar{T}$ the wife is better off hiding. ■

<u>Proof of Proposition 4:</u>

$$max_{\bar{s}\geq 0;\, \underline{s}\geq 0}\, EU_m = \pi\theta\left[v\left(Q(\underline{s},T)\right) + u(Y_m - \underline{s})\right] + [\pi(1-\theta) + \theta(1-\pi)]\left[v\big(Q(\bar{s},0)\big) + u(Y_m - \bar{s})\right]$$

$s.t.\;\; Q(s) > 0$

$$v\left(Q(\underline{s},T)\right) + u\left(Y_f + T + \underline{s} - Q(\underline{s},T)\right) \geq v\big(Q(\bar{s},0)\big) + u\left(Y_f + T + \bar{s} - Q(\bar{s},0)\right) \;\; \text{(IC1)}$$

The Lagrangian is:

$$\mathcal{L} = \pi\theta\left[v\left(Q(\underline{s},T)\right) + u(Y_m - \underline{s})\right] + [\pi(1-\theta) + \theta(1-\pi)]\left[v\big(Q(\bar{s},0)\big) + u(Y_m - \bar{s})\right]$$
$$+\lambda_1\left[v\left(Q(\underline{s},T)\right) + u\left(Y_f + T + \underline{s} - Q(\underline{s},T)\right) - v\big(Q(\bar{s},0)\big) - u\left(Y_f + T + \bar{s} - Q(\bar{s},0)\right)\right]$$

Kuhn-Tucker First-Order Conditions:

$$\frac{\partial\mathcal{L}}{\partial\underline{s}} = \pi\theta\left[v'\left(Q(\underline{s},T)\right)Q'(\underline{s},T) - u'(Y_m - \underline{s})\right] + \lambda_1\left[v'\left(Q(\underline{s},T)\right)Q'(\underline{s},T) + \left(1 - Q'(\underline{s},T)\right)u'\left(Y_f + T + \underline{s} - Q(\underline{s},T)\right)\right] \leq 0 \qquad (4.1)$$

$$\frac{\partial\mathcal{L}}{\partial\bar{s}} = [\pi(1-\theta) + \theta(1-\pi)]\left[v\big(Q(\bar{s},0)\big)Q'(\bar{s},0) - u(Y_m - \bar{s})\right] - \lambda_1\left[v'\big(Q(\bar{s},0)\big)Q'(\bar{s},0) + (1 - Q'(\bar{s},0))u'\left(Y_f + T + \bar{s} - Q(\bar{s},0)\right)\right] \leq 0 \qquad (4.2)$$

$$\frac{\partial\mathcal{L}}{\partial\lambda_1} = v\left(Q(\underline{s},T)\right) + u\left(Y_f + T + \underline{s} - Q(\underline{s},T)\right) - v\big(Q(\bar{s},0)\big) - u\left(Y_f + T + \bar{s} - Q(\bar{s},0)\right) \leq 0 \;\; (4.3)$$

$$\underline{s}\left[\frac{\partial \mathcal{L}}{\partial \underline{s}}\right] = 0,\ \bar{s}\left[\frac{\partial \mathcal{L}}{\partial \bar{s}}\right] = 0;\ \lambda_1\left[\frac{\partial \mathcal{L}}{\partial \lambda_1}\right] = 0;\ \bar{s} \geq 0;\ \underline{s} \geq 0;\ \lambda_1 \geq 0. \quad (4.4)$$

Case (i): If $Y_m > \overline{Y}_m \in (0, Y_f + T)$, $\bar{s} > \underline{s} > 0$ *and* $\lambda_1 = 0$
Then (4.1) and (4.2) imply:

$$\pi\theta\left[v'\left(Q(\underline{s},T)\right)Q'(\underline{s},T) - u'(Y_m - \underline{s})\right] = [\pi(1-\theta) + \theta(1-\pi)]\left[v\left(Q(\bar{s},0)\right)Q'(\bar{s},0) - u(Y_m - \bar{s})\right]$$

Which only holds when $v'\left(Q(\underline{s},T)\right)Q'(\underline{s},T) - u'(Y_m - \underline{s}) = 0$ *and* $v\left(Q(\bar{s},0)\right)Q'(\bar{s},0) - u(Y_m - \bar{s}) = 0$. *The former is the husband's FOC under first best if the wife wins the lottery and* $v'\left(Q(\underline{s},T)\right)Q'(\underline{s},T) = u'(Y_m - \underline{s})$ *iff* $\underline{s} = \underline{s}^{FB}$. *The latter is the husband's FOC under first best if the wife does not win the lottery and* $v\left(Q(\bar{s},0)\right)Q'(\bar{s},0) = u(Y_m - \bar{s})$ *iff* $\overline{s}^{FB} = \overline{s}$.
$\lambda_1 = 0$ *iff*

$$v\left(Q(\underline{s},T)\right) + u\left(Y_f + T + \underline{s} - Q(\underline{s},T)\right) > v\left(Q(\bar{s},0)\right) + u\left(Y_f + T + \bar{s} - Q(\bar{s},0)\right)$$

If we assume $T \leq (\overline{s}^{FB} - \underline{s}^{FB}) > 0$ *then* $Q(\underline{s},T) > Q(\bar{s},0)$

$$v\left(Q(\underline{s}^{FB},T)\right) + u\left(Y_f + T + \underline{s}^{FB} - Q(\underline{s}^{FB},T)\right) = v\left(Q\left(\overline{s}^{FB}\right)\right) + u\left(Y_f + \overline{s}^{FB} - Q\left(\overline{s}^{FB}\right)\right) < v\left(Q\left(\overline{s}^{FB},0\right)\right) + u\left(Y_f + T + \overline{s}^{FB} - Q\left(\overline{s}^{FB},0\right)\right)$$

If we assume $T > (\overline{s}^{FB} - \underline{s}^{FB}) > 0$ *then* $Q(\underline{s},T) > Q(\bar{s},0)$

$Q(\underline{s}^{FB},T) > Q\left(\overline{s}^{FB},0\right)$ *and* $0 < T + \underline{s}^{FB} - Q(\underline{s}^{FB},T) < T + \overline{s}^{FB} - Q\left(\overline{s}^{FB},0\right)$ *therefore* $v\left(Q(\underline{s}^{FB},T)\right) > v\left(Q\left(\overline{s}^{FB},0\right)\right)$ *and* $\left(Y_f + T + \underline{s}^{FB} - Q(\underline{s}^{FB},T)\right) < u\left(Y_f + T + \overline{s}^{FB} - Q\left(\overline{s}^{FB},0\right)\right)$.

This implies that for a $T > (\overline{s}^{FB} - \underline{s}^{FB})$ *there exists a threshold level* $\bar{T} \in (\overline{s}^{FB} - \underline{s}^{FB}, T)$ *where:*

$$v\left(Q(\underline{s}^{FB},T)\right) + u\left(Y_f + T + \underline{s}^{FB} - Q(\underline{s}^{FB},T)\right) > v\left(Q\left(\overline{s}^{FB},0\right)\right) + u\left(Y_f + T + \overline{s}^{FB} - Q\left(\overline{s}^{FB},0\right)\right)$$

Case (ii): If $Y_f + T > Y_m > \overline{Y}_m \in (0, Y_f)$, $\bar{s} > \underline{s} = 0$ *and* $\lambda_1 = 0$
Then (3.1) and (3.2) imply:

$$\pi\theta\left[v'\left(Q(0,T)\right)Q'(0,T) - u'(Y_m)\right] < [\pi(1-\theta) + \theta(1-\pi)]\left[v\left(Q(\bar{s},0)\right)Q'(\bar{s},0) - u(Y_m - \bar{s})\right]$$

From the husband's FOC under perfect information we know that $\underline{s} = 0$ *iff* $v'(Q(0,T))Q'(0,T) < u'(Y_m)$ *and* $v(Q(\bar{s},0))Q'(\bar{s},0) = u(Y_m - \bar{s})$ *iff* $\bar{s}^{FB} = \bar{s}$.

$\lambda_1 = 0$ *iff*

$$v(Q(0,T)) + u\left(Y_f + T - Q(0,T)\right) > v\left(Q\left(\bar{s}^{FB},0\right)\right) + u\left(Y_f + T + \bar{s}^{FB} - Q\left(\bar{s}^{FB},0\right)\right)$$

If we assume $T \leq \bar{s}^{FB} > \underline{s}^{FB} = 0$ *then* $Q(0,T) = Q(\bar{s}^{FB},0)$

$$v(Q(0,T)) + u\left(Y_f + T - Q(0,T)\right) < v\left(Q\left(\bar{s}^{FB},0\right)\right) + u\left(Y_f + T + \bar{s}^{FB} - Q\left(\bar{s}^{FB},0\right)\right)$$

which is a contradiction.

If we assume $T > \bar{s}^{FB} > \underline{s}^{FB} = 0$ *then* $Q(0,T) > Q(\bar{s}^{FB},0)$ *therefore* $v(Q(0,T)) > v\left(Q\left(\bar{s}^{FB},0\right)\right)$ *and* $\left(Y_f + T - Q(0,T)\right) < u\left(Y_f + T + \bar{s}^{FB} - Q\left(\bar{s}^{FB},0\right)\right)$

This implies that for a $T > \bar{s}^{FB} > \underline{s}^{FB} = 0$ *there exists a threshold level* $\bar{T} \in (\bar{s}^{FB}, T)$ *such that:*

$$v(Q(0,T)) + u\left(Y_f + T - Q(0,T)\right) > v\left(Q\left(\bar{s}^{FB},0\right)\right) + u\left(Y_f + T + \bar{s}^{FB} - Q\left(\bar{s}^{FB},0\right)\right) \blacksquare$$

Proof of Proposition 5:

If $(\bar{s}^{FB} - \underline{s}^{FB}) \geq T$ *and* $\lambda_1 \neq 0$ *then (4.1) and (4.2) imply:*

$$\frac{\pi\theta\left[u'(Y_m - \underline{s}) - v'\left(Q(\underline{s},T)\right)Q'(\underline{s},T)\right]}{u'\left(Y_f + T + \underline{s} - Q(\underline{s},T)\right)} > \frac{[\pi(1-\theta) + \theta(1-\pi)]\left[v\left(Q(\bar{s},0)\right)Q'(\bar{s},0) - u(Y_m - \bar{s})\right]}{v'\left(Q(\bar{s},0)\right)Q'(\bar{s},0) + \left(1 - Q'(\bar{s},0)\right)u'\left(Y_f + T + \bar{s} - Q(\bar{s},0)\right)}$$

A pooling equilibrium would imply $\bar{s}^{FB} > \bar{s} = \underline{s} = s^P > \underline{s}^{FB} \geq 0$ *then*

$$\frac{\pi\theta\left[u'(Y_m - s^P) - v'\left(Q(s^P,T)\right)Q'(s^P,T)\right]}{u'\left(Y_f + T + s^P - Q(s^P,T)\right)} > \frac{[\pi(1-\theta) + \theta(1-\pi)]\left[v\left(Q(s^P,0)\right)Q'(s^P,0) - u(Y_m - s^P)\right]}{v'\left(Q(s^P,0)\right)Q'(s^P,0) + \left(1 - Q'(s^P,0)\right)u'\left(Y_f + T + s^P - Q(s^P,0)\right)}$$

From the husband's FOC under perfect information we know that $\underline{s} > \underline{s}^{FB}$ *iff* $v'\left(Q(\underline{s},T)\right)Q'(\underline{s},T) < u'(Y_m - \underline{s})$ *and* $\bar{s}^{FB} > \bar{s}$ *iff* $v(Q(\bar{s},0))Q'(\bar{s},0) < u(Y_m - \bar{s})$ *such that:*

$$v'\left(Q(s^P,T)\right)Q'(s^P,T) < u'(Y_m - s^P) < v\left(Q(s^P,0)\right)Q'(s^P,0)$$

And $u'\left(Y_f + T + s^P - Q(s^P,T)\right) < v'(Q(s^P,0))Q'(s^P,0) + (1 - Q'(s^P,0))u'\left(Y_f + T + s^P - Q(s^P,0)\right)$ *since:*

$$v'\left(Q\left(s^P,T\right)\right) < u'\left(Y_f + T + s^P - Q\left(s^P,T\right)\right) < u'\left(Y_f + T + \underline{s}^{FB} - Q\left(\underline{s}^{FB},T\right)\right) =$$

$$v'\left(Q\left(\underline{s}^{FB},T\right)\right) \leq v'\left(Q\left(\overline{s}^{FB},0\right)\right) = u'\left(Y_f + \overline{s}^{FB} - Q\left(\overline{s}^{FB},0\right)\right) \leq u'\left(Y_f + S^P - Q\left(S^P,0\right)\right) <$$

$$v'\left(Q\left(S^P,0\right)\right) < u'\left(Y_f + T + \overline{s}^{FB} - Q\left(\overline{s}^{FB},0\right)\right)$$

$\lambda_1 \neq 0$ *iff*

$$v\left(Q\left(\underline{s},T\right)\right) + u\left(Y_f + T + \underline{s} - Q\left(\underline{s},T\right)\right) = v\left(Q\left(\bar{s},0\right)\right) + u\left(Y_f + T + \bar{s} - Q\left(\bar{s},0\right)\right)$$

If $0 < T \leq \left(\overline{s}^{FB} - \underline{s}^{FB}\right)$ *and* $T \leq s^P = \overline{s} = \underline{s}$

$v\left(Q\left(s^P,T\right)\right) > v\left(Q\left(s^P,0\right)\right)$ *and* $u\left(Y_f + T + s^P - Q\left(s^P,T\right)\right) < u\left(Y_f + T + s^P - Q\left(s^P,0\right)\right)$

Such that there exists a $T \leq s^P \in \left(\underline{s}^{FB},\overline{s}^{FB}\right)$ *where*

$$v\left(Q\left(s^P,T\right)\right) + u\left(Y_f + T + s^P - Q\left(s^P,T\right)\right) = v\left(Q\left(s^P,0\right)\right) + u\left(Y_f + T + S^P - Q\left(S^P,0\right)\right)$$

■

APPENDIX B: Supplementary Tables and Robustness Checks

B.1. Robustness, Testing for Pooling vs. Separating Equilibrium

Lottery Outcome	Restricted Sample (>0)				Including Controls [a/]				Including Polygamous Households			
	Small Prize (< GH¢20)		Large Prize (> GH¢20)		Small Prize (< GH¢20)		Large Prize (> GH¢20)		Small Prize (< GH¢20)		Large Prize (> GH¢20)	
	Inverse Hyperbolic	Linear	Inverse Hyperbolic	Linear	Inverse Hyperbolic	Linear	Inverse Hyperbolic	Linear	Inverse Hyperbolic	Linear	Inverse Hyperbolic	Linear
Large Prize	-	-	-0.126	-2.346*	-	-	-0.675**	-4.729***	-	-	-0.581**	-4.033**
(=1 if Prize > GH¢20)			(0.087)	(1.352)			(0.235)	(1.327)			(0.273)	(1.445)
Wife												
Public Cash Prize	0.005	0.093	-0.005	-0.079	0.073*	0.382*	-0.067	-0.345	0.088*	0.388**	-0.085*	-0.450*
	(0.010)	(0.256)	(0.010)	(0.258)	(0.040)	(0.226)	(0.041)	(0.230)	(0.046)	(0.185)	(0.047)	(0.244)
Private Cash Prize	0.007	0.099	-0.003	-0.012	0.018	0.119	-0.012	-0.054	0.034	0.336	-0.018	-0.076
	(0.004)	(0.107)	(0.004)	(0.108)	(0.036)	(0.202)	(0.036)	(0.205)	(0.043)	(0.238)	(0.044)	(0.226)
Livestock	0.007*	0.112	-0.007*	-0.103	0.031	0.184	-0.019	-0.121	0.039*	1.064***	-0.021	-0.150
	(0.003)	(0.075)	(0.004)	(0.080)	(0.022)	(0.126)	(0.023)	(0.131)	(0.023)	(0.102)	(0.024)	(0.123)
Public Cash Prize (Lag)	0.002	0.041	N/A	N/A	0.007	0.053	N/A	N/A	0.008	0.898*	N/A	N/A
	(0.001)	(0.032)			(0.007)	(0.039)			(0.007)	(0.481)		
Private Cash Prize (Lag)	0.005	0.059	-0.001	-0.004	0.027	0.156	-0.012	-0.075	0.048	0.453	-0.036	-0.159
	(0.003)	(0.061)	(0.003)	(0.060)	(0.047)	(0.266)	(0.048)	(0.269)	(0.057)	(0.311)	(0.057)	(0.297)
Livestock (Lag)	0.009**	0.348***	-0.006	-0.308**	0.032*	0.439***	-0.014	-0.331***	0.038**	0.451**	-0.029	-0.366***
	(0.002)	(0.107)	(0.003)	(0.110)	(0.016)	(0.093)	(0.017)	(0.098)	(0.018)	(0.155)	(0.019)	(0.099)
Public = Private	0.03	0.00	0.05	0.06	0.01	0 .00	0.07	0.06	0.72	0.81	1.07	1.26
Public = Private = No Prize	1.43	0.49	1.01	1.47	5.75*	2.61	6.49**	4.39	4.22	4.52	4.76*	7.87
Public = Private (Lag)	0.64	0.07	0.32	0.01	0.54	0.85	0.64	1.04	0.47	0.34	0.39	0.29
Public = Private = No Prize (Lag)	1.85	1.15	1.35	1.54	5.22*	4.65*	6.26**	4.60	1.97	3.01	5.10*	8.23***
Husband												
Public Cash Prize	0.008**	0.178**	-0.008**	-0.171**	0.030	0.225*	-0.027	-0.202	0.042	0.316**	-0.029	-0.227
	(0.003)	(0.080)	(0.004)	(0.086)	(0.022)	(0.125)	(0.023)	(0.133)	(0.026)	(0.148)	(0.028)	(0.156)
Private Cash Prize	0.005	0.198	-0.002	-0.128	0.035	0.413***	-0.034	-0.367**	0.049*	0.118	-0.045	-0.067
	(0.005)	(0.196)	(0.005)	(0.201)	(0.023)	(0.129)	(0.024)	(0.136)	(0.026)	(0.150)	(0.028)	(0.160)
Livestock	0.018***	0.378**	-0.017**	-0.332**	0.045	0.385**	-0.039	-0.320*	0.058	0.654***	-0.050	-0.577***
	(0.005)	(0.151)	(0.005)	(0.158)	(0.031)	(0.173)	(0.031)	(0.176)	(0.036)	(0.143)	(0.037)	(0.148)
Public Cash Prize (Lag)	0.006	0.099	-0.001	-0.035	0.009	0.015	0.002	0.069	0.050	0.371	-0.034	-0.333
	(0.004)	(0.105)	(0.005)	(0.110)	(0.039)	(0.219)	(0.040)	(0.226)	(0.047)	(0.256)	(0.048)	(0.264)
Private Cash Prize (Lag)	-0.002	-0.031	0.007*	0.137	0.010	0.188	-0.010	-0.128	0.031	-0.088	-0.030	0.057
	(0.003)	(0.098)	(0.004)	(0.111)	(0.026)	(0.150)	(0.028)	(0.158)	(0.030)	(0.198)	(0.032)	(0.208)
Livestock (Lag)	0.017**	0.316**	-0.015**	-0.279*	0.050*	0.341**	-0.038	-0.265	0.079**	0.591**	-0.065*	-0.515**
	(0.006)	(0.154)	(0.006)	(0.154)	(0.029)	(0.164)	(0.030)	(0.168)	(0.034)	(0.188)	(0.035)	(0.192)
Public = Private	0.25	0.01	0.8	0.04	0.81	0.28	0.66	0.24	0.04	0.34	0.16	0.33
Public = Private = No Prize	3.88**	2.85*	1.56	1.25	4.9*	2.71	7.61**	4.82*	5.83*	12.60***	3.90	6.61**
Public = Private (Lag)	2.08	0.79	1.77	1.16	0.60	0.50	0.25	0.24	0.12	0.05	0.01	0.01
Public = Private = No Prize (Lag)	1.05	0.48	2.60*	2.22	0.61	0.59	7.80**	4.85*	2.24	2.36	3.90	7.00**
Unsensored					880	880			907	907		
N	880	880	-	-	1027	1027	-	-	1088	1088	-	-

Note: Results estimated using a RE Tobit Model, include controls for initial assets, village and round fixed effects. Standard errors in parentheses.

Ln (Expenditure) is computed using the Inverse Hyperbolic Sine Transformation.

a/ Controls include marital relationship variables, age, No. cildren and household members, number of plots, area and math-scores.

*** p-value<0.001, ** p-value<0.05, * p-value<0.10

B.2. Treatment Effects of Asymmetric Information on Spousal Expenditure (Linear Specification)

	Household Public Goods						Private Observable Expenditure						Private Concealable Expenditure					
	Husband's Report			Wife's Report			Husband			Wife			Husband			Wife		
	Assets	Food	Health	Assets	Food	Health	Adult Clothing	Ceremony	Personal Care	Adult Clothing	Ceremony	Personal Care	Cash Gifts	Inkind Gifts	Loans	Cash Gifts	Inkind Gifts	Loans
Husband																		
Public Cash	0.560**	-0.323	0.243	0.555**	-0.137	0.222	0.363**	0.785***	-0.009	0.016	-0.090	0.020	-0.142	-0.290	-0.229	-0.109	-0.058	0.436
Prize	(0.223)	(0.354)	(0.181)	(0.237)	(0.378)	(0.193)	(0.116)	(0.207)	(0.014)	(0.089)	(0.067)	(0.023)	(0.301)	(0.185)	(2.421)	(0.237)	(0.083)	(0.477)
Public Cash	-0.310	-0.026	0.171	-0.545	0.193	0.071	0.093	0.067	0.012	0.156*	-0.046	0.027	0.049	0.153**	-4.258	0.128	-0.029	0.522
Prize	(0.284)	(0.367)	(0.186)	(0.345)	(0.380)	(0.198)	(0.138)	(0.220)	(0.014)	(0.085)	(0.065)	(0.023)	(0.276)	(0.067)	(4.249)	(0.196)	(0.092)	(0.489)
Livestock	-0.137	0.004	-0.127	-0.065	0.232	-0.060	0.085	-0.009	-0.018*	0.022	-0.009	-0.008	-0.066	0.117**	0.085	-0.051	-0.192**	-0.237
	(0.190)	(0.256)	(0.136)	(0.176)	(0.235)	(0.125)	(0.094)	(0.158)	(0.010)	(0.055)	(0.040)	(0.014)	(0.195)	(0.048)	(1.159)	(0.132)	(0.072)	(0.384)
Public Cash	0.304	-0.179	0.111	0.350	0.002	0.100	0.063	0.012	-0.013	0.036	-0.032	-0.027	-0.400	-0.078	-2.128	0.170	-0.029	-2.025
Prize (Lag)	(0.304)	(0.458)	(0.245)	(0.313)	(0.473)	(0.247)	(0.180)	(0.312)	(0.018)	(0.115)	(0.082)	(0.030)	(0.501)	(0.136)	(4.779)	(0.236)	(0.112)	(2.272)
Private Cash	0.044	0.159	-0.034	0.047	0.046	0.031	-0.384	-0.083	-0.009	0.065	-0.091	0.013	-0.016	-0.005	1.571	-0.361	-0.227a/	0.326
Prize (Lag)	(0.296)	(0.450)	(0.234)	(0.327)	(0.482)	(0.250)	(0.275)	(0.280)	(0.017)	(0.117)	(0.087)	(0.029)	(0.376)	(0.104)	(2.055)	(0.389)	(0.181)	(0.725)
Livestock	0.064	-0.123	-0.022	0.214	0.055	0.093	0.013	-0.007	-0.010	0.031	-0.007	-0.005	-0.028	-0.021	1.389	0.039	-0.079	0.285
(Lag)	(0.203)	(0.304)	(0.155)	(0.181)	(0.279)	(0.144)	(0.123)	(0.190)	(0.012)	(0.068)	(0.047)	(0.017)	(0.237)	(0.069)	(1.288)	(0.149)	(0.076)	(0.365)
Wife																		
Public Cash	-0.106	0.445	-0.039	-0.038	0.447	-0.008	-0.041	0.317*	0.004	-0.137	0.049	0.036*	-0.127	-0.042	2.145*	-0.018	0.078	0.687**
Prize	(0.253)	(0.322)	(0.163)	(0.250)	(0.319)	(0.164)	(0.131)	(0.191)	(0.012)	(0.097)	(0.049)	(0.019)	(0.219)	(0.068)	(1.232)	(0.149)	(0.060)	(0.343)
Public Cash	-0.012	0.215	-0.104	0.052	0.155	0.025	0.238*	-0.233	-0.009	0.018	-0.044	0.019	0.017	0.012	-1.162	0.232 a/	0.037	0.373
Prize	(0.258)	(0.383)	(0.198)	(0.253)	(0.366)	(0.190)	(0.136)	(0.247)	(0.015)	(0.089)	(0.060)	(0.022)	(0.274)	(0.075)	(2.292)	(0.152)	(0.075)	(0.476)
Livestock	-0.087	0.013	-0.060	-0.180	-0.039	-0.108	-0.048	0.061	-0.011	0.078	0.032	-0.010	-0.070	0.062	0.780	-0.205	0.096**	0.217
	(0.178)	(0.250)	(0.127)	(0.181)	(0.240)	(0.125)	(0.098)	(0.150)	(0.009)	(0.055)	(0.037)	(0.014)	(0.187)	(0.048)	(0.923)	(0.141)	(0.048)	(0.347)
Public Cash	-0.068	0.135	-0.003	-0.065	0.161	-0.023	0.064	0.266	-0.002	0.062	0.125**	0.052**	-0.112	-0.017	1.056	0.392**	0.118*	-0.174
Prize (Lag)	(0.241)	(0.329)	(0.168)	(0.242)	(0.326)	(0.169)	(0.122)	(0.202)	(0.013)	(0.077)	(0.051)	(0.019)	(0.239)	(0.074)	(1.574)	(0.136)	(0.064)	(0.502)
Private Cash	0.015	-0.052	0.103	0.182	-0.057	0.308	-0.559	-0.167	-0.004	0.047	-0.052	-0.013	0.046	0.020	-3.545	0.056	-0.281	0.541
Prize (Lag)	(0.283)	(0.428)	(0.217)	(0.270)	(0.410)	(0.211)	(0.455)	(0.265)	(0.016)	(0.103)	(0.068)	(0.024)	(0.310)	(0.090)	(4.555)	(0.215)	(0.185)	(0.478)
Livestock	0.293*	-0.238	-0.122	0.277	-0.347	-0.130	0.018	-0.022	-0.015	0.053	0.003	-0.010	-0.192	0.052	-0.099	0.062	-0.046	-0.075
(Lag)	(0.168)	(0.267)	(0.138)	(0.169)	(0.263)	(0.138)	(0.098)	(0.160)	(0.010)	(0.060)	(0.041)	(0.016)	(0.216)	(0.054)	(1.069)	(0.129)	(0.063)	(0.422)
Unsensored	341	1026	825	342	1069	854	197	576	839	291	479	1009	335	270	97	182	292	116
N	1048	1048	1048	1070	1070	1070	1027	1027	1027	1070	1070	1070	1048	1048	1048	1100	1100	1100

Note: Results estimated using a RE Tobit Model, include controls for initial assets, village and round fixed effects. Standard errors in parentheses.

Ln (Expenditure) is computed using the Inverse Hyperbolic Sine Transformation.

*** p-value<0.001, ** p-value<0.05, * p-value<0.10

B.3. Testing for Limited Insurance within the Household

	Fixed Effects						Tobit					
	Husband			Wife			Husband			Wife		
	Total (w/food)	Total (w/o food)	Private	Total (w/food)	Total (w/o food)	Private	Total (w/food)	Total (w/o food)	Private	Total (w/food)	Total (w/o food)	Private
Husband												
Public Cash Prize	0.838*	0.789*	0.816*	-0.204	0.280	0.040	0.789	0.805	0.845**	-0.037	0.252	-0.000
	(0.482)	(0.470)	(0.455)	(0.374)	(0.215)	(0.085)	(0.511)	(0.496)	(0.346)	(0.329)	(0.197)	(0.144)
Livestock	-0.164	-0.204	-0.011	0.222	-0.020	0.044	-0.218	-0.250	-0.088	0.026	-0.082	-0.002
	(0.327)	(0.316)	(0.129)	(0.217)	(0.082)	(0.064)	(0.370)	(0.360)	(0.251)	(0.206)	(0.123)	(0.089)
Public Cash Prize (lag)	-0.048	-0.033	0.258	-0.154	0.152	0.165	-0.071	-0.012	0.100	-0.056	0.096	0.058
	(0.326)	(0.326)	(0.211)	(0.500)	(0.151)	(0.191)	(0.660)	(0.641)	(0.460)	(0.415)	(0.246)	(0.184)
Livestock (lag)	0.222	0.223	0.045	0.082	0.009	0.046	0.096	0.146	-0.019	-0.106	-0.044	0.008
	(0.400)	(0.401)	(0.116)	(0.147)	(0.092)	(0.056)	(0.438)	(0.426)	(0.296)	(0.245)	(0.145)	(0.106)
Wife												
Public Cash Prize	-0.033	0.006	-0.056	0.586**	0.446*	0.196	-0.150	-0.091	-0.025	0.568**	0.409**	0.191
	(0.660)	(0.658)	(0.349)	(0.277)	(0.228)	(0.130)	(0.469)	(0.456)	(0.318)	(0.277)	(0.164)	(0.119)
Livestock	-0.475	-0.432	-0.070	-0.037	0.022	0.073	-0.290	-0.211	0.000	0.026	0.062	0.066
	(0.326)	(0.283)	(0.115)	(0.161)	(0.083)	(0.050)	(0.359)	(0.349)	(0.243)	(0.208)	(0.123)	(0.090)
Public Cash Prize (lag)	0.087	0.010	0.221	0.467**	0.422**	0.193*	-0.034	-0.089	0.186	0.447	0.381**	0.188
	(0.363)	(0.361)	(0.183)	(0.223)	(0.173)	(0.109)	(0.478)	(0.465)	(0.328)	(0.282)	(0.167)	(0.122)
Livestock (lag)	-0.689*	-0.672*	-0.218**	-0.291	-0.149	0.006	-0.557	-0.516	-0.216	-0.233	-0.109	-0.008
	(0.405)	(0.387)	(0.109)	(0.270)	(0.199)	(0.104)	(0.387)	(0.377)	(0.263)	(0.229)	(0.135)	(0.099)
Private Prizes (controls)												
Husband Cash Private	0.079	0.056	0.001	0.084	0.133	0.073	0.039	-0.009	0.063	0.044	0.117	0.059
	(0.439)	(0.350)	(0.238)	(0.259)	(0.090)	(0.072)	(0.527)	(0.512)	(0.356)	(0.330)	(0.196)	(0.142)
Husband Cash Private Lagged	-0.422	-0.237	-0.215	0.042	0.132	0.207	-0.440	-0.315	-0.126	0.039	0.122	0.199
	(0.320)	(0.292)	(0.161)	(0.253)	(0.147)	(0.161)	(0.646)	(0.628)	(0.437)	(0.419)	(0.248)	(0.181)
Wife Cash Private	0.788	0.729	0.097	0.461	0.395***	0.254**	0.638	0.627	-0.021	0.385	0.282	0.182
	(0.545)	(0.547)	(0.150)	(0.362)	(0.103)	(0.100)	(0.549)	(0.534)	(0.372)	(0.317)	(0.188)	(0.137)
Wife Cash Private Lagged	0.214	0.229	-0.137	0.321	0.136	0.103	-0.049	0.021	-0.202	0.152	-0.012	-0.004
	(0.333)	(0.336)	(0.178)	(0.333)	(0.087)	(0.067)	(0.614)	(0.597)	(0.415)	(0.356)	(0.211)	(0.154)
Unsensored	-	-	-	-	-	-	986	986	976	1035	1031	1024
N	1027	1027	1027	1070	1070	1070	1027	1027	1027	1070	1070	1070

Note: RE Tobit results include controls for initial assets, village and round fixed effects. Standard errors in parentheses.
Dependent Variable: Expenditure.
*** p-value<0.001, ** p-value<0.05, * p-value<0.10

B.4. Treatment Effects of Asymmetric Information on Spousal Expenditure (Controls Included)

	Husband			Wife			Husband			Wife			Husband		Wife	
	Assets	Food	Health	Assets	Food	Health	Adult Clothing	Ceremony	Personal Care	Adult Clothing	Ceremony	Personal Care	Cash Gifts	Inkind Gifts	Cash Gifts	Inkind Gifts
Husband																
Public Cash Prize	0.059**	-0.004	0.025**	0.047*	-0.002	0.029**	0.061**	0.030**	-0.004	-0.011	-0.013	-0.036**	0.007	-0.070	-0.049	-0.051*
	(0.022)	(0.003)	(0.010)	(0.026)	(0.003)	(0.012)	(0.028)	(0.012)	(0.005)	(0.026)	(0.010)	(0.017)	(0.029)	(0.050)	(0.053)	(0.029)
Public Cash Prize	-0.039	0.000	0.009	-0.069**	0.002	0.000	0.021	0.014	0.003	0.045**	-0.014	-0.017	-0.008	0.047**	0.025	-0.004
	(0.027)	(0.003)	(0.010)	(0.033)	(0.003)	(0.011)	(0.030)	(0.012)	(0.005)	(0.021)	(0.009)	(0.014)	(0.027)	(0.019)	(0.034)	(0.024)
Livestock	-0.008	0.002	-0.013*	-0.012	0.002	-0.012	0.019	0.001	-0.010**	0.002	-0.006	0.002	-0.000	0.036**	-0.021	-0.039**
	(0.018)	(0.002)	(0.008)	(0.018)	(0.002)	(0.007)	(0.022)	(0.009)	(0.004)	(0.015)	(0.005)	(0.009)	(0.019)	(0.014)	(0.025)	(0.019)
Public Cash Prize (Lag)	0.048*	-0.003	0.011	0.054*	-0.001	0.018	0.012	0.001	-0.003	-0.003	-0.015	-0.006	-0.028	-0.010	0.029	-0.005
	(0.029)	(0.003)	(0.014)	(0.031)	(0.004)	(0.014)	(0.044)	(0.017)	(0.007)	(0.031)	(0.011)	(0.018)	(0.048)	(0.037)	(0.042)	(0.030)
Private Cash Prize (Lag)	-0.006	0.000	-0.001	-0.000	-0.000	0.007	-0.113*	-0.009	-0.002	0.012	0.003	-0.025	0.000	-0.003	-0.074	-0.058
	(0.029)	(0.003)	(0.013)	(0.032)	(0.004)	(0.014)	(0.065)	(0.016)	(0.007)	(0.030)	(0.011)	(0.019)	(0.035)	(0.030)	(0.070)	(0.047)
Livestock (Lag)	0.011	-0.003	-0.002	0.030	-0.004*	0.003	-0.000	-0.006	-0.003	0.002	-0.012*	-0.003	0.006	-0.009	-0.003	-0.016
	(0.020)	(0.002)	(0.009)	(0.018)	(0.002)	(0.008)	(0.028)	(0.010)	(0.004)	(0.018)	(0.006)	(0.010)	(0.022)	(0.020)	(0.029)	(0.020)
Wife																
Public Cash Prize	-0.048*	-0.005*	-0.009	-0.034	-0.005**	-0.002	-0.033	0.016	0.003	-0.054**	0.011	0.016	-0.014	-0.017	-0.016	0.028*
	(0.026)	(0.002)	(0.010)	(0.026)	(0.002)	(0.009)	(0.032)	(0.011)	(0.005)	(0.027)	(0.007)	(0.011)	(0.022)	(0.020)	(0.029)	(0.016)
Public Cash Prize	-0.005	-0.001	-0.007	0.012	-0.001	0.003	0.061*	-0.026*	-0.002	0.003	-0.001	-0.010	0.006	0.010	0.056**	0.001
	(0.024)	(0.003)	(0.011)	(0.024)	(0.003)	(0.010)	(0.031)	(0.014)	(0.006)	(0.022)	(0.008)	(0.013)	(0.026)	(0.021)	(0.026)	(0.019)
Livestock	-0.013	0.001	-0.000	-0.018	0.001	-0.003	-0.013	-0.004	-0.005	0.015	-0.000	0.008	-0.015	-0.001	-0.023	0.014
	(0.017)	(0.002)	(0.007)	(0.017)	(0.002)	(0.007)	(0.023)	(0.009)	(0.004)	(0.014)	(0.005)	(0.008)	(0.018)	(0.015)	(0.023)	(0.013)
Public Cash Prize (Lag)	-0.012	-0.002	-0.005	-0.021	-0.003	-0.003	0.020	0.020*	-0.001	-0.008	0.011	0.009	-0.006	-0.010	0.072**	0.028
	(0.023)	(0.002)	(0.010)	(0.025)	(0.002)	(0.010)	(0.028)	(0.012)	(0.005)	(0.021)	(0.007)	(0.012)	(0.023)	(0.021)	(0.024)	(0.017)
Private Cash Prize (Lag)	-0.001	-0.001	0.005	0.027	-0.001	0.005	-0.107	-0.016	0.001	0.016	0.002	-0.010	0.011	0.010	0.025	-0.078*
	(0.027)	(0.003)	(0.012)	(0.026)	(0.003)	(0.012)	(0.089)	(0.015)	(0.006)	(0.025)	(0.009)	(0.014)	(0.029)	(0.025)	(0.036)	(0.045)
Livestock (Lag)	0.032*	0.000	-0.011	0.028*	0.001	-0.006	0.014	0.004	-0.003	0.018	-0.002	0.011	-0.005	0.024	0.028	-0.006
	(0.016)	(0.002)	(0.008)	(0.016)	(0.002)	(0.008)	(0.022)	(0.009)	(0.004)	(0.015)	(0.006)	(0.009)	(0.020)	(0.016)	(0.022)	(0.016)
Uncensored	341	1026	825	342	1069	854	197	576	839	291	479	1009	335	270	292	116
N	1048	1048	1048	1070	1070	1070	1027	1027	1027	1070	1070	1070	1027	1027	1070	1070

B.4. Treatment Effects of Asymmetric Information on Spousal Expenditure (continued, controls)

	Husband			Wife			Husband			Wife			Husband		Wife	
	Assets	Food	Health	Assets	Food	Health	Adult Clothing	Ceremony	Personal Care	Adult Clothing	Ceremony	Personal Care	Cash Gifts	Inkind Gifts	Cash Gifts	Inkind Gifts
Ln (Initial Illiquid Assets)	-1.084**	0.040	-0.003	-1.034**	-0.017	-0.028	-0.584	-0.023	0.109	-0.853**	0.110	-0.161	0.029	0.056	0.496	0.040
	(0.387)	(0.050)	(0.133)	(0.383)	(0.050)	(0.133)	(0.396)	(0.176)	(0.081)	(0.289)	(0.109)	(0.175)	(0.344)	(0.288)	(0.402)	(0.262)
Ln (Initial Liquid Assets)	-0.487*	-0.089**	-0.090	-0.634**	-0.076**	-0.100	0.362	0.016	-0.032	0.043	0.081	-0.189	0.793**	-0.080	0.406	0.183
	(0.260)	(0.034)	(0.091)	(0.255)	(0.033)	(0.087)	(0.277)	(0.123)	(0.055)	(0.190)	(0.072)	(0.119)	(0.252)	(0.194)	(0.279)	(0.180)
Ln (Total Expenditure)	3.288***	1.746***	2.021***	3.115***	1.700***	2.027***	2.516***	2.210***	0.578***	2.404***	0.847***	1.489***	0.656	0.373	0.743	0.628*
	(0.507)	(0.060)	(0.198)	(0.506)	(0.057)	(0.189)	(0.623)	(0.250)	(0.108)	(0.430)	(0.148)	(0.242)	(0.486)	(0.411)	(0.581)	(0.376)
Get Along	3.414**	-0.209	-0.154	0.610	0.100	-0.106	3.527**	0.796	-0.291	1.495**	-0.242	-0.219	0.001	0.220	0.974	-0.191
(=1 if Spouses get along)	(1.379)	(0.175)	(0.461)	(0.964)	(0.128)	(0.332)	(1.600)	(0.625)	(0.279)	(0.744)	(0.274)	(0.437)	(1.237)	(0.994)	(1.064)	(0.654)
Trust (=1 if trusts spouse completely or mostly)	-20.01	0.088	-0.365	1.330	-0.106	0.235	3.846	1.489	-0.451	-0.113	0.103	-0.245	-1.905	-2.077	-0.318	1.657**
	(480.2)	(0.431)	(1.117)	(1.177)	(0.159)	(0.413)	(3.036)	(1.438)	(0.674)	(0.887)	(0.346)	(0.543)	(2.931)	(2.269)	(1.296)	(0.842)
Fair Treatment	17.87	0.100	0.336	0.588	-0.104	-0.488	-6.230*	-2.523*	0.248	-1.077	-0.055	0.450	2.077	0.712	-1.928	-1.235
(=1 if treated fairly)	(480.2)	(0.453)	(1.179)	(1.157)	(0.157)	(0.405)	(3.329)	(1.525)	(0.712)	(0.868)	(0.339)	(0.531)	(3.096)	(2.409)	(1.225)	(0.808)
Age	-0.005	-0.005	0.001	-0.029	-0.003	0.002	-0.064**	0.047***	-0.012**	-0.035*	-0.003	0.040***	-0.109***	-0.029	-0.035	-0.018
	(0.026)	(0.003)	(0.009)	(0.026)	(0.003)	(0.008)	(0.027)	(0.012)	(0.005)	(0.019)	(0.006)	(0.011)	(0.025)	(0.019)	(0.025)	(0.017)
No. Children	0.314	-0.014	0.184	0.358	-0.005	0.132	0.631*	0.036	0.070	-0.087	-0.222**	-0.146	-0.099	0.161	-0.461	-0.570**
	(0.340)	(0.043)	(0.114)	(0.330)	(0.040)	(0.105)	(0.359)	(0.151)	(0.068)	(0.238)	(0.087)	(0.140)	(0.303)	(0.241)	(0.324)	(0.212)
Household Size	-0.192	0.021	-0.233**	-0.263	0.011	-0.194**	-0.615**	-0.039	-0.079	0.039	0.042	0.144	-0.064	-0.073	0.118	0.602***
	(0.238)	(0.030)	(0.080)	(0.230)	(0.027)	(0.073)	(0.261)	(0.106)	(0.048)	(0.167)	(0.060)	(0.095)	(0.217)	(0.174)	(0.218)	(0.147)
Math-score	0.041	0.001	-0.107**	0.168	-0.015	-0.027	-0.179	-0.007	0.034	0.076	0.053*	0.058	0.061	0.100	0.064	-0.031
(= # correct responses, 0 - 10)	(0.128)	(0.016)	(0.043)	(0.111)	(0.014)	(0.036)	(0.129)	(0.058)	(0.026)	(0.082)	(0.030)	(0.049)	(0.121)	(0.096)	(0.113)	(0.071)
Area	0.000	-0.000***	-0.000	0.000	-0.000*	-0.000	0.000	0.000	-0.000*	-0.000	-0.000	0.000	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
No. of Plots	-0.879**	-0.055	0.024	0.791	-0.029	-0.025	-0.546	-0.373**	0.048	0.076	0.324**	0.399*	0.842**	0.857***	0.659	0.250
	(0.375)	(0.047)	(0.125)	(0.541)	(0.072)	(0.188)	(0.381)	(0.167)	(0.075)	(0.420)	(0.157)	(0.238)	(0.319)	(0.258)	(0.555)	(0.364)
Uncensored	341	1026	825	342	1069	854	197	576	839	291	479	1009	335	270	292	116
N	1048	1048	1048	1070	1070	1070	1027	1027	1027	1070	1070	1070	1027	1027	1070	1070