

Stashing and Reputation: Social Norms in Remittance-Based Intra-Household Bargaining

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24 April 2025

Abstract

Intra-household bargaining significantly influences resource allocation, particularly in remittance-dependent households where geographic separation and asymmetric information complicate trust and cooperation. Prior research highlights unequal resource sharing within households, revealing gender gaps and intra-household poverty despite aggregate household income. These studies emphasize the limitations of traditional models assuming cohabitation and symmetric information. Our paper, however, first models a finitely repeated game between a husband sending remittances and a wife who may stash funds for private consumption. Our analysis, incorporating reputation effects and grim-trigger punishment strategies, identifies a unique perfect Bayesian equilibrium where the wife initially requests high funds but subsequently demands low amounts to sustain trust, with the husband's response varying by type (strategic or grim-trigger). A second, infinitely repeated bargaining model, further reveals "conservative" and "liberal" norms, driven by the wife's type (stasher or strategic) and the husband's trust. We propose extending the model with verification mechanisms to examine monitoring's impact on stashing. Our findings illuminate how reputation and punishment foster cooperative norms in migrant-worker households, offering novel insights into trust dynamics under imperfect information. These insights provide further evidence for intra-household poverty and suggest that poverty alleviation policies should target wives.

1 Introduction

Social norms shape the strategic dynamics of resource allocation within households, particularly in remittance-dependent settings where trust and coopera-

tion are tested by geographic separation. Our study explores a novel scenario where a husband, working remotely, sends funds to his wife, who may stash a portion for private consumption, creating tension over transparency. We model this interaction as a finitely repeated game with complete but imperfect information, drawing on game-theoretic perspectives to examine how reputation as well as punishment foster norms of cooperation or restraint. Our motivation stems from the prevalence of such households in migrant-worker economies, where asymmetric information drives strategic behavior. By analyzing stashing and the husband’s response, we aim to uncover how social norms emerge and stabilize, offering insights into trust dynamics and policy implications, notably those concerning poverty alleviation. We ground our models in Grose and Paternotte (2013), whose findings of social norms in repeated interactions provide a robust theoretical basis for modeling context dependence in our intra-household setting.

Grose and Paternotte provide a critical foundation for understanding social norms through game theory, emphasizing the advantages of repeated interaction models over one-shot frameworks. They argue that repeated games naturally capture norm evolution, as punishment strategies, such as grim-trigger, where defection prompts permanent retaliation, are embedded in equilibrium outcomes. The folk theorem in repeated games generates multiple equilibria, and norms resolve equilibrium selection by making context-specific behaviors salient, such as cooperation in a prisoner’s dilemma. Unlike one-shot models, where norms transform utilities to enforce conformity, repeated interaction models integrate punishment as part of the strategy, aligning with our focus on the husband’s response to stashing, such as reducing remittances. Context dependence is also worth highlighting, especially given that norms shift as agents’ suspicions evolve with observed behavior, complicating predictions about stability. This perspective is ideal for our household scenario, where the wife’s fund requests signal her adherence to cooperative norms, and the husband’s strategies reflect trust dynamics. Their advocacy for repeated interaction models shapes our approach, emphasizing the dynamic interplay of reputation and norms in sustained interactions.

These models will extend Grose and Paternotte’s theoretical framework by applying repeated interaction approach to an intra-household bargaining game centered on stashing and reputation. We model a husband and wife, separated geographically, where the altruistic husband sends high or low funds. The wife, with a private type, requests high or low amounts, and her type may change, reflecting norm evolution. This infinitely repeated game with imperfect information captures reputation effects, as the wife’s requests shape the husband’s trust. By incorporating grim-trigger strategies in one of the models,

we enrich Grose and Paternotte’s approach, exploring how severe punishments influence norm emergence. Our model reforms their framework by tailoring it to a household context, where stashing introduces asymmetric information, and repeated interactions reveal trust or suspicion, yielding ”conservative” or ”liberal” norms. This further suggests that, in public policy, efforts to foster household welfare and alleviate poverty are more effective when financial transfers are directed to the wife rather than the husband as it may better guarantee the effectiveness of the policy.

Our models diverge from traditional baseline approaches to intra-household bargaining, which typically assume cohabitation and symmetric information, focusing on direct resource allocation without hidden actions like stashing. Motivated by Grose and Paternotte, we introduce a modified prisoner’s dilemma with a finitely repeated structure, where the husband’s altruism conflicts with the wife’s strategic restraint, resolved through reputation and punishment. Unlike standard models that emphasize static bargaining or utility maximization, our setup captures dynamic norm emergence under imperfect information, reflecting real-world complexities of remittance-dependent households. The inclusion of the wife’s type changes and the husband’s grim-trigger strategy distinguishes our model from traditional frameworks, which rarely account for reputation-driven norms or costly verification. Incorporating grim-trigger strategies enhances this divergence, modeling credible threats to explore trust dynamics, offering a more nuanced perspective on household interactions and potential public policy decisions regarding household poverty alleviation.

To uncover the underlying nuances of the models, the paper is organized in the following manner: the next section reviews and analyzes the existing literature that directly engages with the topic of intra-household bargaining and remittances. This will be followed by the presentation of the first model of stashing and reputation. The latter will be then complemented by the second model that dissects the players’ behavior in a repeated bargaining setting. The section of a possible extension will then consider the need for including verification mechanisms in both of the analyzed models. The aforementioned sections will be summarized with a conclusion.

2 Literature Review

The need to study household bargaining is informed by its implications and policy relevance. Seminal works such as Browning, Chiappori, and Lewbel (2004), Dunbar, Lewbel, and Pendakur (2013), and Leche, Pendakur, and Wolf (2022) argue that poverty estimation efforts rely on household incomes

to estimate poverty rates, which may lead to underestimation. According to these authors, the underestimation arises from the lack of consideration of intra-household bargaining or resource sharing in poverty estimations which are used to design policies.

Since Becker (1965, 1981), economic theory relies on the "representative household" to model various phenomena. However, there is an unequal distribution of resources within households. Consequently, while households may not be poor, there is evidence of intra-household poverty. Empirical evidence suggests that typically, across generations, males tend to consume more resources than their female counterparts within a household, leading to "missing women" in older generations (Calvi, 2020). Furthermore, intra-household bargaining has implications for health, education, fertility, and labor force participation-related choices. For example, Jayachandran and Pande (2017) find evidence of parents distributing more resources to the first-born, resulting in stunting in later-order born children. Therefore, there is a need to understand intra-household resource sharing, which this paper tries to do.

Browning, Chiappori, and Lewbel (2004) (hereafter, BCL) present a collective household bargaining model to capture changes in intra-household resource sharing due to bargaining power. Using structural models assuming single individuals have the same preferences, the paper non-parametrically identifies resource sharing levels among individuals. Essentially, BCL uses structural modeling to empirically explore the household resource sharing question.

The Dunbar, Lewbel, and Pendakur (2013) (hereafter, DLP) paper tackles the BCL's limitations in its structural form model, which it then leverages to study intra-household resource sharing in Malawi. DLP's structural model estimates a child's well-being as "the total amount of the household's resources consumed by the child" and attempts to design budget share equations for privately assignable goods¹ such as clothing. We borrow this understanding of well-being in designing the spouses' utility functions. DLP finds that children tend to access a large share of resources (20% for the first child) while fathers access larger shares than mothers, with mothers sacrificing more than fathers (evidenced by a transfer of shares with multiple children). Interestingly, DLP finds that if all children are girls, then the mother's share tends to increase as the children's shares fall.

While the DLP paper considers a non-linear model, Lechene, Pendakur, and Wolf (2022) (henceforth, LPW) provide a linear method to estimate resource shares while extending the setup to include single-parent households

¹These are goods which may only be individually consumed, i.e., consumption by one individual hinders consumption of another.

and scale economies for assignable goods. LPW also builds a structural form model and its reduced form linear models that policy makers can easily apply.

All these articles consider variations of Chiappori's (1992) collective household models in which households comprise utility-maximizing individuals who collectively reach the Pareto frontier. This framework enabled the aforementioned papers to develop structural form models that can easily leverage available datasets for empirical research. All the aforementioned papers reject equal sharing within households and reveal gender gaps.

In the present paper, we try to model for intra-household resource sharing using a game-theoretic approach and make a significant departure from the Chiappori (1992) framework. We model two decision-making members and other non-decision-making members with key variations, such as the decision-making members are not in the same geographical location, and one decision-making member stashes a fraction of incoming resources, without any strong focus on household outcomes. This game-theoretic approach helps identify norms that may be guiding decision-making within households.

In this approach, Lundberg and Pollak (2003) and Basu (2006) have helped model the marriage dynamics between the two decision makers in the households of our model.

Lundberg and Pollak (2003) show that when a current decision affects future bargaining power, then inefficient outcomes are more likely. However, such inefficiencies can be avoided if binding commitments are made. In this paper, the authors model a specific question of a couple choosing where to reside such that the location benefits one over the other. This provided insights into a non-cooperative marriage set-up. Lundberg and Pollak focus on a two-stage finite game with extensions such as a one-stage (non-)cooperative game with efficient equilibria. This paper also confirms the intuition that binding commitments are useful in resolving inefficiencies, thereby setting up useful norms.

On the other hand, Basu (2006) used game-theoretic models to study the effect of household decisions on the power balances within households. The paper establishes that there are consumption levels along which households can stabilize in a subgame perfect equilibrium, which may be Pareto sub-optimal. The paper also distinguishes between the "collective household" model and modeling dynamics. Although this paper reiterates the applicability of such results for labor force participation decisions, stashing lies beyond the scope of the paper.

In this study, the game-theoretic intuition for "stashing" comes from Malapit (2012), where a household bargaining model is presented in which cooperative and non-cooperative behaviors may occur simultaneously. The model finds

that individuals are incentivized to stash (hide incomes) when there is limited autonomy and bargaining power.

While these papers support the motivation and intuitions in this paper, Kreps et al. (1982) provide the foundation for adapting the finitely repeated prisoners' dilemma game (with incomplete information) to study stashing and bargaining. Then, Binder and Francois's (2013) game theory-driven discussion on the 'emergence of political accountability' informs the present paper's baseline model with norm-formation.

Kreps et al. (1982) consider the prisoners' dilemma set up to show that in finite repetitions, players will not always play the single-period dominant strategy but will choose to cooperate in some rounds. Such cooperation, they argue, is explained by incomplete information about player(s)' motivations, choices, and behaviors. Players resort to a tit-for-tat strategy in the Kreps et al. (1982) study. The present paper borrows but considers a modified prisoners' dilemma set-up and presents two types for the "husband": the first type is strategic, while the second type is grim-trigger. Similar to Kreps et al. (1982) defining the threshold at which the tit-for-tat strategy is applied, the present paper determines the threshold at which trust breaks down and the husband plays the grim-trigger strategy.

Then, to identify norms, the paper considers two types of the "wife": stasher or strategic. The wife's character is inspired by the politician's character, who must choose to lie (or not) to the voters in Binder and Francois' (2013) "Emergence of Political Accountability". Here, the husband must choose to support or raise suspicion given the wife's reputation, just as the voters choose to verify the politician's claims, given their reputation. However, unlike Binder and Francois (2013), this paper considers a repeated-bargaining, infinite game.

Finally, applied game theory and empirically driven papers, such as Ashraf (2009), Anderson and Baland (2002), Duflo and Udry (2004), and Schaner (2017), helped consider the extension to the models discussed in this paper. These papers will be discussed in the possible extension section.

3 Stashing and Reputation

First, inspired by the aforementioned Grose and Paternotte theoretical framework, we model the strategic interaction of a husband and a wife as a finitely repeated prisoner's dilemma modified to suit the strategic interaction in question. We do so to analyze the reputation effects of the husband on the behavior of the wife in stashing a certain amount of the remittances the husband sends back home. We follow the framework provided in Kreps et al. (1982) with

major modifications in the payoff structure and the strategies of the husband's types. The action set of both husband and wife is $\{L, H\}$. Here, the actions H and L correspond to the request of high and low funds by the wife respectively. And, the actions H and L correspond to the dispatch of high and low funds by the husband respectively. An altruistic husband would prefer to send high amounts of money back home rather than low amounts of money. We thus assume that the husband in the model is altruistic in nature. The wife prefers high amounts of funds to low amounts of funds as stashing is much easier to do so when she receives high amounts of funds. The husband cannot observe stashing and deduces the existence of such stashing based on the wife's actions: if the wife requests high amounts of funds it is taken as an indication for stashing. We assume that the husband takes two private types: strategic or grim-trigger. The strategic type of husband plays like a "standard" player and thus plays rationally in each stage. The grim-trigger type of the husband obeys to the following simple strategy:

1. In the first period $t = 1$ he always plays H .
2. In every period henceforth $t > 1$ he continues to play H as long as the wife chooses L .
3. If in any period t the wife defects to requesting H then the husband switches to playing L from period $t + 1$ henceforth. That is, he keeps playing L indefinitely (from period $t + 1$) if the wife requests H in period t .

We assume that with probability $p > 0$ the husband is of the grim-trigger type and this is drawn by nature.

The payoff table is thus a modified prisoner's dilemma with modification being on the placement of strategies reflecting the above incentives, the game is repeated for a total of T periods. Note that the game differs from the standard prisoner's dilemma payoff matrix as it is no longer symmetric in strategies. This was done to ensure that the husband is altruistic in nature, notice that his dominant strategy is to send high amounts of funds back home, that is, to play H . And, notice that the dominant strategy of the wife is to request for low amounts of funds, that is, to play L , this captures her reluctance to play H and raise suspicions of stashing and provoking the grim-trigger type. We assume that $a > 1$, $b < 0$ and $a + b < 0$, following Kreps et al. (1982). We thus have the payoff table as follows:

We now proceed to solve the above game by first analyzing the one-period play case, then the two-period case, and then the three-period case. We con-

		Wife	
		<i>H</i>	<i>L</i>
Husband	<i>L</i>	(1, 1)	(<i>b</i> , <i>a</i>)
	<i>H</i>	(<i>a</i> , <i>b</i>)	(0, 0)

clude by presenting a general set-up of repeated games in the T period.

One-Period Case

The one-period case is straightforward. As the game is played only once, the wife and the husband (of both types) play according to their respective dominant strategies. Thus, the equilibrium play in this case would be *H* for husband and *L* for wife.

Two-Period Case

In the two-period case we have the following play path:

	<i>t</i> = 1	<i>t</i> = 2
<i>M</i> (<i>GT</i>)	<i>H</i>	<i>X'</i>
<i>M</i> (<i>R</i>)	<i>H</i>	<i>H</i>
<i>W</i>	<i>X</i>	<i>L</i>

Here, *M*(*GT*) refers to the grim-trigger type of the husband, *M*(*R*) refers to the rational type of the husband and *W* refers to the wife. Now, if *X* = *H* then *X'* = *L* will be played for sure by *M*(*GT*). The expected payoff (over the two periods) for the wife in this case would be,

$$EU_W(H) = pb + (1 - p)b + pa + (1 - p) \cdot 0$$

$$\implies EU_W(H) = b + pa$$

Now, if *X* = *L* the *X'* = *H* will be played for sure by *M*(*GT*). The rational type of the husband will play *H* always and the wife plays *L* in *t* = 2 in both cases as if they are their dominant strategies in both cases. The expected payoff (over the two periods) for the wife in this case would be,

$$EU_W(L) = p \cdot 0 + (1 - p) \cdot 0 + p \cdot 0 + (1 - p) \cdot 0$$

$$\implies EU_W(L) = 0$$

Thus, the wife will play $X = H$ in $t = 1$ if and only if $b + pa \geq 0$ holds true. We assume that this condition is true henceforth.

Three-Period Case

We propose the following game play as the equilibrium play and check for deviations:

	$t = 1$	$t = 2$	$t = 3$
$M(GT)$	H	L	L
$M(R)$	H	H	H
W	H	L	L

The total payoff to $M(R)$ from playing H in the first period (and H henceforth) is $a+0+0 = a$; and from playing L in the first period (and H henceforth) is $1+0+0 = 1$ which is lower than a from our earlier assumption $a > 1$. Thus, $M(R)$ would always play H in $t = 1$ and in the next two periods in accordance with his best response. The wife would play L in the second and third periods as it is her best response to the strategies played by both types of husband. The grim-trigger type of husband will stick to playing L in $t = 2$ and $t = 3$. The total expected payoff for the wife from playing H in $t = 1$ and L in the next two periods is as follows,

$$EU_W(H) = \underbrace{pb + (1-p)b}_{t=1} + \underbrace{pa + (1-p) \cdot 0}_{t=2} + \underbrace{pa + (1-p) \cdot 0}_{t=3}$$

$$EU_W(H) = b + 2pa$$

We now check for the wife to deviate in the first period to playing L . The following play will unfold in this case:

	$t = 1$	$t = 2$	$t = 3$
$M(GT)$	H	H	H
$M(R)$	H	H	H
W	L	L	L

In the above sequence of play, both types of the husband play H and the wife plays L in the last two periods as it is her best response to the actions of both types of the husband. Also, the total expected payoff for the wife in this case would be,

$$EU_W(L) = \underbrace{p \cdot 0 + (1-p) \cdot 0}_{t=1} + \underbrace{p \cdot 0 + (1-p) \cdot 0}_{t=2} + \underbrace{p \cdot 0 + (1-p) \cdot 0}_{t=3}$$

$$\implies EU_W(L) = 0$$

Now we see that, clearly $b + 2pa \geq 0$ as we also have that $b + pa \geq 0$ is true. Thus, the wife does not deviate to play L in $t = 1$ and plays H in $t = 1$ always and L in the next two periods.

Now we consider two alternative deviations for the wife: play H in $t = 2$ and play H in $t = 3$, and play L in other two periods. Consider the first deviation, the following play unfolds:

	$t = 1$	$t = 2$	$t = 3$
$M(GT)$	H	H	L
$M(R)$	H	H	H
W	L	H	L

Here, the rational husband will play H throughout as his best response to the wife's actions, and the grim-trigger husband will play L in the last period. The total expected payoff for the wife here is.

$$\underbrace{p \cdot 0 + (1 - p) \cdot 0}_{t=1} + \underbrace{p \cdot b + (1 - p) \cdot b}_{t=2} + \underbrace{p \cdot a + (1 - p) \cdot 0}_{t=3} = b + pa$$

Clearly, the expected payoff for the wife in the proposed equilibrium play is greater than the expected payoff in this case, as $b + 2pa > b + pa$. Therefore, this alternative deviation in $t = 2$ will not be played by the wife.

For the second alternative deviation we have the following sequence of play:

	$t = 1$	$t = 2$	$t = 3$
$M(GT)$	H	H	H
$M(R)$	H	H	H
W	L	L	H

Here, the actions of both types of the husband are justified as explained before. For the wife, the total expected payoff will be,

$$\underbrace{p \cdot 0 + (1 - p) \cdot 0}_{t=1} + \underbrace{p \cdot 0 + (1 - p) \cdot 0}_{t=2} + \underbrace{p \cdot b + (1 - p) \cdot b}_{t=3} = b$$

We know that $b < 0$, thus this alternative deviation will not be played by the wife.

$T > 3$ Period Case

The stage game now repeats for $T > 3$ times. We see from the previous cases that the wife has an incentive to choose H in $t = 1$ itself. Consider the case

when the wife chooses H in $t = 1$ and L for rest of the periods. Here, the total expected payoff for the wife will be,

$$\underbrace{b}_{\text{for } t=1} + \underbrace{(T-1)pa}_{\text{for } t=2,\dots,T} \equiv U_1$$

Now in the case when the wife chooses H in a period $1 < \bar{t} < T$ and L elsewhere, she gets the following total expected payoff,

$$\underbrace{0 + \dots + 0}_{\text{for } t=1,\dots,\bar{t}-1} + \underbrace{b}_{\text{for } t=\bar{t}} + \underbrace{(T-\bar{t})pa}_{\text{for } t=\bar{t}+1,\dots,T} = b + (T-\bar{t})pa \equiv U_2$$

We clearly see that $U_1 > U_2$. Now consider the case when the wife chooses H in all periods. The total expected payoff for the wife will be then,

$$\underbrace{b}_{\text{for } t=1} + \underbrace{(T-1)(p + (1-p)b)}_{\text{for } t=2,\dots,T} \equiv U_3$$

For this extreme case to not hold true as an equilibrium, we must have $U_1 \geq U_3$, that is,

$$\begin{aligned} b + (T-1)pa &\geq b + (T-1)(p + (1-p)b) \\ \implies (a-1)p &\geq b(1-p) \end{aligned}$$

From our earlier assumptions, $a > 1$ and $b < 0$, we see that the above inequality is strictly obeyed, that is, $(a-1)p > b(1-p)$.

Now we check for the husband's deviation from this proposed equilibrium play, for the grim-trigger type of husband he abides by playing L even if the wife plays H once, so he plays L in all periods $t > 1$ in either case and does not violate his strategy rule. For the rational type of husband, he derives a total payoff of a in the proposed equilibrium play and a total payoff of $a \cdot T$ in the extreme case, but he has no choice to avail these payoffs as the wife has no incentive to demand H in all time periods. Thus, he keeps playing rationally and the proposed equilibrium is sustained. Therefore, we have a unique perfect Bayesian equilibrium where the wife demands H in the first period itself and demands L henceforth for all following periods.

Proposition 1 *For a $T > 3$ period repeated game we have a unique perfect Bayesian equilibrium where the wife demands for high funds in the first period and demands low funds for all periods thereafter. The grim-trigger type of husband abides by his strategy rule by sending low funds for all periods $t > 1$, and the strategic type of the husband chooses to send high amounts of funds for all periods, thus abiding by his rational dominant strategy.*

Proof

Proved in text above.

4 Repeated Bargaining

4.1 The Model

Now, with the help of Grose and Paternotte's theoretical findings, we model the strategic situation of remittances between the husband and the wife, who live in urban and rural areas respectively, as a simple infinitely repeated bargaining setup where the wife puts up demands for funds and the husband sends the funds simultaneously. For simplicity, we model the choice of demand of funds and sending of funds as a binary choice: high levels of funds or low levels of funds. In this model the wife now can be of two private types, a stasher or a strategic type. The former type always demands high levels of funds, which enables her to stash some for future private consumption. The latter type acts strategically when making the demand for funds. The husband decides whether to support the demand of funds based on the reputation effects of the wife's demands.

We operate in discrete time, and there are two strategic agents: the husband (that is, the husband m) and the wife (w). Their actions are,

$$\begin{aligned}a_m &\in \{H, L\} \\ a_w &\in \{H, L\}\end{aligned}$$

Evidently, the wife demands either high (H) or low (L) amounts of funds and the husband decides to send the aforementioned levels of funds.

The type of the wife is private, with probability σ_s she is a stasher and with probability $1 - \sigma_s$ she is strategic in the current time period, these probabilities are common knowledge. Both husband and wife have a discount factor of δ . In each time period $t = 1, 2, \dots$ the wife chooses her action and after observing this the husband decides whether to support the wife or not with the required levels of funds. Let $p(a_w)$ be the probability that the husband supports the wife, that is, with probability p we have $a_m = a_w$. Let q be the probability that the rational type of wife chooses action $a_w = H$, that is, here we assume that choosing action H as a way of raising suspicions of stashing taking place. The wife can change her type which when she loses the support of her husband, we assume that with probability π the wife retains her previous period type. Assume that for the wife, $u(H) > u(L) > 0$, where $u(H)$ and $u(L)$ are the per period payoffs from receiving high and low funds respectively, this condition holds for both types.

For the husband, we assume that he is inherently altruistic in nature and thus derives per period benefit from sending money back to home. The husband's per period payoff is denoted by $U(a_w)$. We assume that with every

choice of H by the wife, the per period payoff of the husband reduces by a fixed constant α . This is the disutility which accounts for the gradual loss of trust from the husband's side for his wife. Also, we assume that there is a positive utility gained by the husband when the wife chooses L ; this utility accounts for the gain in trust when the wife requests for low amounts of funds as a signal of humility, denoted by β . So, the per period payoff for the husband is given as,

$$U(a_w) = \mathcal{A} - \mathbb{1}_H(\alpha) + \mathbb{1}_L(\beta)$$

Where, $\mathbb{1}_{a_w}$ is an indicator function which denotes the gain or loss in trust due to the previous period's action of the wife, and $\mathcal{A}$ is the altruistic benefit which he derives from sending funds back home. Also, $\mathcal{A} > 0, 1 > \alpha > 0, 1 > \beta > 0$ and $\mathcal{A} > \alpha, \mathcal{A} > \beta$.

For the husband, the per period payoff from supporting the wife who chooses H (the stasher) is given by,

$$U(H) = \mathcal{A} - \alpha + \delta(p(H) \cdot U(H) \cdot \pi + \bar{U}(1 - \pi p(H)))$$

Here, $\bar{U}$ is the expected payoff from the new type of the wife in the next stage-game. Similarly, the per period payoff from supporting the wife who chooses L is given by,

$$U(L) = \mathcal{A} + \beta + \delta(p(L) \cdot U(L) \cdot \pi + \bar{U}(1 - \pi p(L)))$$

And, the expected payoff from the wife's type in the next period is given by,

$$\bar{U} = [\sigma_s + (1 - \sigma_s)q] \cdot U(H) + [1 - \sigma_s - (1 - \sigma_s)q] \cdot U(L)$$

The above expected payoff is straightforward as with probability $\sigma_s + (1 - \sigma_s)q$ the husband derives utility $U(H)$ and with probability $1 - \sigma_s - (1 - \sigma_s)q$ he derives utility $U(L)$ from the wife in the next period. Note that this expected payoff appears in the flow payoffs of the husband as this is a repeated game setup with complete but imperfect information. The type is revealed only if the wife defects and it changes only if she loses the husband's support.

The husband supports the wife if $U(a_w) > \bar{U}$ and does not support the wife if $U(a_w) < \bar{U}$, otherwise he is indifferent. We see that the husband supports the wife whenever the wife chooses L . That is, we have that $U(L) > \bar{U}$ holds true always. This is proved in the following proposition (see derivations in the *Appendix*).

Proposition 2 *All equilibria must have $p(L) = 1$, that is, $U(L) > \bar{U}$ is always satisfied.*

We now show that the game has two pure-strategy subgame-perfect equilibria which are also stationary equilibria. A stationary equilibrium is one in which the rule of choosing an action is the same in every stage. We see that two norms arise in equilibrium and hold true always. In the first one the strategic wife never chooses H and the husband never supports the wife when $a_w = H$ for both types, we define these norms as **"conservative" norms**, here $p(H) = q = 0$. In the second equilibrium the strategic wife always chooses H and the husband always support this choice, we define these norms as **"liberal" norms**, here $p(H) = q = 1$.

Proposition 3 *There exist two pure-strategy subgame-perfect equilibria, which are stationary in nature, the first defines conservative norms where $p(H) = q = 0$ holds true and the second defines liberal norms where $p(H) = q = 1$.*

4.2 Possibility of Multiple Equilibria

In the above analysis we only focused on pure-strategies and found that two norms exist with respect to the strategic interaction of the request and dispatch of funds from the wife and husband respectively. Interestingly, multiple equilibria may be possible in mixed strategies. We recognize that for our project this remains out of scope as our primary focus was to show the existence of extreme norms thereby suggesting further implications for policy and better understand the bargaining mechanism from the perspective of the husband in this model. The problem can be enriched further by understanding the transition between norms this would entail introducing Bayesian updating and thus incomplete information.

5 Possible Extension

After solving the baseline model of intra-household bargaining, some new extensions can be introduced. One of the most evident limitations in the original game clings to the fact of imperfect information in the repeated game between the stashing wife and the husband residing abroad. Admittedly, there are several studies showing that the husband has a strong preference for monitoring the spent money and hence actively engages in such monitoring. For example, in one field study based in the Philippines, after examining intra-household dynamics, it was found that when spouses lack transparency over financial

decisions like savings and expenditure, they resort to monitoring strategies to align outcomes with their preferences (Ashraf 2009). Making information public also caused shifts from the equilibrium game outcome, leading husbands to allocate funds to consumption rather than saving.

Obviously, given he has preferences over how and whether she spends the received money, there are multiple mechanisms that can be utilized for the husband to oversee the manner in which the wife uses the provided money. It is thus important to introduce verification into the model that stems from empirical evidence on trust and monitoring household resource allocation. One of the ways to impose verification is by considering the implementation of bank accounts in the household. In a case study of Kenyan families with asymmetric information on savings, strategic behavior such as stashing received income ensures resource control on the side of the wife (Schaner 2017). Introducing bank accounts and ATM cards incentivized wives to keep money in hard-to-access accounts to hide it from their husbands. Yet, this still fails to prevent verification as not only joint but also individual bank accounts reduce the cost of monitoring the wife’s actions significantly.

Consequently, after having considered the literature behind it, the aforementioned extension of the model seems like a significant complement to the original model. By incorporating verification, the model will now be able to simulate how costly or cheap monitoring influences the wife’s stashing decisions and the individual welfare of both players.

One needs to ascertain whether the theoretical and practical results are translated into the specific setting with verification as an additional strategy in the game. By integrating it, the model would be able to better explore how the threat of lower remittances affects the wife’s stashing behavior and whether it fosters cooperation or leads to inefficient outcomes due to mistrust.

6 Conclusion

There is a rich body of work that establishes the need and methods for empirically studying intra-household bargaining, such as DLP, BCL, and LPW. Papers such as Basu (2006) provide game-theoretic models to discuss bargaining power but are yet to discuss stashing with norms.

In this paper, we reference Kreps et al. (1982) and Binder and Francois’ (2013) to develop two models. For both of these models, we consider a multi-person household with two decision-makers: a husband and a wife. We consider a case where one of the spouses has migrated out and sends remittances home. Traditionally, husbands tend to migrate for work while wives

are left behind which we follow in our models. Here, the husband must send remittances home. The wife decides how much remittances to request based on household needs.

In the first model, we model for the husband's choices, to send high or low levels of remittances, by using a repeated, modified prisoners' dilemma. In this incomplete information, finitely repeated game, we considered two types for the "husband" - strategic and grim-trigger who chose his strategy as a best response to the wife's reputation. We considered a variety of time periods to find the equilibrium. In the case with t time periods, we found a unique perfect Bayesian equilibrium for $T > 3$ such that the wife demands H in $t = 1$ and L for all other time periods.

In the second model, we developed an infinitely repeating bargaining model with complete and imperfect information. The wife takes two types, that is, she is either a stasher or a strategic player. Through this model, we found two norms that always hold true. In the first equilibrium, the wife never demands high amounts of funds. When she does, the husband does not support her. We call this the "conservative norms". In the second equilibrium, we find that the wife always choose to demand high amounts of funds which the husband supports. We call this the "liberal norms". These norms also constitute the two pure strategy sub-game perfect equilibria. These equilibria are stationary.

These norms hold significant policy implications. In both of the models, the husband is altruistic (derives utility from sending funds home). In the first model, the husband's type determines if the wife can receive high amounts of funds. In the second model, we consider two types of "wife" with only one type of a husband. Yet, here the wife's type is immaterial to whether the husband shares high amounts of funds. More importantly, there are two stable equilibria where the husband will either share high funds with probability one or with probability zero. Thus, the wife's type is immaterial. In the public policy context, it is difficult to determine the husband's type or probability of sending "high" amount of funds. Thus, our results indicate that any policies relying on financial transfers (for example, aid or conditional cash transfers) should transfer funds to the wives' accounts.

However, this paper is exposed to some limitations. First, we consider binary choices when, in reality, financial decisions are quite complex. Second, while we suggest verification mechanisms, we do not apply these to our models. Third, our second model may have multiple equilibria which we are unable to reconcile for uniqueness. The first limitation was considered as a model simplification while we consider the second limitation as an opportunity for future research.

Future studies in this topic area may also consider lab-in-the field and field

experiments to determine the type of norms prevailing in the interest region. Such empirical applications may stem from models with more flexible strategy sets, dynamic time horizons, and active verification strategies.

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Appendix

Proof of Proposition 2

We have,

$$\begin{aligned} U(L) &= \mathcal{A} + \beta + \delta(p(L) \cdot U(L) \cdot \pi + \bar{U}(1 - \pi p(L))) \\ \implies U(L) &= \frac{\mathcal{A} + \beta + \bar{U}\delta(1 - \pi p(L))}{1 - \delta\pi p(L)} \\ \implies U(L) - \bar{U} &= \frac{\mathcal{A} + \beta + \bar{U}\delta(1 - \pi p(L)) - (1 - \delta\pi p(L))\bar{U}}{1 - \delta\pi p(L)} \\ \implies U(L) - \bar{U} &= \frac{\mathcal{A} + \beta - \bar{U}(1 - \delta)}{1 - \delta\pi p(L)} \end{aligned}$$

We see that the right hand side is always positive as $\delta\pi p(L) < 1$ and $\mathcal{A} + \beta > \bar{U}(1 - \delta)$ holds true. Thus, $U(L) > \bar{U}$ holds true.

Proof of Proposition 3

We have,

$$\begin{aligned} U(H) &= \mathcal{A} - \alpha + \delta(p(H) \cdot U(H) \cdot \pi + \bar{U}(1 - \pi p(H))) \\ \implies U(H) &= \frac{\mathcal{A} - \alpha + \bar{U}\delta(1 - \pi p(H))}{1 - \delta\pi p(H)} \end{aligned}$$

Now, for notational simplicity we write $p(H) \equiv p$ and then subtract both sides by $\bar{U}$. We thus have,

$$U(H) - \bar{U} = \frac{\mathcal{A} - \alpha - \bar{U}(1 - \delta)}{1 - \delta\pi p}$$

For conservative norms to hold true, we must have that $p = q = 0$. This condition will be satisfied if and only if the net benefit to the husband from supporting the action H of the wife is negative, that is, $U(H) - \bar{U} < 0$. For this to hold, we see from the above equation that, $(1 - \delta)\bar{U}_c \geq \mathcal{A} - \alpha$ should be true. The expected payoff from the possible new type of the wife under conservative norms is thus,

$$\bar{U}_c = [\sigma_s + (1 - \sigma_s)q] \cdot (\mathcal{A} - \alpha + \delta\bar{U}_c) + [1 - \sigma_s - (1 - \sigma_s)q] \cdot (\mathcal{A} + \beta + \delta\bar{U}_c)$$

Solving for $\bar{U}_c$, and now plugging in $q = 0$, we get,

$$\bar{U}_c = \frac{\mathcal{A} - \alpha\sigma_s + \beta(1 - \sigma_s)}{1 - \delta}$$

Thus, for conservative norms to hold, substituting the value of $\bar{U}_c$ in the condition $(1 - \delta)\bar{U}_c \geq \mathcal{A} - \alpha$ we get,

$$\begin{aligned} \mathcal{A} - \alpha\sigma_s + \beta(1 - \sigma_s) &\geq \mathcal{A} - \alpha \\ \implies \alpha(1 - \sigma_s) + \beta(1 - \sigma_s) &\geq 0 \\ \implies \alpha + \beta &\geq 0 \end{aligned}$$

This condition is always true as we have assumed that $1 > \alpha > 0$ and $1 > \beta > 0$.

Now, for liberal norms we must have $p = q = 1$. This condition will be satisfied if and only if the net benefit to the husband from supporting the action H of the wife is positive, that is, $U(H) - \bar{U} > 0$. And for this to hold true we must have that, $(1 - \delta)\bar{U}_l \leq \mathcal{A} - \alpha$. The expected payoff from the possible new type of the wife under liberal norms is thus,

$$\begin{aligned} \bar{U}_l &= [\sigma_s + (1 - \sigma_s)] \cdot U(H) + [1 - \sigma_s - (1 - \sigma_s)] \cdot U(L) \\ \implies \bar{U}_l &= U(H) \\ \implies \bar{U}_l &= \frac{\mathcal{A} - \alpha + \bar{U}_l\delta(1 - \pi)}{1 - \delta\pi} \\ \implies \bar{U}_l &= \frac{\mathcal{A} - \alpha}{1 - \delta} \\ \implies (1 - \delta)\bar{U}_l &= \mathcal{A} - \alpha \end{aligned}$$

We thus see that the condition required for the existence of liberal norms is satisfied with equality.