Disparities in Spousal Income and Inefficient Household Behavior

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Abstract

This paper argues that disparities in spousal income lead to inefficient behavior. I consider a non-cooperative model of the household characterized by limited commitment in which couples use the threat of future punishment to enforce a spending rule. Income is stochastic and an efficient spending rule provides full mutual insurance against idiosyncratic income risk. However, each period individuals have the option to deviate from the spending rule and keep their income for themselves. The spending rule is feasible only when the future expected costs from deviating exceed the current gains. The gains from deviating are increasing in current income. The costs of deviating are declining in expected income, since own income limits the severity of punishment. Thus, the gains of deviating are most likely to exceed the costs in periods in which there are large disparities between the current income of the spouses and for households in which there are large disparities between the expected income of spouses. In such cases the household allocates more resources to the spouse with relatively higher income, which represents a violation of full insurance. I find empirical support for the key predictions of the model by revisiting a field experiment conducted by Robinson (2012).

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1 Introduction

While household members often act together as a unit and achieve efficient outcomes, there are clearly instances in any family in which conflict breaks out and cooperation breaks down.[1] Understanding when and why this occurs is important for at least two reasons. First, inefficient behavior can have substantial welfare consequences–particularly for poor households who have little margin for error when deciding how to allocate limited resources–and knowledge of the source of conflict might highlight ways to prevent it. Second, the collective model, developed by Chiaporri (1988 and 1992), is the standard model of the household in economics and is built on the assumption that households achieve efficient outcomes.[2] Accounting for systematic violations of this assumption will lead to more realistic models of behavior. This paper studies how disparities between the income of spouses affects the ability of the couple to achieve efficient outcomes.

It is widely believed that the relative income of spouses plays an important role in shaping household behavior. Indeed, this view has influenced policy in important ways. For example, cash transfer programs often target women within the household with the explicit goal of empowering these individuals.[3] In most economic models relative income affects the intra-household allocation of resources through its effect on some notion of bargaining power. Intuitively, the spouse with greater income is able to negotiate greater control over how resources are spent. In this paper, I focus on an alternative, though not mutually exclusive, channel: relative income shapes the set of feasible allocations that can be agreed upon, where a more unequal intra-household distribution of income restricts the options of the household and leads to inefficient outcomes.

My theoretical analysis considers a non-cooperative model of the household characterized by limited commitment. The model is stylized but is similar to standard models

[1] I use the term "efficiency" to refer to the concept of a Pareto efficient equilibrium, which is an equilibrium for which there does not exist an alternative equilibrium that makes all parties better off.

[2] A number of papers have developed and implemented empirical tests the assumption that households achieve efficient outcomes (e.g., Bourguignon et al. 1993; Browning et al. 1994; Chiappori et al. 2002; Rangel and Thomas 2005; Bobonois 2009; Cherchye et al. 2009; Attanasio and Lechene 2014). This body of evidence suggests that efficiency appears to be a reasonable assumption in many contexts and provides empirical support for using the collective model as the baseline model of the household.

[3] Fizbein and Schady (2009) review 40 conditional cash transfer programs implemented in developing countries and find that 53% of the programs target a female as the primary recipient of the transfer.

of risk-sharing with limited commitment (e.g., Coate and Ravallion 1993; Kocherlakota 1996; Kimbal 1988; Ligon et al. 2002; Mazzocco 2007). Spouses interact in an infinitely repeated game and use the threat of future punishment to enforce a spending rule. Income is stochastic and an efficient spending rule provides full mutual insurance against idiosyncratic income risk. However, in each period, individuals have the option to deviate from the spending rule and keep their income for themselves. To be feasible, the spending rule must be incentive compatible, which requires that the future expected costs from deviating exceed the current gains in every period. My analysis focuses on understanding how disparities in spousal income affect the gains and costs from deviating, which in turn shape the optimal spending rule.

There are two key predictions of the model. First, couples are more likely to deviate from the full insurance equilibrium in periods in which there are large disparities in the realized income of spouses. An individual's gains from deviating are increasing in own income. In extreme cases, the gains from deviating from the full insurance allocation exceed the expected costs and the couple allocates more resources to the spouse with higher income. In such cases, expenditures depend on realized income and this represents a violation of full insurance. Second, couples are more likely to deviate from the full insurance equilibrium if there is a large disparity between the expected income of spouses. Because individuals have the option to retain control over their own income, they cannot be severely punished in periods in which they have a high realization of income. Thus, the future expected costs of deviating are declining in expected income. The larger the difference in expected income, the more difficult it is for the household to incentivize the higher-income spouse to adhere to the full insurance allocation.

The stylized model illustrates that disparities in either the realized or expected income of spouses generates inefficiencies by leading to violations of full insurance. The first prediction, which relates violations of full insurance to disparities in realized income, is standard to models of limited commitment and has been highlighted by existing theoretical work. The second prediction, which relates violations of full insurance to disparities in expected income, has not been previously discussed in the literature.

I test the two predictions of the model using data from a field experiment implemented by Robinson (2012). In the experiment, husbands and wives in Kenya are randomly allocated unconditional cash transfers over an eight-week period. If spouses fully insure each other against idiosyncratic income risk, then how the money is spent should not depend on which spouse receives the transfer. Robinson (2012) finds that transfers made to husbands lead to different spending patterns relative to transfers made to wives and rejects a model of full insurance. My theoretical analysis highlights two predictions of the limited commitment model that are not explored in Robinson (2012) and I test them empirically using data from the experiment. First, I exploit variation within households and find that the violation of mutual insurance is driven by periods in which there are larger disparities in the realized income of the husband and wife. Second, I exploit variation across households and find that the violation of mutual insurance is driven by households with greater disparities in the expected income of the husband and wife.

My paper makes two contributions to the literature on household behavior. First, I use a model of limited commitment to illustrate why disparities in the expected incomes of spouses can lead to inefficient behavior. Previous work suggests that households exhibit inefficient behavior when: current decisions influence future bargaining power (Konrad and Lommerud 2000; Lundberg and Pollak 2003; Basu 2006), social norms and customs constrain behavior (Udry 1996), spouses have different discount factors (Schaner 2015), and when information asymmetries (Ashraf 2009; Ashraf, Field and Lee 2014; Castilla and Walker 2013) or domestic violence (Ramos 2016; Lewbel and Pendakur 2019) are features of the household environment. My paper illustrates that disparities in spousal income can also lead to inefficient outcomes by limiting the extent to which couples mutually insure each other against income risk. While existing theoretical work on risk-sharing under limited commitment finds that disparities in realized income lead to violations to full insurance, my paper is the first to show that disparities in the expected income of spouses can also lead to violations to full insurance.[4]

[4]Other work, such as Krueger and Perri (2006), studies how the volatility of income affects risk-sharing agreements. In a more closely related paper, Genicot (2006) studies how wealth inequality affects risk-sharing agreements. Section 2 provides a more detailed discussion of her paper.

The second contribution of my paper is to provide new empirical evidence supporting collective models of limited commitment as a useful characterization of the household. There are three ways to model household behavior in a dynamic environment:[5]

1. *no intertemporal commitment:* individuals have no means by which they can credibly commit to any future action and thus spouses will renegotiate the division of surplus each period without considering the past or future,

2. *full intertemporal commitment:* spouses can fully commit to any future action and thus the division of surplus in each period will be defined by negotiations that take place at the start of their relationship, and

3. *limited intertemporal commitment:* spouses can only credibly commit to future actions that would be in their best interest and thus there will be some periods (but not every period) in which spouses will renegotiate the division of surplus (I also use the term "limited commitment" to refer to this model).

Distinguishing between the three models empirically is difficult. In addition to Robinson (2012), a number of papers find that consumption patterns respond differently to income shocks that affect different members within the household.[6] Models of limited commitment offer a possible explanation for this behavior. In this framework household members are only able to partially insure each other against idiosyncratic income risk. However, the violation of full insurance can also be explained by a model of no intertemporal commitment, in which spouses provide no mutual insurance. Thus, the rejection of full insurance alone does not distinguish between models of no intertemporal commitment and models of limited commitment.

My paper provides new empirical evidence to support the models of limited commitment over the alternative models of no intertemporal commitment or full intertemporal

[5]These three models of intertemporal behavior are defined more explicitly in Section 2. Chiappori et al. (2019) use the same terminology to distinguish between the three types of models.

[6]Papers that study income shocks include: Dercon and Krishnan 2000; Doss 2001; Duflo and Udry 2004; Goldstein 2004; Dubois and Ligon 2009; Robinson 2012). Another set of papers including Mazzocco (2007), Voena (2015), and Blau and Goodstein (2016), use alternative approaches to show that the division of surplus within the household responds to unanticipated shocks in such a way to suggest that households are no characterized by full intertemporal commitment.

commitment. Specifically, I offer empirical evidence of partial insurance within the household, in which full insurance is sustained in some cases but not in others, and I show that the observed heterogeneity (both across and within households) is related to disparities in spousal income in a way that is consistent with the theoretical predictions. Finding evidence of partial insurance offers stronger support for models of limited commitment since partial insurance is consistent with models of limited commitment but is inconsistent with models of no intertemporal commitment and full intertemporal commitment. Lise and Yamada (2019) and Chiappori et al. (2019) are the two other papers that develop and implement direct tests of models of limited commitment within the household, and both find evidence to support this class of models.[7] Relative to these two papers, I offer further support for models of limited commitment using an alternative methodology in a different context. A related literature finds empirical evidence that models of limited commitment characterize risk-sharing agreements across households (e.g., Townsend 1994; Mazzocco 2012). Relative to these papers, I focus on risk-sharing agreements within the household and use a distinct empirical test.

The paper proceeds as follows. Section 2 develops a stylized model that highlights the mechanisms through which disparities in spousal income limit the scope for cooperation. Section 3 describes how the field experiment offers a way to test the predictions from the model. Section 4 presents the empirical evidence. Section 5 concludes.

2 Stylized Model

Consider a household that consists of a husband and wife denoted by the superscript, $i \in \{h, w\}$.[8] In each period, denoted by subscript t, the household receives a fixed amount of income, which is normalized to one. While total income is constant across periods, the

[7] Lise and Yamada (2019) use a structural model to conduct a test of limited commitment. While this is an excellent paper, the methodology imposes strong and generally untestable assumptions. In a recent working paper, Chiappori et al. (2019) compliment this work with a more reduced form approach and study the labor supply responses to unanticipated shocks to wages. The key result is that, conditional on current and future expected wages, past shocks influence current labor supply. This behavior is specific to models of limited insurance as developed by Mazzocco (2007) and cannot be explained by collective models in which couples can fully commit or have no ability to commit to future actions.

[8] I use the notation $-i$ to denote the spouse of i.

individual income of the husband, y_t^h, and the wife, y_t^w, is stochastic and is distributed uniformly with $\mathbb{E}[y_t^i] = \bar{y}^i$ and $Var(y_t^i) = \sigma_y^2$. The choice to use the uniform distribution is based on: (1) $\bar{y}^i$ is an intuitive measure of permanent income inequality and (2) mean and variance are determined by independent parameters, which allows me to study the effects of changes in permanent income inequality holding income volatility constant.[9] The latter point is important since volatility in expected income will affect the gains from mutual insurance. There are no information asymmetries as both spouses know the distribution of individual income and observe the realized values each period. The utility of i in a given period is the log of their own private consumption, q_t^i, and individuals discount future utility at the rate, $\delta \in (0, 1)$. Households have no ability to save. Each period, income is realized and the couple decides how to allocate total income between the private goods of the husband and wife.

My goal is to understand how disparities in realized income (difference between y_t^h and y_t^w) and disparities in expected income (difference between $\bar{y}^h$ and $\bar{y}^w$) affect expenditures in three different environments characterized by: no intertemporal commitment, full intertemporal commitment, and limited intertemporal commitment. The model is highly stylized but contains three key insights: (1) a spending rule that provides mutual insurance can make both spouses better offer, (2) the gains from deviating from a spending rule are increasing in own realized income, and (3) the costs from deviating from a spending rule are declining in own expected income. These insights illustrate why disparities in realized and expected income can prevent spouses from fully insuring each other against idiosyncratic income shocks, thereby leading to inefficient outcomes. The only novel theoretical results are stated in Proposition 2, which characterizes the role of disparities in expected income in the environment of limited commitment. However, I discuss the role of disparities in both realized and expected income in all three environments in order to illustrate how the empirical analysis differentiates between models of limited commitment, no intertemporal commitment, and full intertemporal commitment.

[9] Not only does $\bar{y}^i$ determine differences in the expected values, but for $y' < y''$ the distribution characterized by $\bar{y}^i = y''$ first order stochastically dominates the distribution characterized by $\bar{y}^i = y'$.

2.1 No Intertemporal Commitment

In the model with no intertemporal commitment individuals cannot commit to any future actions and thus do not take into account the future or past when making decisions. Each period is treated as a one-shot game and there is no incentive to share income. The solution in this environment corresponds to a sequence of unrelated static Nash equilibria in which each spouse consumes their own income every period. In other words, the couple will not insure each other against income shocks and private consumption is increasing in own income in every state, $\partial q_t^i/\partial y_t^i > 0$.[10]

2.2 Full Intertemporal Commitment

In the collective model with full intertemporal commitment spouses can fully commit to any future agreements. In this case they are able to agree upon an ex ante efficient spending rule, which can be written as the solution to the following problem:

$$\max_{q^h(y_t^h),q^w(y_t^w)} \{\sum_{t=0}^{\infty} \delta^t \mathbb{E}[\lambda^h ln\big(q^h(y_t^h)\big) + \lambda^w ln\big(q^w(y_t^w)\big)]\} \tag{1}$$

$$\text{subject to } q^h(y_t^h) + q^w(y_t^w) \leq y_t^h + y_t^w \equiv 1, \forall\ t$$

where the Pareto weight of i, λ^i, determines their share of the household surplus.[11] The Pareto weight does not depend on the realization of income ($\frac{\partial \lambda^i}{\partial y_t^i} = 0$) but may depend on the distribution of income ($\frac{\partial \lambda^i}{\partial \bar{y}_t^i} \geq 0$). The solution to this problem dictates that individual i will receive λ^i of total household income to spend on their own private good in each period. Thus, when spouses can fully commit, households achieve full insurance and private consumption will be unrelated to the realization of relative income, $\partial q_t^i/\partial y_t^i = 0$.

[10] If the model were extended to allow for altruistic preferences, then there would be partial income sharing in each period in which the spouse with higher income would make a transfer to the spouse with lower income. However, it would still be the case that private consumption would be increasing in own income in every period.

[11] I normalize the Pareto weights such that $\lambda^h + \lambda^w = 1$ and $\lambda^i \in [0, 1]$.

2.3 Limited Intertemporal Commitment

In the collective model with limited commitment spouses are forward looking but can only commit to spending agreements that are incentive compatible. The idea that spouses are able to sustain cooperation is often justified by the fact that they engage in repeated interaction and I explicitly model this process.[12] Applying the framework of Abreu (1986), I consider an environment in which couples develop a strategy that allows them to coordinate behavior via threat of future punishment. I use a model of static limited commitment in the spirit of Coate and Ravallion (1993) in which behavior is independent of past history.[13] At the end of this section I provide a more detailed discussion of why I chose not to use a dynamic model of limited commitment as in Ligon, Thomas and Worrall (2002).

Each period income is realized and individuals decide whether to pool income and allocate resources according to the strategy or to deviate, in which case each individual controls their own income. The strategy states that if neither individual deviated from the strategy in the previous period, then both individuals should allocate their income according to the cooperative phase spending rule. However, if individual i deviated in the previous period then i will be punished in the current period. The punishment phase is temporary, since if individuals accept their punishment they will return to the cooperative phase the following period. I assume couples will use the most severe feasible punishment in order to maximize their ability to sustain cooperation (individuals have the option to deviate in either the cooperative or punishment phase).

A novel feature of my model is that cooperation is enforced by threat of temporary punishment. Existing theoretical work on the household has employed a grim trigger strategy in which spouses inflict a permanent punishment represented by divorce or non-cooperative behavior within the marriage (Lundberg and Pollak 1993). While permanent punishment is clearly unrealistic in many cases, the assumption is largely inconsequential

[12]Cooperation within the household can also be explained by the presence of altruistic preferences or the presence of public goods. See Foster and Rosenzweig (2001) and Wahhaj (2007) for an analysis of how risk-sharing arrangements under limited commitment are affected by the presence of altruism and public goods, respectively.

[13]Technically, my framework allows current decisions to depend on actions in the past period, since deviations are punished in the following period. The model is static in the sense that the allocations within the punishment and cooperative phase are independent of past history.

since models with temporary punishment tend to deliver the same predictions. However, one important way in which these frameworks differ is in the determinants of payoffs in the punishment phase. For example, in the case of permanent punishment, factors that shape long-run earnings potential such as educational attainment will determine the payoff. In contrast, in the case of temporary punishment, the payoff will be determined by shorter-term measures of income. In this way, my paper highlights one channel through which the observed intra-household distribution of income–in contrast to longer-run measures of income or earnings potential–can shape behavior.

In the collective model with limited commitment, the couple defines a spending rule subject to the constraint that all allocations must be incentive compatible. Formally, the optimal spending rule is the solution to the following problem:

$$\max_{q^h(y_t^h), q^w(y_t^w)} \{\sum_{t=0}^{\infty} \delta^t \mathbb{E}[\lambda^h ln\big(q^h(y_t^h)\big) + \lambda^w ln\big(q^w(y_t^w)\big)]\} \tag{2}$$

subject to:

$$\begin{aligned} & q^h(y_t^h) + q^w(y_t^w) \leq 1, \forall t \\ & ln(y_t^i) - ln\big(q^i(y_t^i)\big) \leq C^i, \forall t \text{ and } i \in \{h, w\} \end{aligned}$$

where $q^i(y_t^i)$, which is a function of the realization of income, is the spending on i's private good in the cooperative phase. The first constraint is the budget constraint and the second constraint is the incentive compatibility constraint in the cooperative phase. I use the notation

$$C^i \equiv \delta \mathbb{E}[ln\big(q^i(y_{t+1}^i)\big) - ln\big(p^i(y_{t+1}^i)\big)] \tag{3}$$

where $p^i(y_t^i)$ is the amount allocated to i when i is in the punishment phase. The term, C^i, represents the future expected costs from deviating (an individual who deviates in period t will be punished in period $t+1$).

A few important points can be made without fully solving the model. First, the assumption that the most severe feasible punishment is used implies that,

$$ln\big(p^i(y_t^i)\big) = ln(y_t^i) - C^i \tag{4}$$

Because C^i does not vary with the realization of income, it immediately follows that the severity of punishment is declining in realized income. Intuitively, in periods when an individual earns a large share of income, they cannot be punished harshly since they have an appealing outside option.

Second, the optimal spending rule will take the following form:

$$q^i(y_t^i) = \begin{cases} 1 - (1 - y_t^i)e^{-c^{-i}} & \text{if } y_t^i < 1 - \hat{y}^{-i} \\ \lambda^i & \text{if } 1 - \hat{y}^{-i} \leq y_t^i \leq \hat{y}^i \\ y_t^i e^{-c^i} & \text{if } \hat{y}^i < y_t^i \end{cases} \tag{5}$$

where $\hat{y}^i = \lambda^i e^{c^i}$. When realized income is relatively equal (y_t^i is close to λ^i), then the gains from deviating will be relatively small and the couple will achieve the full insurance allocation, where expenditures are determined according to the Pareto weight (and not according to realized income). However, for sufficiently large disparities in realized income, the spouse with relatively higher income will have to be incentivized to adhere to the agreement by allocating resources to their private consumption. In this case, the couple will not achieve the full insurance allocation and private consumption will be increasing in income share.

Combining equations 4 and 5 yields the following expression, which relates the future costs from deviating to the future realization of income,

$$ln\big(q^i(y_{t+1}^i)\big) - ln\big(p^i(y_{t+1}^i)\big) = \begin{cases} ln\big(1 - (1 - y_{t+1}^i)e^{-c^{-i}}\big) - ln(y_{t+1}^i) + C^i & \text{if } y_{t+1}^i < 1 - \hat{y}^{-i} \\ ln(\lambda^i) - ln(y_{t+1}^i) + C^i & \text{if } 1 - \hat{y}^{-i} \leq y_{t+1}^i \leq \hat{y}^i \\ 0 & \text{if } \hat{y}^i < y_{t+1}^i \end{cases} \tag{6}$$

Equation 6 highlights a key feature of the model: the costs from deviating are weakly decreasing in realized income. The costs from deviating from the spending rule in period

t are small if the individual earns a large share of household income in period $t+1$, since their spouse will only be able to inflict a mild punishment in period $t+1$.

Equation 6 shows that the future costs from deviating are declining in the future realization of income, which might seem to imply that the expected costs from deviating are declining in expected income. However, to determine the relationship between the expected value of of future income and the expected costs of deviating, we must account for the fact that C^i is determined within the model. To do this, I make two simplifications. First, I assume that the Pareto weight is not excessively sensitive to changes in expected income, $\frac{\partial \lambda^i}{\partial \bar{y}^i} \leq \tilde{\lambda}^i$.[14] This assumption plays an important role in Proposition 2. Second, I assume that $\tilde{\delta} < \delta$, where $\tilde{\delta}$ is defined such that full insurance is feasible when $\bar{y}^i = \lambda^i$ and to rule out equilibria in which the incentive compatibility constraint of both spouses are binding. This second simplification makes the model tractable and allows for analytic proofs. After presenting the two propositions, I provide a more detailed discussion of these two assumptions. See Appendix for details on how $\tilde{\delta}$ and $\tilde{\lambda}^i$ are defined.

Proposition 1 *If $\lambda^i < \bar{y}^i$, then there exists some $\hat{y}^i$ such that $\frac{\partial q^i(y^i_t)}{\partial y^i_t} = 0$ if $y^i_t \leq \hat{y}^i$ and $\frac{\partial q^i(y^i_t)}{\partial y^i_t} > 0$ if $\hat{y}^i < y^i_t$.*

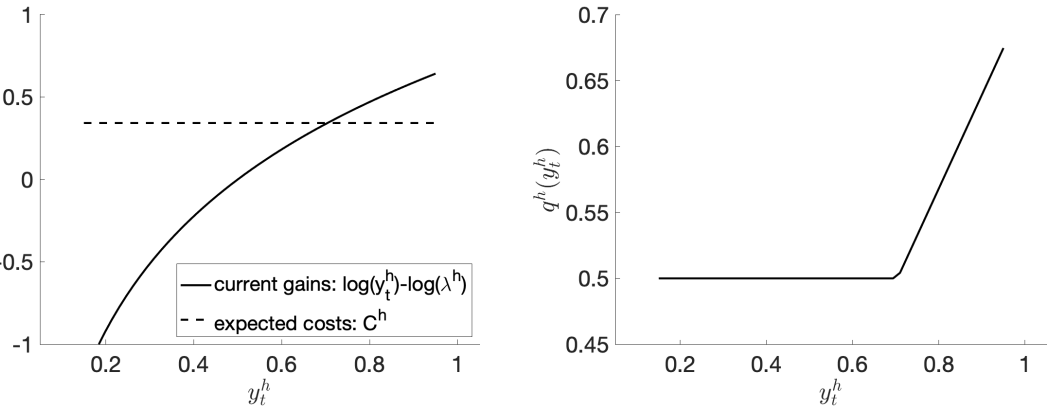
Proof: See Appendix. ■

Proposition 1 characterizes the relationship between the optimal spending rule and disparities between the realized income of the husband and wife. To help illustrate the intuition, Figure 1 presents results from a numerical solution of the model for the case in which the expected income of the husband exceeds his Pareto weight. The solid line in Panel A, plots the current period gains of deviating from the full insurance allocation as a function of his realized income and shows that the gains are increasing in realized income. The dashed line represents the future expected costs of deviating from the spending rule, which do not vary with the realization of income in the current period. Panel B plots

[14] As in the full intertemporal commitment model, I assume that the Pareto weight does not depend on the realization of income. Furthermore, I consider the case in the full insurance allocation would imply a transfer to the spouse with lower income when they have their lowest possible draw of income; formally, $\bar{y}^i - \sigma_y\sqrt{3} < \lambda^i$. If this condition is not met, cooperation completely breaks down, the equilibrium is the same as the no commitment environment and proofs of Proposition 1 and 2 are trivial.

Figure 1: Predictions from Proposition 1

(A) Gains and Costs from Deviating (B) Spending Rule



Note: The figure presents numerical solutions based on the following parameter values: $\lambda^i = 0.5$, $\delta = 0.85$, $\sigma_y^2 = 0.05$ and $\bar{y}^h = 0.55$. Panel A plots the husband's current gains from deviating from the full insurance allocation, $log(y_t^h) - log(\lambda^h)$, and his expected future costs from deviating from the spending rule, C^h, against his realized income. Panel B plots the spending on the private good of the husband, $q^h(y_t^h)$, against the realized income of the husband, y_t^h.

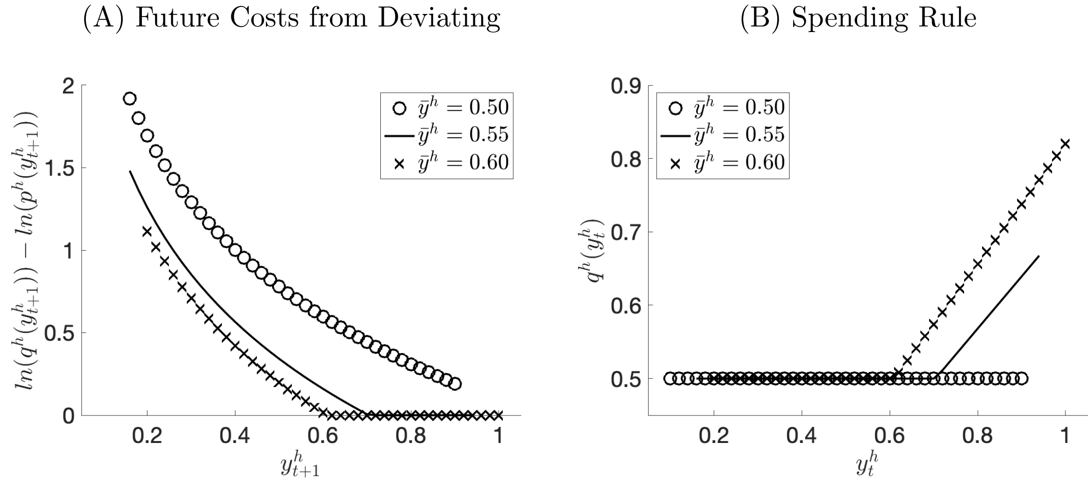
the optimal spending rule as a function of the husband's realized income. When the realized income of the husband is relatively low, the future expected costs exceed the current gains from deviating and the full insurance allocation is achieved. However, when the income of the husband is sufficiently high, the full insurance allocation is not incentive compatible and the couple responds by allocating a larger share of resources to the husband to incentivize him to adhere to the spending rule. The key insight from Proposition 1 is that a departure from the full insurance equilibrium is more likely to occur when the realized income of one individual greatly exceeds the realized income of their spouse. This prediction is standard to models of limited commitment.

Proposition 2 *If* $\lambda^i < \bar{y}^i$, *then* $\frac{\partial C^i}{\partial \bar{y}^i} < 0$, $\frac{\partial \hat{y}^i}{\partial \bar{y}^i} \leq 0$, *and* $\frac{\partial q^i(y_t^i)}{\partial \bar{y}^i} \geq 0$.

Proof: See Appendix. ■

Proposition 2 characterizes the relationship between the optimal spending rule and disparities between the expected income of the husband and wife. Using the same parameter values used to produce Figure 1, the solid black line in Panel A of Figure 2 plots the husband's costs from deviating, $ln\big(q^i(y_{t+1}^i)\big) - ln\big(p^i(y_{t+1}^i)\big)$, as a function of his realized income in period $t+1$. As is apparent from equation 6, the costs are declining in realized

Figure 2: Predictions from Proposition 2

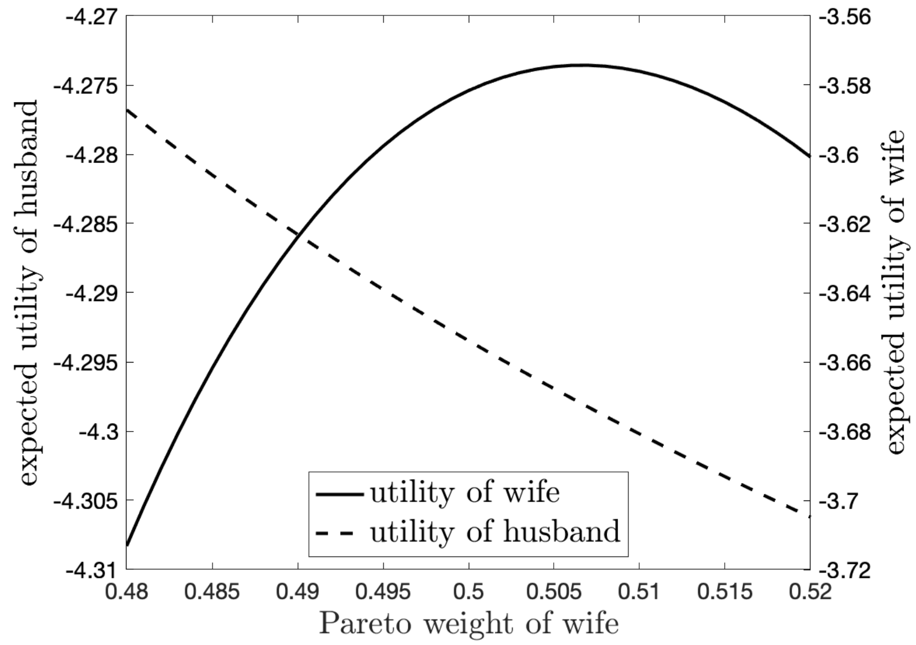


Note: The figure presents numerical solutions based on the following parameter values: $\lambda^i = 0.5$, $\delta = 0.85$ and $\sigma^2_y = 0.05$. The solid line corresponds to solutions in the case when $\bar{y}^h = 0.55$ and the circle and cross markers correspond to solutions in the cases when $\bar{y}^h = 0.50$ and $\bar{y}^h = 0.60$, respectively. Panel A plots the husband's future costs from deviating, $ln\big(q^i(y^i_{t+1})\big) - ln\big(p^i(y^i_{t+1})\big)$, against his future realized income, y^h_{t+1}. Panel B plots the spending on the husband's private good, $q^h(y^h_t)$, against the realized income of the husband, y^h_t.

income. However, what is not apparent from equation 6, is that the costs of deviating are also decreasing in his expected income–this follows from $\frac{\partial C^h}{\partial \bar{y}^h} < 0$. Intuitively, if the husband expects to earn a large share of household income in the next period, then he will expect that the wife fill be unable to inflict a severe punishment. The cross (circle) markers illustrate that the costs from deviating decrease (increase) when the expected income of the husband increases (decreases). Panel B of Figure 2 presents the implications for the spending rule and shows that an increase in the husband's expected income leads to an increase in the probability that expenditures on the husband's private goods are increasing in his realized income. The key insight from Proposition 2 is that a departure from the full insurance equilibrium is more likely to occur for households in which the expected income of one individual greatly exceeds the expected income of their spouse. This prediction is novel and has not been discussed in the literature.

Three caveats warrant discussion. First, Proposition 2 relies on the assumption that the Pareto weight is not excessively sensitive to changes in expected income, $\frac{\partial \lambda^i}{\partial \bar{y}^i} \leq \tilde{\lambda}^i$. Intuitively, this assumption captures the idea that the division of household surplus likely depends on factors beyond income–such as, culture, norms, and institutions. This

Figure 3: Expected Utility and the Pareto Weight



Note: The figure presents numerical solutions based on the following parameter values: $\delta = 0.85$, $\sigma_y^2 = 0.05$ and $\bar{y}^h = 0.55$. The model is solved using different values of the Pareto weight of the wife, with $\lambda^w \in [0.48, 0.52]$. The present discounted value of future utility for the husband and wife, defined as $\sum_{t=0}^{\infty} \delta^t \mathbb{E}[q^i(y_t^i)]$, is plotted against the values of λ^w.

assumption would be problematic if couples could always respond to changes in expected income by renegotiating λ^i in a way that would lead to a Pareto improvement through increased scope for cooperation. However, such a value of λ^i may not exist since any new agreement must be incentive compatible.

Figure 3 plots the present discounted value of future utility for equilibria corresponding to different values of λ^w.[15] The dashed line indicates that the husband always prefers lower values of λ^w since this increases both total surplus by moving the household closer to the full insurance allocation as well as his share of surplus. For sufficiently large values of λ^w, the solid line shows that it is mutually beneficial to reduce λ^w since both the husband and wife benefit from the additional surplus created by moving closer to the full insurance equilibrium. However, for smaller values of λ^w–which include the parameter

[15] I am not considering a dynamic model in which the household anticipates that λ^i will be renegotiated every time the incentive compatibility constraint binds. Rather, I am still considering a static environment but asking if the household could make a one-time change to the λ^i to adjust for a change in expected income.

values that correspond to the solution in Figure 1–the wife would prefer an increase in λ^w because the gains from an increase in her share of the household surplus outweigh the losses from the decline in total surplus. In this range, the household is unable to achieve full insurance but there does not exist an alternative value of the Pareto weight that would make both spouses better off. In other words, it is possible to have a situation in which disparities in expected income produce inefficient behavior but the husband and wife are unable to renegotiate the division of surplus (change the value of λ^i) in a way that would make both of them better off.

In an unpublished working paper, Genicot (2006) argues that greater inequality in expected income facilitates risk-sharing. Her findings are not inconsistent with the results stated in Proposition 2. Translating the main results of her paper using my notation, Proposition 3 of Genicot (2006) finds that an increase in $|\bar{y}^h - \bar{y}^w|$ expands the range of λ^i in which the full insurance allocation is feasible. In her setting, which studies relationships that are formed primarily to share risk, it is reasonable to think that the Pareto weight would be chosen to maximize the surplus generated from the risk-sharing arrangement. However, this approach is less reasonable in my context, in which risk-sharing is only one of many reasons for why married couples form a relationship. As the previous two paragraphs illustrate; while an increase in the expected income of the husband may make it easier to achieve the full insurance allocation for sufficiently low values of λ^w, the couple might not chose to renegotiate λ^i (either because λ^i is defined by factors beyond income or because it would not be optimal for the wife to accept a lower value of λ^i).

The second caveat is that I consider a model of static limited commitment, in which current spending decisions do not depend on past history. An alternative approach developed in Thomas, Ligon and Worrall (2002), uses a model of dynamic limited commitment in which current expenditures may depend on past history. My choice to use a static model of limited commitment is based on two considerations. First, I chose to consider an environment in which the division of surplus responds to changes in income in a limited way. Models of limited commitment predict that a sufficiently low realization of the wife's income in one period could reduce her share of surplus both in the current and future periods (at least until there is another large income shock). In my framework, a low realization income affects the division of surplus in that period but would not affect the division of surplus in future periods. Which one of these frameworks is a better characterization of reality is an open empirical question.[16] Second, the static model is tractable enough to allow for analytic proofs of Proposition 2. The proof of Proposition 2, exploits the fact that the expected future costs from deviating are time invariant and can therefore be written as a function of themselves. In a dynamic model, these costs may depend on the history, making it difficult to prove how they will respond to changes in the distribution of income. While it might be possible to prove some version of Proposition 2 in the dynamic setting, doing so is outside of the scope of this paper.

The third caveat is that I only consider a subset of equilibria in which the incentive compatibility constraint is binding for no more than one spouse; formally, I assume that $\tilde{\delta} < \delta$. This simplification makes the model tractable and allows for analytic proofs. However, it is possible to construct equilibria in which the incentive compatibility constraints of both the husband and wife are binding. In this case, proving Proposition 2 becomes more difficult since there is a complicated feedback loop between the actions of the husband and wife.[17] When the husband's expected costs of deviating decline, he demands more resources and this reduces the wife's expected costs of deviating, which leads her to demand more resources but this reduces the husband's expected costs and the cycle continues. Despite this complication, the basic intuition of the model follows through and, at least for some parameter values, so do the key comparative statistics stated in Propositions 1 and 2.

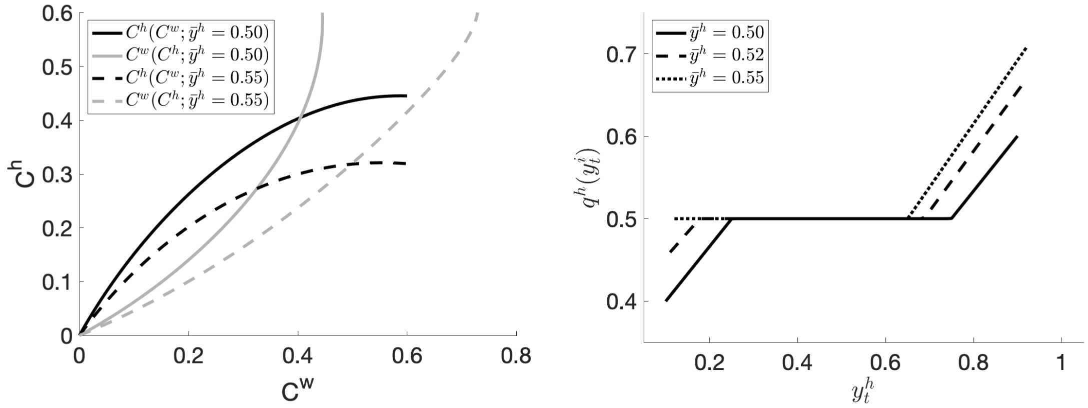
Figure 4 illustrates why proving Proposition 2 is more complicated when the incentive compatibility constraints are binding for both the wife and husband. Panel A plots the husband's expected costs from deviating as a function of wife's expected costs and vice

[16]Chiappori et al. (2019) find evidence that income shocks have a persistent effect on the division of surplus. While this supports the predictions from the models of dynamic limited commitment there is not yet enough evidence to conclude with confidence that dynamic models of limited commitment are a better characterization of reality compared to static models.

[17]Proposition 1 can still proved in the case in which the incentive compatibility constraints of both spouses. Indeed, this proposition has been proved in more general settings than the one considered in this paper. For example, see Coate and Ravallion (1993).

Figure 4: Binding Constraints for Husband and Wife

(A) Expected Costs from Deviating (B) Spending Rule



Note: The figure presents numerical solutions based on the following parameter values: $\lambda^i = 0.5$, $\delta = 0.75$ and $\sigma_y^2 = 0.05$. The solid and dashed lines correspond to solutions when $\bar{y}^h = 0.50$ and $\bar{y}^h = 0.52$, respectively. Panel A plots the husband's expected future costs from deviating, C^h, as a function of the wife's expected costs, C^w, and vice versa. Panel B plots the spending on the private good of the husband, $q^h(y_t^h)$, against the realized income of the husband, y_t^h. In Panel B, the dotted line corresponds to the solution when $\bar{y}^h = 0.55$.

versa. The solution to C^h and C^w is represented by the intersection of the two lines. The solid and dashed lines present results for solutions when $\bar{y}^h$ is set to 0.50 and 0.52, respectively. An increase in the expected income of the husband has both a direct and indirect effect. The direct effect is that an increase in the husband's expected income reduces his expected cost from deviating because it becomes less likely that the wife will be able to inflect a severe punishment. This is depicted by the shift of the solid black line to the dashed black line. However, an increase in the husband's expected income also raises the wife's expected costs of deviating by making it more likely that the husband could inflict a severe punishment on her. With a greater expected cost of deviating, the wife becomes less like to deviate form the full insurance allocation. This is depicted by the shift in the solid grey line to the dashed grey line. This creates an indirect effect, which increases the husband's costs from deviating because if he deviates in the current period he now forgoes a larger transfer from the wife in the event that the wife has a high realization of income in the next period.

The direct and indirect effect of an increase in the husband's expected income have conflicting implications for the husband's expected costs of deviating, but the direct effect dominates in the numerical solution presented in Figure 4. Panel B presents the implications for the spending rule. As the expected income of the husband increases, it becomes more likely that the husband's incentive compatibility constraint is binding and less likely that the wife's incentive compatibility constraint is binding. When the expected income of the husband is sufficiently large, the wife's incentive compatibility constraint will not bind in any period. This is depicted by the dotted line in which $\bar{y}^h = 0.55$. While the Figure 4 illustrates that full insurance may be violated when the wife has a relatively large realization of income, this scenario might be less relevant in contexts in which the husband is the primary source of income; a characteristic of the environment in which I empirically test the predictions.

Finally, it is worth emphasizing that the conclusions of the model correspond to a notion of efficiency related to consumption; an inefficient equilibrium means that there exists an alternative spending rule (characterized by full insurance), which is Pareto improving. I focus on this notion of efficiency because this is what is relevant for the empirical analysis, which studies how consumption patterns respond to income shocks. Alternatively, one could consider a different dimension of efficiency that relates to income generating activities. For example, Udry (1996) finds that factors such as labor and fertilizer are not allocated efficiently across farm plots owned by the members of the same household and this implies that households are capable of producing more output by reallocating the same inputs. My model abstracts from this as I assume income is determined exogenously, and not by the maximizing behavior of household members. While one could extend the analysis to consider implications for this alternative dimension of efficiency, the conclusions stated in the two propositions will hold as long as decisions related to consumption and income generating activities are separable.

3 Data and Empirical Strategy

The empirical section of this paper seeks to test the main predictions of the model, which are stated formally in Propositions 1 and 2. Specifically, I ask if married couples are less able to insure each other against idiosyncratic income risk when there are large disparities between the realized or expected income of the husband and wife. To do this, I analyze data from the field experiment conducted by Robinson (2012).

While I refer the reader to the paper for a full description of the experiment and the data, I highlight the key points here. Robinson (2012) conducts a field experiment to test whether married couples fully insure each other against small positive income shocks. The study was conducted between April and October 2006 with a sample of 142 married couples in three towns in the Western and Nyanza Provinces of Kenya. Over an eight week period each spouse had a 50% chance of receiving an income transfer worth 150 Kenyan shilling (about $2.14 USD) every week. These transfers are large relative to weekly earnings (equal to about on and a half day's earnings for men and one weeks' earnings for women) but small relative to lifetime earnings since the transfers are only made over an eight week period. The transfer was public knowledge and it is possible that both the husband and wife could receive the transfer in the same week. Detailed individual-level expenditure data were collected at weekly intervals in between income transfers. The final data set contains 898 household/week observations.

The main finding of Robinson (2012) is that the recipient of the transfer significantly affects expenditures, implying that couples are unable to fully insure themselves against idiosyncratic income shocks. The test of mutual insurance is implemented by estimating the following regression,

$$q_{it}^{j} = \beta^{w} T_{it}^{w} + \beta^{h} T_{it}^{h} + \lambda_i + \phi_t + \epsilon_{it} \tag{7}$$

where i is the household, t is the week, q_{it}^{j} is the inverse hyperbolic sine (IHS) of weekly expenditures on the private good of the husband ($j = h$) or wife ($j = w$), T_{it}^{j} is an indicator equal to one if spouse j of household i received a transfer through the experiment in week t, λ_i is a household fixed effect, ϕ_t is a fixed effect for the week and standard errors are clustered at the level of the household.[18] While the data include expenditures

[18] I use the IHS of expenditures, defined as $log(y_{it} + \sqrt{1 + y_{it}^2})$, since this transformation reduces the sensitivity to outliers but retains zeros (see Burbidge et al. 1988). Later on I show robustness to alternative transformations of the dependent variable.

on other categories, I focus on understanding how the recipient of the experimental income transfers affects expenditures on the private goods of the husband and wife–private goods include clothing, meals in restaurants, alcohol, soda, cigarettes and other private goods–since it is not clear how to map expenditures on public goods to individual level consumption. This is consistent with Robinson (2012), who notes that "the main test of efficiency is the consumption of private goods ... and expenditures on these items are equal to (the monetary value of) consumption in most cases."

Full insurance is rejected if a transfer to the husband has a different effect on expenditures relative to a transfer to the wife; or more formally, if $\beta^h \neq \beta^w$. Table 1 presents the estimates from equation 7 and replicates the main results in Robinson (2012). The outcome variable in column 1 is the IHS of expenditures on the wife's private goods. The point estimates presented in Panel A suggest that a transfer to the wife leads to an increase in spending on the wife's good by 35% (statistically significant at the 5% level), while a transfer to the husband reduces spending on the wife's private good by 8% (not statistically significant). The post-estimation test presented in Panel B indicates that the difference between the effect of the transfer to the wife versus the husband is statistically significant at 10% level. Column 2 presents results related to the husband's private goods. While the results for this outcome are not statistically significant, the point estimates suggest that a transfer to the husband leads to a larger increase in spending on the husband's private goods relative to a transfer to the wife. To increase power, the outcome in column 3 is the difference between the IHS of expenditures on the husband's and wife's private goods. Intuitively, this outcome captures expenditures on the husband's private goods relative to expenditures of the wife's private goods. The point estimates suggest that a transfer to the husband increases spending on the husband's goods relative to the wife's goods where as a transfer to the wife increases spending on the wife's goods relative to the husband's good. With more power, the difference between the effect of the transfer to the husband and wife is statistically significant at the 5% level. Taken together, the results in Table 1 replicate the main findings of Robinson (2012) and indicate that couples are unable to fully insure each other against idiosyncratic income shocks.

Table 1: Test of Mutual Insurance

	q_{it}^w (1)	q_{it}^h (2)	$q_{it}^h - q_{it}^w$ (3)
A. Regression Estimates			
β^w: T_{it}^w	0.350**	-0.078	-0.429**
	(0.154)	(0.106)	(0.185)
β^h: T_{it}^h	-0.084	0.051	0.135
	(0.173)	(0.115)	(0.193)
B. Test of Full Insurance			
$\beta^h - \beta^w$	-0.434*	0.130	0.564**
	[0.077]	[0.361]	[0.048]
observations	898	898	898

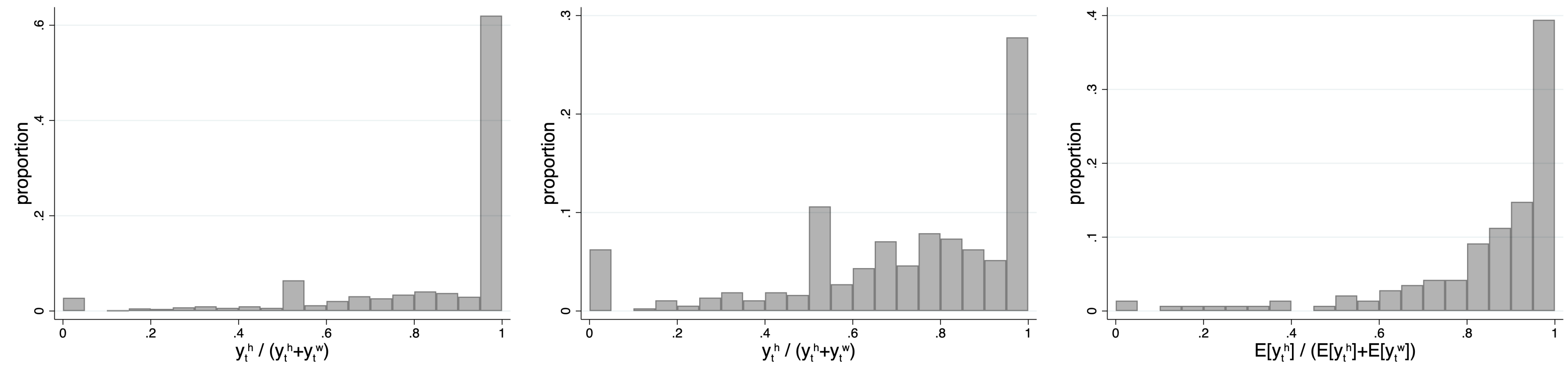
Note: Columns 1 and 2 present estimates from separate regressions in which the outcome variable is the inverse hyperbolic sine (IHS) of the spending on the wife's and husband's private goods, respectively. The outcome in column 3 is the difference between the IHS of spending on the husband's private goods and the IHS of spending on the wife's private goods. Panel A presents coeficient estimates from the model and Panel B presents post estimation tests of full insurance. The main regressors include the indicator T_{it}^j equal to one if spouse $j \in \{h, w\}$ received a transfer in period t. All regressions include a household fixed effect and a fixed effect for the survey week. Standard errors are presented and parentheses and are clustered at the level of the household. The p-values are presented in brackets.
*** p≤0.01, ** p≤0.05, * p≤0.10.

The rejection of full insurance indicates that household behavior is inconsistent with the model of full intertemporal commitment. The results are consistent with a model of limited commitment, but could also be rationalized by a model of no intertemporal commitment. The contribution of my empirical analysis is to distinguish between these two alternatives by testing the additional predictions of the limited commitment model developed in this paper: the violation of full insurance is most likely to occur in periods in which there are large disparities in the realized income of spouses and for households in which there are large disparities in the expected income of spouses.

Figure 5 presents the distribution of realized and expected income in Panels A and C, respectively. The measures of individual income do not include experimental transfers. For most periods and households the husband's income is greater than the wife's. However, there is heterogeneity across the sample with some periods and some households in which the wife receives a larger share of income. My analysis explores this heterogeneity.

Figure 5: Distribution of Husband's Income Share

(A) Realized (B) Realized (Analysis Sample) (C) Expected



Note: This figure present histograms that depict the distribution of income within the household. Panel A presents the distribution of the realized share of income of the husband relative to total household income. There are 898 household by survey week observations. Panel B presents the distribution of this variable for a sample of 367 household by survey week observations in which there is some variation in the husband's share of income across survey waves. Panel C presents the distribution of the average share of income of the husband relative to total household income, where the average is calculated across all survey waves in which the household appears. The results are based on 142 household observations.

My empirical analysis uses a straightforward extension of the model used in Robinson (2012). Specifically, I estimate the following specification,

$$q_{it}^{j} = \sum_{s \in \{h,w\}} [\beta_{small}^{k,s} T_{it}^{s} \times (1 - D_{it}^{k}) + \beta_{large}^{k,s} T_{it}^{s} \times D_{it}^{k}] + \alpha D_{it}^{k} + \lambda_i + \phi_t + \epsilon_{it} \tag{8}$$

where the variable, D_{it}^{k}, is a binary variable equal to one if there are large disparities between the realized or expected income of the spouses for k equal to r and e, respectively. For expected income, $\alpha^k D_i^e$ is absorbed into the household fixed effect since it is time-invariant.

I use the estimates from equation 8 to test the two predictions from the model. Proposition 1 predicts that the recipient of the transfer will affect expenditures only in periods in which there are sufficiently large disparities between the income of the husband and wife. Proposition 2 predicts that the recipient of the transfer will affect expenditures for households in which there are large disparities between the expected income of the husband and the expected income of the wife. The empirical tests can be written as,

$$\begin{aligned} \beta_{small}^{k,h} - \beta_{small}^{k,w} &= 0 \\ \beta_{large}^{k,h} - \beta_{large}^{k,w} &\neq 0 \end{aligned} \tag{9}$$

where k equal to r and e correspond to the tests for Proposition 1 and 2, respectively. The theory actually makes a stronger prediction that when full insurance is violated a transfer will lead to an increase in spending on own private goods and a decrease in spending on the wife's private goods. For example, if the outcome is spending on the husband's private goods, then the theory predicts that $\beta_{large}^{k,w} < 0 < \beta_{large}^{k,h}$. While the data are consistent with this prediction, I follow Robinson (2012) and use equation 9 as the main test of full insurance.

Propositions 1 and 2 indicate that if $\lambda^i < \bar{y}^i$ then the incentive compatibility constraint of individual i will be binding only when y_t^i is sufficiently large but the incentive compatibility constraint of $-i$ will never be binding. While I can measure $\bar{y}^i$ from the data, I do not have a readily available measure of λ^i. As Panel C of Figure 5 makes clear, the expected income of the husband is far greater than the expected income of the wife for the vast majority of households. Without a measure of λ^i, my baseline approach is to assume that the division of surplus within the household is not as unequal as the distribution of income; formally, I assume that $\lambda^h < \bar{y}^h$. Under this assumption, the incentive compatibility constraint will bind only in periods when husband's income is sufficiently greater than his wife's income. After presenting the main results I show that the main findings are robust to alternative ways of addressing the fact that I do not observe λ^i.

Disparities in realized income capture differences within households over time. Specifically, I measure disparities in realized income as the husband's income divided by the sum of the husband's and wife's income in that week. The indicator for large disparities in realized income, D^r_{it}, is equal to one if the share of income earned by the husband exceeds the median value observed for that household across survey weeks. For the analysis related to disparities in realized income, I drop approximately 60% of households who exhibit no variation in the share of income earned by the husband over time–the lack of within-household variation is primarily explained by cases in which the husband is the sole source of income in every period. This restriction retains 367 household by survey week observations. Panel B of Figure 5 presents the distribution of realized income for this sample. Within this sample, 44% of household by survey week observations are classified as having large disparities in realized income.

Disparities in expected income capture differences across households. Specifically, I measure disparities in expected income as the average value of the husband's income divided the average total household income (income of husband plus the income of the wife). The indicator for large disparities in expected income, D^e_i, is equal to one if the expected income share of the husband exceeds the sample median calculated across households. The value of the median is 0.92 and the division between small and large disparities splits the sample exactly in half.[19]

Table 2 presents summary statistics on key variables separately by the size of the

[19]There are 71 households with $D^e_i = 1$ and 71 households with $D^e_i = 0$. Since not all households appear in each survey wave the observation count for household by weeks is not exactly even across groups, although is it quite similar. Specifically, there are 455 household by survey week observations with $D^e_i = 0$ and 443 household by survey week observations with $D^e_i = 1$.

Table 2: Summary Statistics

	Disparities in Expected Income			Disparities in Realized Income		
	$D_i^e = 0$ small (1)	$D_i^e = 1$ large (2)	t-stat (3)	$D_{it}^r = 0$ small (3)	$D_{it}^r = 1$ large (4)	t-stat (5)
A. Fixed Variables						
Household						
owns land	0.45	0.52	0.69			
owns animals	0.23	0.22	-0.12			
number of children	2.76	2.14	-2.03			
Wife						
age	26.18	22.66	-3.03			
literate	0.68	0.75	0.91			
Luo tribe	0.83	0.89	0.98			
Luhya tribe	0.08	0.10	0.34			
Husband						
age	32.20	29.39	-1.82			
literate	0.82	0.87	0.82			
Luo tribe	0.86	0.89	0.43			
Luhya tribe	0.09	0.08	-0.23			
observations	66	62	128			
B. Weekly Variables						
total income	1016.69	743.14	-2.98	999.41	1010.49	0.06
total spending	1206.69	1171.35	-0.44	1244.20	1231.90	-0.20
spending on public goods	1018.90	992.00	-0.37	1050.23	1039.48	-0.20
spending on wife's goods	43.24	36.51	-0.85	55.46	43.62	-1.48
spending on husband's goods	144.55	142.84	-0.10	138.50	148.81	0.88
husband's income	708.99	729.86	0.27	515.17	902.18	2.83
wife's income	307.70	13.28	-5.94	484.24	108.31	-3.60
husband's share of income	0.75	0.96	9.09	0.57	0.89	14.06
observations	455	443	898	205	162	367

Note: This table presents summary statistics for the anlaysis sample. Panel A and Panel B present results calculated from a dataset in which the unit of observation is the household and household by survey week, respectively. The sample size in Panel A is less than the total of 142 households as some households were not interviewed in the baseline survey from which these variables are derived. Columns 1-2 present the average value of the row variable for housheold with small and large disparities in expected income, respecitvely. Columns 4-5 present the average value of the row variable for periods in which disparities in realized income are small and large, respectively. Columns 3 and 6 present the t-statstic for the difference between the means in columns 2 and 1 and 5 and 4, respectively. In Panel B the t-statistics are calculated by clustering standard errors at the household level. The results in columns 1-3 are calculated on the full sample while the results in columns 4-6 are calculated on a sample that has some variation in the realized income share of the husband across survey waves. All monteary values are displayed as Kenyan Shillings.

income disparities. Columns 1 and 2 present the mean of the row variable for households with small and large disparities in expected income, respectively. The differences between these two types of households, described by the t-statistic in column 3, are generally small, although individuals in households with large disparities in expected income do appear to be slightly younger and have fewer children (potentially as a results of being younger). Columns 3 and 4 present analogous results describing the time varying variables for periods in which disparities in spousal income are small and large, respectively. The statistics in Panel B illustrate that, by construction, the husbands earn a far greater share of income for households with large disparities in expected income and in periods in which there are large disparities in realized income. For expected income, this seems to be driven by a lack of income for wives in unequal households whereas there are differences in both the average income of the husbands and wives for realized income.

4 Results

Table 3 presents the test of Proposition 1, which states that full insurance will be violated in periods in which the are large disparities between the realized income of the husband and wife. Panel A presents coefficient estimates from specification 8. The outcome variables in columns 1 and 2 are the IHS of weekly expenditures on the private good of the wife and husband, respectively. The results indicate that the experimental transfer has a statistically significant effect on private spending only in weeks in which there are relatively large disparities in realized income. In weeks when there are large disparities in realized income, a transfer made to the wife increases spending on the wife's private goods by 79% (significant at the 5% level) but has no effect on spending on the husband's private goods. Similarly, a transfer to the husband increases in spending on the private goods of the husband by 46% (significant at the 10% level) but has no effect on spending on the wife's private goods. In contrast, in periods when there are small disparities in realized income, the transfers to the wife and husband do not have a statistically significant impact on spending.

Table 3: Test of Proposition 1

	q^w_{it} (1)	q^h_{it} (2)	$q^h_{it} - q^w_{it}$ (3)
A. Regression Estimates			
$\beta^{w,r}_{small}$: $T^w_{it} \times (1 - D^r_{it})$	-0.517	0.134	0.651
	(0.336)	(0.211)	(0.437)
$\beta^{h,r}_{small}$: $T^h_{it} \times (1 - D^r_{it})$	-0.001	-0.066	-0.065
	(0.340)	(0.263)	(0.430)
$\beta^{w,r}_{large}$: $T^w_{it} \times D^r_{it}$	0.793**	0.030	-0.763*
	(0.341)	(0.285)	(0.448)
$\beta^{h,r}_{large}$: $T^h_{it} \times D^r_{it}$	-0.037	0.464*	0.502
	(0.358)	(0.257)	(0.447)
B. Test of Full Insurance			
$\beta^{h,r}_{small} - \beta^{w,r}_{small}$	0.516	-0.200	-0.716
	[0.334]	[0.570]	[0.292]
$\beta^{h,r}_{large} - \beta^{w,r}_{large}$	-0.830	0.435	1.265*
	[0.119]	[0.238]	[0.062]
observations	367	367	367

Note: Columns 1 and 2 present estimates from separate regressions in which the outcome variable is the inverse hyperbolic sine (IHS) of the spending on the wife's and husband's private goods, respectively. The outcome in column 3 is the difference between the IHS of spending on the husband's private goods and the IHS of spending on the wife's private goods. Panel A presents coeficient estimates from the model and Panel B presents post estimation test of full insurance. The main regressors include the interactions between the indicator T^j_{it} equal to one if spouse $j \in \{h, w\}$ received a transfer in period t and the indicator D^r_{it} equal to one if the husband's realized share of income is greater than the median share observed for the household across weeks in the sample. All regressions also include a household fixed effect, a fixed effect for the survey week and the indicator D^r_{it}. The sample includes households that experience some variation in husband's share of income across survey weeks. Standard errors are presented and parentheses and are clustered at the level of the household. The p-values are presented in brackets.
*** p≤0.01, ** p≤0.05, * p≤0.10.

Panel B of Table 3 presents results from the post-estimation tests described in equation 9. Columns 1 and 2 indicate that there is no evidence that the recipient of the transfer affects private expenditures in periods in which there are small disparities in spousal income. Indeed the point estimates actually suggest that receiving the transfer leads to a smaller increase in own private expenditures relative to the spouse receiving the transfer. In contrast, in periods when there are large disparities in spousal income, receiving a transfer leads to a larger increase in spending on one's own private goods relative to the spouse receiving a transfer–this difference is marginally significant for the wife's private good with a p-value of 0.12 but is not statistically significant for the husband's private goods. To increase power, column 3 presents estimates in which the outcome variable is the difference between the IHS of spending on the husband's private good and the IHS of spending on the wife's private good. The same patterns hold but with more power, the rejection of full insurance is statistically significant at the 10% level for the periods with large disparities in spousal income. In contrast, full insurance cannot be rejected for the periods with small disparities. Taken together, these results support the predictions from Proposition 1; in periods in which spousal income is relatively equal, the recipient of the transfer does not affect expenditures and I cannot reject full insurance, but in periods when there are large disparities in spousal income the recipient of the transfer does affect expenditures and full insurance is rejected.

Table 4 presents the test of Proposition 2, which states that full insurance is more likely to be violated for households with large disparities between the expected income of the husband and wife. The estimates in Panel A suggest that the transfers only affect expenditures on private goods for households with large disparities in expected income. Specifically, for households with large disparities in expected income, a transfer to the wife increases spending on her private goods by 59% (significant at the 1% level) but decreases spending on the husband's private goods by 26% (significant at the 10% level). While a transfer to the husband decreases spending on the wife's private goods by 42% (significant at the 10% level) and has no effect on spending on his private goods. In contrast, the transfers do not have a significant effect on spending on private goods for

Table 4: Test of Proposition 2

	q^w_{it} (1)	q^h_{it} (2)	$q^h_{it} - q^w_{it}$ (3)
A. Regression Estimates			
$\beta^{w,e}_{low}$: $T^w_{it} \times (1 - D^e_i)$	0.070	0.099	0.029
	(0.212)	(0.136)	(0.264)
$\beta^{h,e}_{low}$: $T^h_{it} \times (1 - D^e_i)$	0.264	0.111	-0.153
	(0.221)	(0.157)	(0.270)
$\beta^{w,e}_{high}$: $T^w_{it} \times D^e_i$	0.591***	-0.261*	-0.852***
	(0.208)	(0.148)	(0.230)
$\beta^{h,e}_{high}$: $T^h_{it} \times D^e_i$	-0.417*	-0.024	0.393
	(0.248)	(0.162)	(0.267)
B. Test of Full Insurance			
$\beta^{h,e}_{low} - \beta^{w,e}_{low}$	0.194	0.012	-0.182
	[0.561]	[0.952]	[0.660]
$\beta^{h,e}_{high} - \beta^{w,e}_{high}$	-1.008***	0.237	1.245***
	[0.003]	[0.241]	[0.001]
observations	898	898	898

Note: Columns 1 and 2 present estimates from separate regressions in which the outcome variable is the inverse hyperbolic sine (IHS) of the spending on the wife's and husband's private goods, respectively. The outcome in column 3 is the difference between the IHS of spending on the husband's private goods and the IHS of spending on the wife's private goods. Panel A presents coeficient estimates from the model and Panel B presents post estimation tests of full insurance. The main regressors include the interactions between the indicator T^j_{it} equal to one if spouse $j \in \{h, w\}$ received a transfer in period t and the indicator D^e_i equal to one if the husband's expected share of income is greater than the median share observed across households. All regressions include a household fixed effect and a fixed effect for the survey week. The sample includes all household by week observations. Standard errors are presented and parentheses and are clustered at the level of the household. The p-values are presented in brackets.
*** p≤0.01, ** p≤0.05, * p≤0.10.

households with small disparities between the expected income of the husband and wife.

The post-estimation tests presented in panel B confirm that, for households with small disparities in expected income, there is no evidence that the recipient of the transfer affects the allocation of resources and thus I cannot reject full insurance. In contrast, full insurance is rejected for households with large disparities in expected income. The rejection of full insurance is driven by expenditures on the wife's private goods. Column 1 indicates that for households with large disparities in expected income, transfers to the wife have a different effect on spending on the wife's private goods relative to transfers to the husband, and this difference is statistically significant at the 1% level. The sign of the estimate in column 2 is consistent with the theory but estimates are not precise enough to reject full insurance when looking at the husband's private goods. Taken together, the results in Table 4 are consistent with the prediction stated in Proposition 2. Specifically, I cannot reject full insurance for households with small disparities in the expected income of the husband and wife but I can reject full insurance for households in which there are large disparities between the expected income of the husband and wife.

It is important to acknowledge that I document an association between disparities in spousal income and the violation of full insurance and not a causal relationship. It is possible that other factors, that are correlated with the relative income of spouses, could be influencing the ability of couples to achieve full insurance. In an ideal setting I would assess this concern by directly controlling for potential confounding variables in the regression analysis. However, two features of the data prevent me from doing so. First, the sample size is relatively small and I would likely lack sufficient power to control for other aspects of heterogeneity (which would require me to include additional interaction terms with the transfers). Second, the data only contain a limited number of variables, which prevents me from observing potential confounding factors. A separate issue is that, even if there is a causal relationship between disparities in income and the violation of full insurance, it is possible that another model could be developed that would generate these comparative statics. For example, if there were a fixed cost to renegotiating the division of surplus this might explain why consumption patterns only respond when there are large disparities in spousal income.

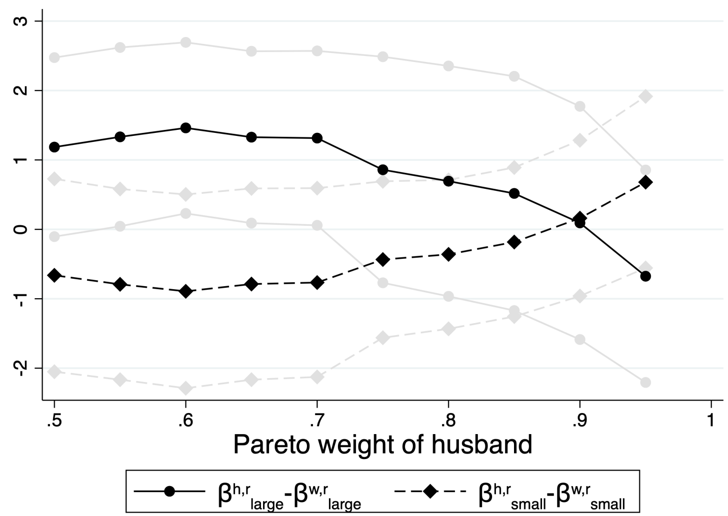
While my empirical analysis cannot completely rule out alternative interpretations of the findings in Tables 3 and 4, there are two strengths of the interpretation offered by my model. First, my model predicts that the relationship between income disparities and the violation of full insurance will hold both across households as well as within households over time. While it is possible to think of other explanations for why disparities in income might be related to the violation of full insurance, it is much more difficult to think of a single explanation that explains both the across- and within-household heterogeneity. Second, there is a general consensus that repeated interaction plays an important role in the process through which spouses coordinate their actions. The predictions of my model are the direct result of this repeated interaction and do not rely on more controversial assumptions about the household decision making process (for example, the presence and nature of negotiating costs). Thus, while my empirical analysis falls short of establishing a causal relationship between disparities in spousal income and the violation of full insurance, I view the results as evidence to support of the empirical relevance of the limited commitment model developed in this paper.

4.1 Robustness Checks

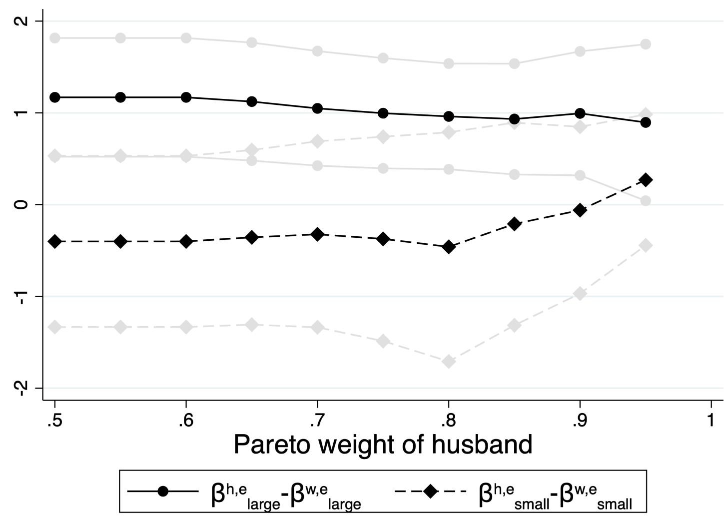
As previously discussed, the main results assume that $\lambda^h \leq \bar{y}^h$, which implies that full insurance will be violated only in periods when the income of the husband exceeds the income of the wife. However, if it were the case that $\lambda^h > \bar{y}^h$, then full insurance would actually be violated in periods in which the income of the wife is relatively high. While I can measure $\bar{y}^h$ directly from the data, I cannot measure λ^h. I assess the robustness of the main findings by considering a range of possible values of λ^h. For a given value of λ^h and a given household, if $\lambda^h \leq \bar{y}^h$ then disparities in spousal income are measured as the share of income earned by the husband. But if $\lambda^h > \bar{y}^h$, then disparities in spousal income are measured as the share of income earned by the wife. I then use these measures of income disparities to construct alternative measures of disparities in realized income (D^r_{it}) and disparities in expected income (D^e_i). Using the alternative definitions of D^r_{it}

Figure 6: Robustness to Alternative Values of Pareto Weight

(A) Proposition 1



(B) Proposition 2



Note: The figure presents results from estimating equation 8, where the outcome variable is difference between the the inverse hyperbolic sine (IHS) of spending on the husband's private goods and the IHS of spending on the wife's private goods. The circle and diamond markers depict the differential effect of a transfer made to the husband versus the wife for the alternative measures of the high and low inequality sample. Each point on the horizontal axis denotes the value of λ^h used to construct the alternative measures of high and low inequality. The alternative measures of H^r_{it} and H^e_i are the measures of income disparities used in regressions specifications that produce Panels A and B, respectively.The grey lines represent the 95% confidence interval and standard errors are clustered at the household.

and D_i^e, I estimate equation 8 where the outcome variable is the difference between the IHS of expenditures on the husband's private goods and the IHS of expenditures on the wife's private goods. The post-estimation results are presented in Figure 6.

The results presented in Figure 6 suggest that the empirical support for Proposition 1 and 2 is robust to a wide range of possible values of λ^h. Panel A presents results relevant to Proposition 1 and the solid line with circle markers presents the points estimates of $\beta_{large}^{h,r} - \beta_{large}^{w,r}$. In weeks when there are large disparities in spousal income, a transfer to the husband leads to a larger increase in spending on the husband's private goods relative to a transfer to the wife for all values of $\lambda^h \leq .9$. The differential impact of the transfer is statistically significant for $\lambda^h \leq 0.7$. In contrast, the dotted line with the diamond markers indicates that when income disparities are small, the recipient of the transfer never has a statistically significant affect on expenditures. Thus, for $0.5 \leq \lambda^h \leq .7$, full insurance is rejected in periods of high in equality but is never rejected in periods of low inequality. Panel B presents the analogous evidence for the test of Proposition 2. Here the results are even more robust. For all $0.5 \leq \lambda^h \leq .95$ full insurance is rejected for households with large disparities in expected income but is not rejected for households with small disparities in expected income.[20]

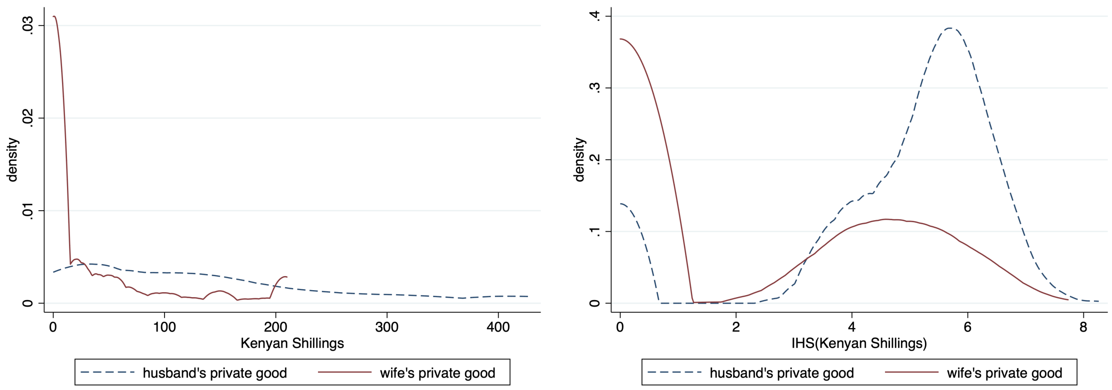
The main analysis uses the IHS of expenditures as opposed to measuring expenditures in Kenyan Shillings as in Robinson (2012). This decision was based on the the fact that there are some large outliers in expenditures. This can be seen in Figure 7, which presents the distribution of private expenditures measured in levels of Kenyan Shillings as well as the IHS transformation.

Tables 5 and 6 investigate the robustness to alternative transformations of expenditures and presents the post-estimation tests for the realized and expected measures of income disparities, respectively. In each table, expenditures in Panels A through E are measured in: Kenyan Shillings, Kenyan Shillings winsorized at the 95th percentile, share of total expenditures, an indicator for positive expenditures and one plus the natural log,

[20]One reason why the empirical evidence is so robust to possible values of λ^h is that $\bar{y}^h$ tends to be very large for many households (see Panel C of Figure 5). Thus, for most households, the theory predicts that the incentive compatibility constraint of the husband will bind even for high values of λ^h.

Figure 7: Total Private Expenditures

(A) Kenyan Shillings (B) Inverse Hyperbolic Sine



Note: This figure presents kernel density plots of the distribution of expenditures on the husband's and wife's private goods. Panels A and B present the distributions for expenditures measured in Kenyan Shillings and the inverse hyperbolic since (IHS) of Kenyan Shillings, respectively.

respectively. Column 3 of Table 5 illustrates that the rejection of full insurance in periods in which there are large disparities in realized income is robust across every measure with the one exception of the indicator for positive expenditures, whereas I can never reject full insurance in periods in which there are small disparities in income. Column 3 of Table 6 indicates that full insurance is rejected for households with large disparities in expected income for every transformation of the outcome variable with the one exception of the case in which Kenyan Shillings are used, whereas I can never reject full insurance for the households with small disparities in expected income. Taken together, Tables 5 and 6 suggest that the empirical support of Proposition 1 and 2 are robust to alternative transformations of expenditures.

Lastly, my analysis focuses on expenditures on all private goods. This is consistent with Robinson (2012) who also places an emphasis on expenditures on all private goods. However, I also present results for the four detailed categories of private expenditures, which include: meals at restaurants for self; alcohol, soda and cigarettes; own clothing; and other private items. Panels A and B of Figure 8 present the distribution of expenditures on the husband's and wife's goods, respectively. The highest private expenditure category for husbands is meals at restaurants whereas it is own clothes for women.

Table 7 presents the post estimation tests of equation 9 for the detailed expenditure

Table 5: Robustness of Empirical Support for Proposition 1

	q_{it}^{w} (1)	q_{it}^{h} (2)	$q_{it}^{h} - q_{it}^{w}$ (3)
A. Kenyan Shillings			
$\beta_{small}^{h,r} - \beta_{small}^{w,r}$	21.340	25.633	4.293
	[0.257]	[0.381]	[0.893]
$\beta_{large}^{h,r} - \beta_{large}^{w,r}$	-32.156*	40.399	72.554**
	[0.054]	[0.234]	[0.045]
B. Kenyan Shillings (winsorized)			
$\beta_{small}^{h,r} - \beta_{small}^{w,r}$	9.091	17.532	8.441
	[0.523]	[0.437]	[0.739]
$\beta_{large}^{h,r} - \beta_{large}^{w,r}$	-25.253*	45.780*	71.033**
	[0.073]	[0.099]	[0.024]
C. share of total expenditures			
$\beta_{small}^{h,r} - \beta_{small}^{w,r}$	0.010	0.009	-0.002
	[0.497]	[0.668]	[0.950]
$\beta_{large}^{h,r} - \beta_{large}^{w,r}$	-0.040**	0.030	0.070**
	[0.028]	[0.259]	[0.042]
D. positive expenditures			
$\beta_{small}^{h,r} - \beta_{small}^{w,r}$	0.113	-0.060	-0.173
	[0.288]	[0.363]	[0.199]
$\beta_{large}^{h,r} - \beta_{large}^{w,r}$	-0.156	0.037	0.194
	[0.125]	[0.588]	[0.148]
E. natural log			
$\beta_{small}^{h,r} - \beta_{small}^{w,r}$	0.443	-0.161	-0.604
	[0.341]	[0.609]	[0.310]
$\beta_{large}^{h,r} - \beta_{large}^{w,r}$	-0.729	0.409	1.138*
	[0.117]	[0.216]	[0.056]
observations	367	367	367

Note: Columns 1 and 2 present estimates from separate regressions in which the outcome variable is a transformation of the expenditures on the wife's and husband's private goods, respectively. The outcome in column 3 is the difference between the outcomes in columns 2 and 1. In Panels A through E, expenditures are measured in: Kenyan Shillings, Kenyan Shillings winsorized at the 95th percentile, as a share of total expenditures, an indicator for positive expenditures and 1 plus the natural log, respectively. The main regressors include the interactions between the indicator T_{it}^{j} equal to one if spouse $j \in \{h, w\}$ received a transfer in period t and the indicator D_{it}^{r} equal to one if the husband's realized share of income is greater than the median share observed for the household across weeks in the sample. All regressions also include a household fixed effect, a fixed effect for the survey week and the indicator D_{it}^{r}. Each panel presents post estimation tests. The sample includes households that experience some variation in husband's share of income across survey weeks. Standard errors are clustered at the level of the household and p-values are presented in brackets.
*** p≤0.01, ** p≤0.05, * p≤0.10.

Table 6: Robustness of Empirical Support for Proposition 2

	q_{it}^w (1)	q_{it}^h (2)	$q_{it}^h - q_{it}^w$ (3)
A. Kenyan Shillings			
$\beta_{small}^{h,e} - \beta_{small}^{w,e}$	0.231	22.224	21.993
	[0.979]	[0.189]	[0.237]
$\beta_{large}^{h,e} - \beta_{large}^{w,e}$	-1.864	36.100	37.963
	[0.889]	[0.120]	[0.145]
B. Kenyan Shillings (winsorized)			
$\beta_{small}^{h,e} - \beta_{small}^{w,e}$	-1.830	18.707	20.536
	[0.802]	[0.205]	[0.190]
$\beta_{large}^{h,e} - \beta_{large}^{w,e}$	-10.751	24.590*	35.341**
	[0.220]	[0.056]	[0.017]
C. share of total expenditures			
$\beta_{small}^{h,e} - \beta_{small}^{w,e}$	-0.006	0.013	0.019
	[0.463]	[0.388]	[0.267]
$\beta_{large}^{h,e} - \beta_{large}^{w,e}$	-0.014	0.021*	0.035**
	[0.139]	[0.072]	[0.030]
D. positive expenditures			
$\beta_{small}^{h,e} - \beta_{small}^{w,e}$	0.064	-0.012	-0.076
	[0.365]	[0.752]	[0.363]
$\beta_{large}^{h,e} - \beta_{large}^{w,e}$	-0.239***	0.031	0.270***
	[0.000]	[0.425]	[0.000]
E. natural log			
$\beta_{small}^{h,e} - \beta_{small}^{w,e}$	0.155	0.021	-0.134
	[0.590]	[0.906]	[0.710]
$\beta_{large}^{h,e} - \beta_{large}^{w,e}$	-0.851***	0.217	1.068***
	[0.004]	[0.227]	[0.001]
observations	898	898	898

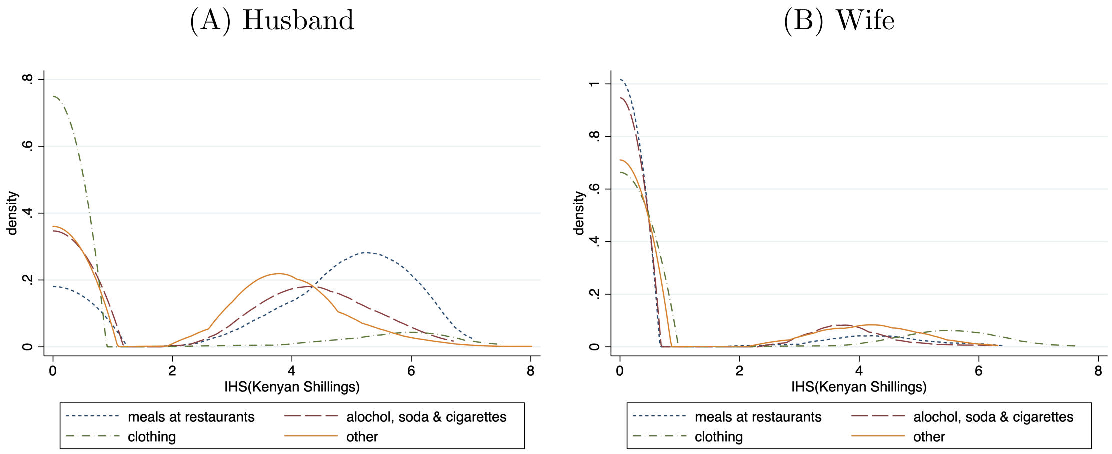
Note: Columns 1 and 2 present estimates from separate regressions in which the outcome variable is a transformation of the expenditures on the wife's and husband's private goods, respectively. The outcome in column 3 is the difference between the outcomes in columns 2 and 1. In Panels A through E, expenditures are measured in: Kenyan Shillings, Kenyan Shillings winsorized at the 95th percentile, as a share of total expenditures, an indicator for positive expenditures and 1 plus the natural log, respectively. The main regressors include the interactions between the indicator T_{it}^j equal to one if spouse $j \in \{h, w\}$ received a transfer in period t and the indicator D_i^e equal to one if the husband's expected share of income is greater than the median share observed across households. All regressions include a household fixed effect and a fixed effect for the survey week. Each panel presents post estimation tests. The sample includes all household by week observations. Standard errors are clustered at the level of the household and p-values are presented in brackets.
*** p≤0.01, ** p≤0.05, * p≤0.10.

Table 7: Test of Proposition 1 with Detailed Expenditure Categories

	Husband's Expenditures				Wife's Expenditures			
	meals at restaurants	alochol, soda cigarettes	clothing	other	meals at restaurants	alochol, soda cigarettes	clothing	other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Test of Proposition 1								
$\beta^{h,r}_{small} - \beta^{w,r}_{small}$	-0.492	0.454	0.275	-0.333	-0.086	0.537**	0.668	-0.489
	[0.301]	[0.176]	[0.561]	[0.443]	[0.801]	[0.047]	[0.152]	[0.189]
$\beta^{h,r}_{large} - \beta^{w,r}_{large}$	0.288	-0.807	0.619	0.306	-0.296	0.152	-1.064**	0.062
	[0.500]	[0.102]	[0.216]	[0.436]	[0.323]	[0.554]	[0.023]	[0.874]
observations	367	367	367	367	367	367	367	367
B. Test of Proposition 2								
$\beta^{h,e}_{small} - \beta^{w,e}_{small}$	-0.180	-0.071	0.308	0.036	-0.068	0.170	-0.160	0.188
	[0.415]	[0.768]	[0.279]	[0.904]	[0.719]	[0.350]	[0.527]	[0.427]
$\beta^{h,e}_{large} - \beta^{w,e}_{large}$	0.504*	0.008	0.295	0.100	-0.053	0.184	-0.217	-0.838***
	[0.064]	[0.975]	[0.245]	[0.712]	[0.594]	[0.406]	[0.422]	[0.001]
observations	898	898	898	898	898	898	898	898

Note: Columns 1-4 present estimates from separate regressions in which the outcome variable is the inverse hyperbolic sine (IHS) of the husband's expenditures on meals at restaurants for self; alcohol, soda and cigarettes; own clothing; and other private items, respectively. Columns 5-8 present estimates for the private expenditures of the wife for these same categories. Panel A and Panel B presents post estimation tests relevant to proposition 1 and 2, respectively. In each regression, the main regressors include the interactions between the indicator T^j_{it} equal to one if spouse $j \in \{h, w\}$ received a transfer in period t and the indicator D^k_{it}. Where k=r for Panel A and k=e for Panel B. And where D^r_{it} is an indicator equal to one if the husband's realized share of income is greater than the median share observed for the household across weeks in the sample. And D^e_i is an indicator equal to one if the husband's expected share of income is greater than the median share observed across households. All regressions also include a household fixed effect and a fixed effect for the survey week. The specifications for Panel A also include the indicator D^k_{it}. In Panel A the sample includes households that experience some variation in husband's share of income across survey weeks. In Panel B The sample includes all household by week observations. Standard errors are presented and parenthese and are clustered at the level of the household. The p-values are presented in brackets.
*** p≤0.01, ** p≤0.05, * p≤0.10.

Figure 8: Types of Private Expenditures



Note: This figure presents kernel density plots of the distribution of expenditures on four categories the husband's and wife's private goods. The four categories include: meals at restaurants; alcohol, soda and cigarettes; clothing; and other. Expenditures are measures as the inverse hyperbolic sine (IHS) of Kenyan Shillings. Panels A and B present the distributions for expenditures on the private goods of the husband and wife, respectively.

categories. Panel A presents results related to proposition 1. The theory predicts that $\beta^{h,r}_{small} - \beta^{w,r}_{small}$ will be zero and $\beta^{h,r}_{large} - \beta^{w,r}_{large}$ will be positive when the outcome is the husband's expenditures and negative when the outcome is the wife's expenditures. For periods with large disparities in realized income, five of the eight estimates of $\beta^{h,r}_{large} - \beta^{w,r}_{large}$ have the predicted sign but only expenditures on the wife's clothing are statistically significant. In contrast, for periods with small disparities in realized income, four of the eight estimates of $\beta^{h,r}_{small} - \beta^{w,r}_{small}$ have the correct sign and the only estimate that is statistically significant has the incorrect sign.

Panel B of Table 7 presents results related to Proposition 2. For households with large disparities in expected income, seven of the eight estimates of $\beta^{h,e}_{large} - \beta^{w,e}_{large}$ have a sign consistent with the theory but only two estimates are statistically significant; a transfer to the husband relative to the wife leads to a relatively larger increase in spending on the husband's private meals while a transfer to the wife relative to the husband leads to a relatively larger increase in spending on the wife's other private goods. In contrast, for households with small disparities in expected income, only four of the estimates of $\beta^{h,e}_{small} - \beta^{w,e}_{small}$ have a sign consistent with the theory but none are statistically significant. Taken together, the results based on the detailed expenditure categories are imprecisely estimated, but the estimates are consistent with Propositions 1 and 2 in the few instances in which they are statistically significant.

5 Conclusion

This paper argues that disparities in spousal income lead to inefficient behavior. I develop a stylized model in which spouses use repeated interaction and threat of future punishment to enforce a spending rule. An efficient spending rule requires couples to fully insure each other against idiosyncratic income risk. However, individuals can deviate from the spending rule and retain control over their own income. In periods in which the gains from deviating from the full insurance allocation exceed the future expected costs, the household is forced to allocate more resources to the spouse with relatively higher income, which represents a violation of full insurance. The gains from deviating are increasing in current income while the future expected costs are decreasing in expected income. Thus, couples are least likely to achieve full insurance when there are large disparities in either the realized or expected income of the spouses. While existing models of limited commitment also predict that disparities in expected income will lead to violations of full insurance, my model is the first to predict that disparities in expected income will produce inefficient outcomes.

I find empirical support for the two key predictions of the model by revisiting data from Robinson (2012). Robinson (2012) conducts a field experiment in Kenya and finds that couples are unable fully insure each other against idiosyncratic income shocks. My theoretical analysis highlights two predictions of the limited commitment model that are not explored in Robinson (2012) and I test them empirically using data from the experiment. Consistent with the predictions of my model, I find that full insurance is rejected only in periods in which there are large disparities between the current income of the husband and wife and for households in which there are large disparities between the expected income of the husband and wife. My results provide the first empirical evidence that disparities in spousal income (realized or expected) lead to inefficient outcomes.

My paper provides new evidence to support the empirical relevance of models of limited commitment. The rejection of full insurance by Robinson (2012) is inconsistent with a model of full intertemporal commitment but is consistent with the predictions of models of no intertemporal commitment or limited commitment. In contrast, the evidence of partial insurance presented in my paper is only consistent with models of limited commitment and is not consistent with the alternative models. Thus, my paper offers stronger evidence to support models of limited commitment and suggests that more fully incorporating models of limited commitment into the study of household behavior is a fruitful area for future research.

In many contexts the most common household structure includes a husband and wife, where the husband represents the primary source of income. There is a general consensus, both within the economics literature and the policy sphere, that this unequal distribution of income limits the power that women have in shaping household-level decisions. Because of this, there are many examples of policies that aim to increase the earned or unearned income of women with the explicit goal of empowering women within the household. The results from my paper highlight another consequence of increasing the relative income of women beyond the improving their relative wellbeing. Increasing the relative income of women, and thus creating a more equal distribution of income within the household, improves total wellbeing by helping spouses to coordinate their actions. This is because couples consisting of a more equal partnership are better able to tackle life's challenges as a collective unit.

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Appendix A Theory

Without loss of generality assume that $\lambda^h < \bar{y}^h$. Furthermore, to simplify notation define $m = \sigma_y\sqrt{3}$, which implies that y_t^i is distributed uniformly between $\bar{y}^i - m$ and $\bar{y}^i + m$.

A.1 Proof of Proposition 1

To prove Proposition 1, I prove the existence and uniqueness of C^h and determine the conditions under which private expenditures depend on the realization of income.

I start by determining the conditions under which full insurance is achieved. Because the gains from deviating are increasing in own income, full insurance is feasible when neither individual has the incentive to deviate from the full insurance allocation when they receive the highest possible realization of income:

$$log(\bar{y}^i + m) - log(\lambda^i) \leq C^i \tag{A.1}$$

for $i \in \{w, h\}$. By assumption this constraint is satisfied for the wife, so I determine when it is also satisfied for the husband. I combine equation 3 with equation 6 to write C^h as a function of itself under the condition that full insurance is achieved,

$$\begin{aligned} C^h &= \delta \int_{\bar{y}^h - m}^{\bar{y}^h + m} [log(\lambda^h) - log(y) + C^h][\frac{1}{2m}]dy \\ &= \frac{\delta}{1-\delta}[log(\lambda^h) + 1 + \frac{\bar{y}^h - m}{2m} log(\bar{y}^h - m) - \frac{\bar{y}^h + m}{2m} log(\bar{y}^h + m)] \end{aligned} \tag{A.2}$$

Combining equation A.2 with equation A.1, implies that full insurance will be feasible when,

$$\frac{\log(\frac{\bar{y}^h + m}{\lambda^h})}{1 + \frac{\bar{y}^h - m}{2m} log(\frac{\bar{y}^h - m}{\bar{y}^h + m})} \leq \delta \tag{A.3}$$

Thus, if equation A.3 holds then the equilibrium is characterized by full insurance and C^h is uniquely determined by equation A.2.

If equation A.3 does not hold, then full insurance is not a feasible equilibrium. I now prove that a unique solution for C^h exists in this case as well. Combine equation 3 and equation 6 to write the following expression for C^h when the incentive compatibility constraint is sometimes binding for the husband but never binding for the wife.

$$C^h(C^h) = \delta \int_{\bar{y}^h - m}^{\lambda^h exp(C^h)} [log(\lambda^h) - log(y) + C^h][\frac{1}{2m}]dy \tag{A.4}$$

I prove that there is a unique value of C^h that solves this expression without explicitly solving for C^h. To do this, I prove that $C^h(0) > 0$, $C^h\big(log(\frac{\bar{y}^h+m}{\lambda^h})\big) < log(\frac{\bar{y}^h+m}{\lambda^h})$ and $\frac{\partial C^h(C^h)}{\partial C^h} < 1$.

Evaluating equation A.4 at zero yields the following,

$$C^h(0) = \frac{\delta}{2m}[\lambda^h + (\bar{y}^h - m)log(\frac{\bar{y}^h - m}{\lambda^h}) - (\bar{y}^h - m)] \tag{A.5}$$

From equation A.5 it follows that $C^h(0) > 0$. To see why, note that $C^h(0) > 0$ is equivalent to, $\frac{\lambda^h}{\bar{y}^h-m} - log(\frac{\lambda^h}{\bar{y}^h-m}) > 1$. The expression $\frac{\lambda^h}{\bar{y}^h-m} - log(\frac{\lambda^h}{\bar{y}^h-m})$ is strictly increasing in $\frac{\lambda^h}{\bar{y}^h-m}$ and is equal to one when $\frac{\lambda^h}{\bar{y}^h-m} = 1$. Therefore, equation A.5 holds for $\bar{y}^h - m < \lambda^h$, which is assumed to be true (if this condition is not met, cooperation fully breaks down and proofs of proposition 1 and 2 are trivial).

Evaluating equation A.4 at $log(\frac{\bar{y}^h+m}{\lambda^h})$ yields the following,

$$C^h\big(log(\frac{\bar{y}^h + m}{\lambda^h})\big) = \delta\Big[1 + \frac{\bar{y}^h - m}{2m} log\big(\frac{\bar{y}^h - m}{\bar{y}^h + m}\big)\Big] \tag{A.6}$$

From equation A.3, it follow that $C^h\big(log(\frac{\bar{y}^h+m}{\lambda^h})\big) < log(\frac{\bar{y}^h+m}{\lambda^h})$ whenever full insurance is not feasible.

Taking the derivative of equation A.4 with respect to C^h yields,

$$\frac{\partial C^h(C^h)}{\partial C^h} = \frac{\delta}{2m}[\lambda^h exp(C^h) - (\bar{y}^h - m)] \tag{A.7}$$

where $\frac{\partial C^h(C^h)}{\partial C^h} < 1$ if $\lambda^h exp(C^h) < \bar{y}^h + m$.

Thus, I have shown that $C^h(0) > 0$, $C^h\big(log(\frac{\bar{y}^h+m}{\lambda^h})\big) < log(\frac{\bar{y}^h+m}{\lambda^h})$ and $\frac{\partial C^h(C^h)}{\partial C^h} < 1$. Because equation A.4 is a continuous function, the single crossing theorem implies that there exists a unique $C^* \leq log(\frac{\bar{y}^h+m}{\lambda^h})$ such that $C^h(C^*) = C^*$.

Thus, when A.3 holds, full insurance is achieved and $\frac{\partial q^i(y_t^i)}{\partial y_t^i} = 0$. When A.3 does not hold, then there exists a unique C^h defined by equation A.4 such that $\frac{\partial q^i(y_t^i)}{\partial y_t^i}|_{y_t^h=x} = 0$ for $x \leq \hat{y}^h$ and $\frac{\partial q^i(y_t^i)}{\partial y_t^i}|_{y_t^h=x} > 0$ for $x > \hat{y}^h$, where $\hat{y}^h \equiv \lambda^h exp(C^h) < \bar{y}^h + m$.

A.2 Proof of Proposition 2

I prove that $\frac{\partial C^h}{\partial \bar{y}^h} < 0$ holds in the two possible equilibria: (case 1) full insurance, when the incentive compatibility constraint of neither the husband nor wife is ever binding and (case 2) partial insurance, when the incentive compatibility constraint of the husband is binding in some states.

Case 1: When A.3 holds then the equilibrium is characterized by full insurance. Taking the derivative of equation A.2 yields,

$$\frac{\partial C^h}{\partial \bar{y}^h} = \frac{\delta}{1-\delta}\left[(\frac{1}{\lambda^h})(\frac{\partial \lambda^h}{\partial \bar{y}^h}) + (\frac{1}{2m})log(\frac{\bar{y}^h - m}{\bar{y}^h + m})\right] \tag{A.8}$$

it is straightforward to show that $\frac{\partial C^h}{\partial \bar{y}^h} < 0$ whenever $\frac{\partial \lambda^h}{\partial \bar{y}^h} < \tilde{\lambda}^i$, where $\tilde{\lambda}^i \leq (\frac{\lambda^h}{2m})log(\frac{\bar{y}^h+m}{\bar{y}^h-m})$.

Case 2: When A.3 does not hold, then the incentive compatibility constraint of the husband binds in periods in which his realized income is sufficiently high. Using equation A.4 we can define the following implicit function,

$$\Psi(C^h, \bar{y}^h) = \delta \int_{\bar{y}^h-m}^{\lambda^h exp(C^h)} [log(\lambda^h) - log(y) + C^h][\frac{1}{2m}]dy - C^h = 0 \tag{A.9}$$

Taking the derivative of equation A.9 with respect to $\bar{y}^h$ yields,

$$\frac{\partial \Psi}{\partial \bar{y}^h} = \underbrace{-\frac{\delta}{2m}\big[log(\frac{\lambda^h}{\bar{y}^h - m}) + C^h\big]}_{<0} + \underbrace{(\frac{\delta}{2m\lambda^h})(\frac{\partial \lambda^h}{\partial \bar{y}^h})\big[\lambda^h exp(C^h) - (\bar{y}^h - m)\big]}_{\geq 0} \tag{A.10}$$

It follows that $\frac{\partial \Psi}{\partial \bar{y}^h} < 0$ when $\frac{\partial \lambda^h}{\partial \bar{y}^h} < \tilde{\lambda}^i$, where $\tilde{\lambda}^i \leq \big[\lambda^h log(\frac{\lambda^h}{\bar{y}^h-m}) + C^h\big]/\big[\lambda^h exp(C^h) - (\bar{y}^h - m)\big]$ and where C^h is defined by equation A.4.

Taking the derivative of equation A.9 with respect to C^h yields,

$$\frac{\partial \Psi}{\partial C^h} = \frac{\delta}{2m}\big[\lambda^h exp(c^h) - (\bar{y}^h - m)\big] - 1 \tag{A.11}$$

where C^h is defined by equation A.4. Because $C^h < log(\frac{\bar{y}^h+m}{\lambda^h})$ it follows that $\frac{\partial \Psi}{\partial C^h} < 0$.

The implicit function theorem implies that $\frac{\partial C^h}{\partial \bar{y}^h} = -\frac{\partial \Psi / \partial b}{\partial \Psi / \partial C^h}$. Thus, $\frac{\partial C^h}{\partial \bar{y}^h} < 0$ when $\frac{\partial \lambda^h}{\partial \bar{y}^h} < \tilde{\lambda}^i$, where $\tilde{\lambda}^i \leq \big[\lambda^h log(\frac{\lambda^h}{\bar{y}^h - m}) + C^h\big] / \big[\lambda^h exp(C^h) - (\bar{y}^h - m)\big]$.

Define $\tilde{\lambda}^h$ as follows,

$$\tilde{\lambda}^h \equiv min\{(\frac{\lambda^h}{2m}) log(\frac{\bar{y}^h + m}{\bar{y}^h - m}), \frac{\lambda^h log(\frac{\lambda^h}{\bar{y}^h - m}) + C^h}{\lambda^h exp(C^h) - (\bar{y}^h - m)}\} \tag{A.12}$$

Then I have shown that if $\frac{\partial \lambda^h}{\partial \bar{y}^h} < \tilde{\lambda}^h$, then $\frac{\partial C^h}{\partial \bar{y}^h} < 0$. It immediate follows that $\frac{\partial \hat{y}^i}{\partial \bar{y}^i} \leq 0$ and $\frac{\partial q^i(y_t^i)}{\partial \bar{y}^i} \geq 0$.

A.3 Definition of $\tilde{\delta}$

Using the same logic to derive the condition in equation A.3, full insurance is feasible when,

$$\frac{\log(\frac{\bar{y}^i+m}{\lambda^i})}{1 + \frac{\bar{y}^i - m}{2m} log(\frac{\bar{y}^i - m}{\bar{y}^i + m})} \leq \delta \text{ for } i \in \{w, h\} \tag{A.13}$$

When the incentive compatibility constraint of the wife is never binding but the incentive compatibility constraint of the husband is binding in some cases, then

$$\begin{aligned} C^w = \frac{\delta}{1-\delta}\Bigg[& \int_{\bar{y}^w - m}^{1-\lambda^h exp(C^h)} log(\frac{1-(1-y)exp(-C^h)}{y})\frac{1}{2m}dy \\ & + \int_{1-\lambda^h exp(C^h)}^{\bar{y}^w + m} log(\frac{\lambda^w}{y})\frac{1}{2m}dy\Bigg] \end{aligned} \tag{A.14}$$

where C^h is defined by equation A.4. To simplify notation, define z such that,

$$\begin{aligned} \frac{1}{z} = \Bigg[& \int_{\bar{y}^w - m}^{1-\lambda^h exp(C^h)} log(\frac{1-(1-y)exp(-C^h)}{y})\frac{1}{2m}dy \\ & + \int_{1-\lambda^h exp(C^h)}^{\bar{y}^w + m} log(\frac{\lambda^w}{y})\frac{1}{2m}dy\Bigg] \end{aligned} \tag{A.15}$$

The incentive compatibility constraint of the wife will never be binding if it is satisfied when she receives the highest possible realization of income. Combining equation A.14 with the incentive compatibility constraint of the wife for this case in which $y_t^w = \bar{y}^w + m$, yields the following,

$$\frac{zlog(\frac{\bar{y}^w+m}{\lambda^w})}{1 + zlog(\frac{\bar{y}^w+m}{\lambda^w})} \leq \delta \tag{A.16}$$

Thus, define $\tilde{\delta}$ as follows,

$$\tilde{\delta} \equiv max\{\frac{zlog(\frac{\bar{y}^w+m}{\lambda^w})}{1 + zlog(\frac{\bar{y}^w+m}{\lambda^w})}, \frac{\log(\frac{\lambda^h+m}{\lambda^i})}{1 + \frac{\lambda^h-m}{2m}log(\frac{\lambda^h-m}{\lambda^h+m})}, \frac{\log(\frac{\lambda^w+m}{\lambda^i})}{1 + \frac{\lambda^w-m}{2m}log(\frac{\lambda^w-m}{\lambda^w+m})}\} \tag{A.17}$$

Then for $\tilde{\delta} \leq \delta$, the incentive compatibility constraint of the wife will never bind and the full insurance equilibrium is achieved when $\lambda^i = \bar{y}^i$.