Kinship Systems, Gender Norms, and Household Bargaining: Evidence from the Matrilineal Belt *

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Abstract: I examine how broader social structures – in particular, kinship systems – affect intra-household bargaining. In matrilineal kinship systems, lineage and inheritance are traced through female members. I test the predictions of the "matrilineal puzzle," the hypothesis that matrilineal kinship systems decrease spousal cooperation relative to patrilineal systems by creating split allegiances between spouses and by reducing a husband's authority over his wife. I use experimental and physiological measures and a geographic regression discontinuity design along the "matrilineal belt" in Africa to test for greater discord between matrilineal couples. I show that individuals from matrilineal ethnic groups cooperate less with their spouses in a lab game and experience greater stress during game play. Despite less spousal cooperation, I find that children of matrilineal women are healthier and better educated. I explore the channels through which matrilineal kinship systems affect cooperation. First, due to split allegiances between spouses, matrilineal individuals are less altruistic towards their spouse. Second, matrilineal women have greater bargaining power and can therefore cooperate less with their husband without fear of reprisal. The results highlight how broader social structures can affect the bargaining process within the household. Additionally, at relatively low levels of women's empowerment, there may be a trade off between increasing women's bargaining power and household efficiency.

Keywords: Kinship systems, household bargaining, culture, gender.

JEL Classification: D13, N47, J16, Z13.

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1. Introduction

Large gaps in outcomes between men and women exist in many developing countries. Women often have less education, poorer health, limited autonomy, and are subjected to physical and emotional violence. One factor that may contribute to the lower status of women is social structure, particularly if social structure affects bargaining within the household. Social structure refers to norms governing how people, families, or societies are organized. A kinship system is an example of a social structure that determines how families trace group membership, descent, and inheritance. Anthropologists have long studied the variation in kinship systems and the implications of these systems for societal outcomes, but economists are just beginning to understand how kinship structure matters for women's outcomes (Alesina et al., 2016; LaFerrara and Milazzo, 2014; Gneezy et al., 2009).

Kinship systems determine the set of people to whom an individual is considered related and their social obligations to this set of people (Radcliffe-Brown, 1950). An important element of a kinship system is the determination of descent.[1] In *unilineal* descent systems, kin are defined using only one of the two parents (Fox, 1934). *Matrilineal* kinship systems, which are prevalent in Central Africa, are a type of unilineal descent system. In matrilineal kinship systems group membership and inheritance are traced through the female members. Individuals are part of their mother's kinship group and inheritance is restricted to the children of the female members of the group. In contrast, in *patrilineal* systems individuals are part of their father's kinship group and inheritance can only be passed on to children of male group members. Importantly, matrilineal systems are not symmetric with patrilineal systems, because in patrilineal systems, a wife is effectively incorporated into the lineage of her husband, while in matrilineal systems, husbands and wives maintain strong allegiances with their own (different) lineages.

This paper examines how matrilineal kinship systems affect intra-household cooperation relative to patrilineal kinship systems. Anthropologists have long puzzled over the stability of matrilineal systems, arguing that matrilineal systems create conflicting allegiances within the household (Fox, 1934). A husband in a matrilineal society has allegiances to his sisters, whose children he may support because they are his heirs, and the wife has allegiances to her brother, who provides her and her children with support. Additionally, matrilineal lineage systems un-

[1] Most Western societies practice *cognatic* descent, in which kinship ties are traced through both parents. An individual considers people related through their mother and through their father to be kin.

dermine men's authority over their spouses. In matrilineal societies a woman's children belong to her lineage, not to her husband's lineage. Thus, relative to patrilineal societies, women maintain greater control over their children. Having the children as part of a woman's lineage may increase the value of her outside option and increase her relative bargaining power. A large literature in anthropology suggests that matrilineal systems reduce spousal cooperation, a hypothesis which I test formally (Radcliffe-Brown, 1950; Gluckman, 1963; Richards, 1950; Douglas, 1969).

To examine the relationship between matrilineal kinship systems and cooperation within the household, I collected data from 320 matrilineal and patrilineal couples in the Democratic Republic of Congo (DRC). The DRC is intersected by the "matrilineal belt," which describes the distribution of matrilineal ethnic groups across the center of Africa. The data are collected in a major city in the south of the DRC, where there are many matrilineal and patrilineal ethnic groups. The individuals come from villages along the border of the matrilineal belt, but they share a common institutional setting presently. Approximately 40% of the sample are from a matrilineal ethnic group.

I use laboratory experiments to measure cooperation within the household. I find that matrilineal individuals - both men and women - cooperate less with their spouses in a household public goods game. These results are driven by opportunities to hide income. When partnered with a stranger of the opposite sex, matrilineal individuals no longer differentially respond to opportunities to hide income, suggesting that the differential cooperation by matrilineal couples is behavior specific to being paired with a spouse and not more general to cooperation with a stranger of the opposite sex. To address identification concerns, I estimate a geographic regression discontinuity specification along the matrilineal belt border. The geographic RD results are consistent with the OLS results: matrilineal individuals cooperate less with their spouse and therefore earn less money in the lab experiment relative to patrilineal individuals.

Additionally, I collect physiological data during game play to provide complementary evidence of greater discord between matrilineal couples. A random subset of respondents completed ultimatum games with their spouse and with a stranger of the opposite sex in a lab environment while wearing equipment designed to monitor electrodermal activity (EDA). I find that when matrilineal individuals are paired with their spouses they experience greater stress responses than patrilineal individuals as measured by an increase in skin conductance. Matrilineal individuals do not exhibit greater stress when they are paired with strangers of the opposite sex. These results

provide physiological evidence that matrilineal individuals exhibit greater stress when engaged in bargaining interactions with their spouses.

Importantly, although I find evidence in favor of less cooperation between matrilineal spouses, I also find evidence of matrilineal women being better able to enact their preferences. Children of matrilineal women are actually healthier and better educated relative to children of patrilineal women. I find similar patterns using Demographic and Health Survey data for the DRC. Women from matrilineal areas have fewer children that have died and their children have more years of education.

I identify two potential channels for how matrilineal kinship systems decrease cooperation between spouses. These channels are related to particular structural features of matrilineal kinship systems. First, matrilineal individuals may have less altruism toward their spouse because they maintain strong allegiances to their own lineage. I find that matrilineal individuals give less money to their spouse in a dictator game relative to patrilineal individuals. Whereas patrilineal individuals are more generous with their spouses than they are with strangers, matrilineal individuals treat their spouses similarly to how they treat strangers. In a non-cooperative model of contributions to a public good, lower levels of altruism lead to smaller contributions to the public good.

Second, matrilineal women appear to have more bargaining power, consistent with the hypothesis that matrilineal systems reduce a husband's authority over his wife. I use a non-cooperative bargaining model to demonstrate how increasing a woman's bargaining power may actually lead her to invest less in a public good if, as her bargaining power increases, she faces less fear of reprisal for investing in her private good. In this model, her contribution is minimized as bargaining weights are equalized between husband and wife. In contrast, a husband's contribution is always increasing in his bargaining weight. I present evidence from an ultimatum game and survey questions that suggest matrilineal women have more bargaining power than patrilineal women. I use DHS data to show that women from matrilineal areas in DRC report greater autonomy in decision making and face lower threat of domestic violence.

This paper is related to several literatures in economics, including literatures on the relationship between cultural norms and outcomes for women, on the economics of the family, and on women's empowerment. In a recent review article, Jayachandran (2015) suggests a variety of cultural practices may affect outcomes for women, such as patrilocality (the practice of living near

the groom's parents after marriage), payment of bride price or dowry, and patrilineality. There is a growing literature that examines the effects of some of these specific cultural practices (Alesina et al., 2016; Ashraf et al., 2016; Bau, 2016; Gottlieb and Robinson, 2016; LaFerrara and Milazzo, 2014). I focus on a region where many different ethnic groups share a similar geographic setting and history. By comparing individuals along the matrilineal belt, I am better able to isolate the effect of matrilineal kinship on spousal cooperation. The paper is also related to the literature on observed inefficiencies in the household. For example, Udry (1996) finds that household agricultural production does not meet the Pareto-efficient assumption of collective models of the household. Recent lab experiments have also rejected productive efficiency in a variety of settings including Ethiopia, Uganda and India (Kebede et al., 2013; Iversen et al., 2011; Castilla, 2013). Finally, this paper relates to the literature on the relationship between economic development and outcomes for women (Duflo, 2012; Doepke and Tertilt, 2014), by providing evidence that increasing women's bargaining power may actually decrease spousal cooperation, but may have positive benefits for investment in children.

The remainder of the paper is organized as follows. Section 2 defines matrilineal kinship and describes its origins and practice. Section 3 describes the data collection process and the experimental design. Sections 4 presents the OLS and geographic RD results. Section 5 presents the physiological results. Section 6 examines the implications of matrilineal kinship systems for child outcomes using survey and DHS data. Section 7 outlines a non-cooperative model of contributions to the public good under threat of violence. Section 8 explores channels and Section 9 concludes.

2. Background

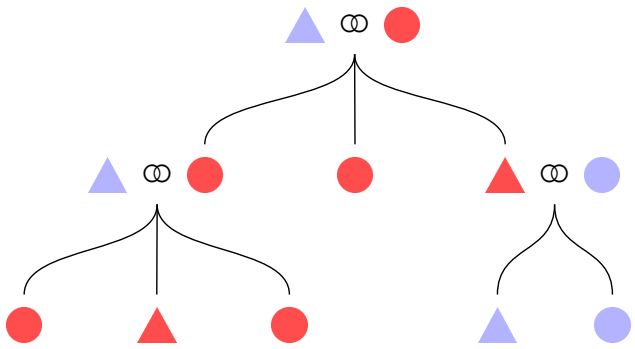
2.1. What are matrilineal kinship systems?

In matrilineal kinship systems, individuals trace lineage and descent through women. Biologically, of course, an individual is related to family on both the mother's side and the father's side; however, in matrilineal systems individuals are considered kin only if they share a common female ancestor. Figure 1 illustrates the structure of matrilineal kinship systems. In the diagram, men are represented by triangles and women are represented by circles. Membership in the same matrilineal group is denoted with red. Children are in the same matrilineal group as their

mothers. Likewise, a mother is in the same matrilineal group as her male and female siblings. In many matrilineal societies, the mother's brother has an important role relative to his sister's children. His inheritance and lineage will be traced through his sister's children, and he has obligations to financially support her children. Importantly, husband and wife do not share the same lineage - for all married couples one spouse is blue and the other spouse is red.

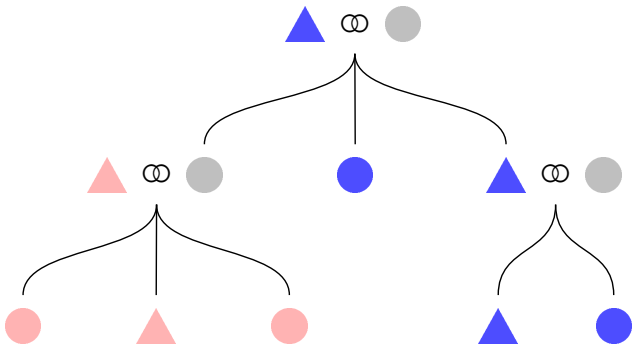
Figure 2 presents the structure of patrilineal kinship. Now, children are in the same group as their father, as denoted in blue. In a patrilineal society, rather than maintaining strong ties with her own lineage, a woman is effectively incorporated into the lineage of her husband upon marriage. This is because once she is married, she is not relevant for determining descent and inheritance for her lineage. This is illustrated in the patrilineal kinship diagram by the married women denoted in grey, while the unmarried daughter shares the same color as her father.

Figure 1: Diagram of Matrilineal Kinship



Legend: ▲ = Males, ● = Females, ●/▲ = Same Matriliny

Figure 2: Diagram of Patrilineal Kinship



Legend: ▲ = Males, ● = Females, ●/▲ = Same Patriliny

The kinship groups defined by matrilineal or patrilineal systems are often important in sub-Saharan Africa. They form a basic political unit in which members recognize each other as kin and often have certain obligations toward each other (Fox, 1934). For example, members of the same matrilineal group may share land and may contribute to bride price payments for lineage members. They may also provide financial support in the form of school fees or burial payments. Thus, membership in a matrilineal or patrilineal society determines your obligations and privileges relative to your kin group.

Matrilineal groups are relatively rare. Of the 1267 societies in the Ethnographic Atlas, only 12 percent are matrilineal (while 46 percent are patrilineal).[2] Within sub-Saharan Africa, 15 percent of the 527 societies in the Ethnographic Atlas are matrilineal and 70 percent are patrilineal. The vast majority of these matrilineal societies are distributed across the center of Africa in the so called "matrilineal belt" (Richards, 1950, p.207). The matrilineal belt intersects present day Angola, Republic of Congo, DRC, Gabon, Malawi, Mozambique, Namibia, Tanzania and Zambia. Figure 3 illustrates the matrilineal belt across Africa, with matrilineal groups denoted in blue, patrilineal groups denoted in green, and bilateral and other groups in beige. For more information on the historical development and spread of matrilineal kinship systems in sub-Saharan Africa, see Appendix A.

Historically, matrilineal kinship systems are correlated with other cultural traits. Table 1 shows

[2]The Ethnographic Atlas is a data set compiled by George Murdock that documents the practices and customs of various societies across the world.

some of the traits that are correlated with matrilineality within Africa in the Ethnographic Atlas. The table presents traits that other work in economics has shown to be important for development, including: bride price, residence after marriage, jurisdictional hierarchy, plough use, and presence of animal husbandry (Ashraf et al., 2016; Bau, 2016; Michalopoulos and Papaioannou, 2013a; Michalopoulos et al., 2016; Alesina et al., 2013, 2016; Alsan, 2015). Not surprisingly, matrilineality is highly correlated with *matrilocal* residence patterns, which is when a couple lives in the same village as the bride's mother's kin group.[3] Historically, matrilineal groups are less likely to pay bride price, to use the plough, or to rely on animal husbandry. There is no difference in levels of jurisdictional hierarchy between matrilineal groups and other groups.

Figure 3: Ethnic Group Boundaries and Matrilineal Belt



To motivate the study of matrilineal and patrilineal ethnic groups near the border of the matrilineal belt, Panel B of Table 1 presents the same historical correlates of matrilineality restricting the Ethnographic Atlas observations to those ethnic groups that can be matched to groups in

[3]There are many potential living arrangements after marriage. In *matrilocal* (or *uxorilocal*) groups, couples live in the same village as the bride's mother's group. A type of uxorilocal residence pattern is *avunculocal* residence, in which the couple lives in the village of the bride's maternal uncle. In *patrilocal* (or *virilocal*) groups, couples live in the same village as the groom's father's group. In *natolocal* groups couples stay in their natal homes on marriage, and in *neolocal* groups they establish a new residence upon marriage (Fox, 1934)).

Table 1: Historical Correlates of Matrilineality

	Panel A: All of Africa				
	Matrilocal Residence	Bride Price	Jurisdictional Hierarchy	Plough Use	Animal Husbandry
	(1)	(2)	(3)	(4)	(5)
Matrilineal	0.643***	-0.228***	-0.172	-0.0578***	-0.831***
	(0.054)	(0.056)	(0.110)	(0.022)	(0.192)
Observations	527	527	472	527	500
Mean Dep. Var.	0.104	0.831	2.201	0.074	2.516
	Panel B: Sample Ethnic Groups				
	Matrilocal Residence	Bride Price	Jurisdictional Hierarchy	Plough Use	Animal Husbandry
	(1)	(2)	(3)	(4)	(5)
Matrilineal	0.900***	-0.200	-0.375	0	0.125
	(0.102)	(0.136)	(0.837)	(0)	(0.127)
Observations	15	15	10	15	13
Mean Dep. Var.	0.600	0.867	2.700	0	1.077

Notes: Robust standard errors are in parentheses. The data are from the Ethnographic Atlas and are restricted to groups in Africa in Panel A and to ethnic groups in my sample in Panel B. Matrilineal is an indicator variable equal to 1 if the society has inheritance and descent traced through women. The other types of descent systems include patrilineal, bilateral, duolateral, ambilineal, quasi-lineages and mixed. *Matrilocal Residence* is an indicator variable equal to 1 if the society has avunculocal, uxorilocal or matrilocal residence patterns. *Bride price* is an indicator variable equal to 1 if the society has bride price. This does not include token bride price or bride service. *Jurisdictional hierarchy* is coded from 0 to 4, with 0 being no levels of political hierarchy to 4 being a large state. *Plough use* is an indicator variable equal to 1 if the society had the plough prior to colonialism or adopted it subsequently. *Animal husbandry* is coded from 0 to 9, corresponding with percentage dependence on animal husbandry. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

the study sample.[4] In the restricted sample many of the differences observed in Panel A are no longer statistically significant, though the sample size is also quite a bit smaller. Reassuringly, the magnitudes on the coefficients are also small. Although, matrilineal ethnic groups are still more likely to be matrilocal historically, this is less relevant for individuals in the study sample, since all of the respondents now live in a common urban environment away from their villages of origin. Additionally, survey data confirm that most individuals in the sample practiced *neolocal* residence after marriage, moving to a location different than that of either spouses' families. Finally, while matrilineal groups were less likely to pay bride price historically, it is now the custom for all ethnic groups in the study sample to pay bride price. There are no differences in amount of bride price paid between matrilineal and patrilineal individuals in my sample.[5]

2.2. *The Matrilineal Puzzle*

Much of the early anthropological scholarship on matrilineality focused on the so called "matrilineal puzzle". The matrilineal puzzle is the hypothesis that matrilineal kinship systems decrease spousal cooperation, and therefore it is puzzling to observe them as a kinship system. Anthropologists note that matrilineal systems (1) split an individual's allegiance between their spouse and their lineage and (2) undermine male authority. First, in patrilineal systems, women effectively relinquish membership in their own lineage to be *de facto* members of their husband's lineage. However, in matrilineal systems both partners retain strong ties with their own lineages. This leads to split allegiances within a matrilineal household. Second, given requirements of *exogamy*, or marrying outside of the kinship group, a woman produces children with a man outside of her group, but these children are to belong to her lineage, rather than her husband's lineage. Thus, a husband in a matrilineal society does not have the same authority and control over his wife or children as a husband in a patrilineal society, in which the children are members of the husband's group. As Richard's writes in her work on matrilineality among the Central Bantu, "the matrilineal system makes for certain elements of conflict for which some kind of

[4]Not all ethnic groups in my sample can be matched to an observation in the Ethnographic Atlas. This is for two reasons. First, the Ethnographic Atlas sometimes aggregates smaller groups into a larger ethnic group. Additionally, some groups in my sample are just not represented in the Ethnographic Atlas.

[5]The survey data confirm that the payment of brideprice is a common practice for all ethnic groups. In the survey data, men report whether they paid brideprice and how much they paid. Almost all couples (99%) report having paid bride price.

solution has to be found. The problem...is the difficulty of combining recognition of descent through the woman with the rule of exogamous marriage" (1950).

The notion that a system that undermines a man's authority over his wife is puzzling requires both the assumption of male dominance and the assumption that the nuclear family is the elementary unit of the household. Richards writes:

> "There is the further difficulty that in most societies, authority over a household...is usually in the hands of men, not women, as are also the most important political offices. Thus any form of [marriage in which the husband lives with wife's family] means that an individual of the dominant sex is...in a position of subjugation in his spouse's village, and this is a situation which he tends to find irksome and tries to escape from." (Richards, 1950, p.246)

In this example, the husband, the presumed dominant partner in the household, would find it distasteful to live with the wife's extended family and therefore would not want to do it. Without the assumption of male dominance, matrilineal kinship systems are no more puzzling than patrilineal kinship systems, where women generally live with the family of their husband and are effectively incorporated into their husband's lineage. Additionally, Mary Douglas writes,

> "Underlying [analyses of matrilineality] is the implicit assumption that the elementary family is the basic, universal unit of society. If matriliny divides the elementary family, and if the latter is taken to be the most viable unit of kinship in the modern world, the outlook for matriliny may indeed by dim." (1969, p. 125)

challenging the assumption that the integral unit of the family is a husband, a wife and their children. This argument highlights that in matrilineal systems, the roles of brother, uncle, sister, and aunt may be relatively more important than in patrilineal societies.

The matrilineal puzzle captures several important features of matrilineality. First, the allegiances of both husband and wife are split between the marriage and natal kin. Though a wife and husband share a bond and children, they must rely on their natal kin for their lineage and inheritance. These conflicting allegiances can lead to tensions within the marriage. Gluckman writes:

> "Hence in matrilineal societies where [a wife] bears children mainly for her own blood-kin, her wifely bond is weak. Divorce is frequent; women are liable to side with their brothers against their husbands. A man trusts his sister, and not his wife: Your sister is always your sister; tomorrow your wife may be another man's wife." (Gluckman, 1963, p.74)

According to this argument, matrilineal systems may lead to weaker bonds between husband and wife than in patrilineal systems, but to stronger bonds between brother and sister.

Second, matrilineality undermines a man's authority over his wife and children relative to patrilineality. As Gluckman writes,

> "what happens in a matrilineal society is that [the rights to a woman as a wife and the rights to a woman as a child-bearer] are held by different sets of men. The woman's kin transfer to the husband, often in return for gifts, rights in her as a wife...they also retain in her rights a child-bearer" (1963, p.73).

A man's children do not belong to him, but to his wife's lineage. He therefore faces competition from his wife's brothers and parents for control over the wife and the children. Relative to a patrilineal man, he has less control over his wife and children. The anthropological literature on the matrilineal puzzle highlights that particular structural features of matrilineal kinship systems undermine cooperation between spouses. I test empirically whether matrilineal individuals cooperate less with their spouses and what the implications of this are for children in the context of the DRC.

3. Data Collection

Data for the project were collected between June and October of 2015 in Kananga, the capital of Kasai Central province in the DRC. Kananga is a city of over a million people. The most populous ethnic group in the city is the Luluwa, a patrilineal ethnic group. However dozens of other ethnic groups are represented in the city. By collecting data in the provincial capital, rather than in smaller villages, I can ensure that couples are in a similar institutional environment today. It also means I have access to a broader range of ethnic groups.

3.1. Sampling

Individuals were selected for participation in the study using both random and targeted sampling methods within the city of Kananga (see Appendix B for additional details on the sampling strategy). Individuals selected to participate in the study after an initial screening survey were re-visited at their homes by a team consisting of one male and one female enumerator. The enumerators asked the husband and wife if they would like to participate in the study. Ultimately,

320 individuals from the screening survey were able to participate in the study, yielding a sample of 640 individuals.[6]

The final sample consists of 28 tribes, 13 of which are matrilineal. The largest patrilineal groups represented in the sample are the Luluwa, Luntu, Luba, Tetela, Songe, Bindi and Dekese. The largest matrilineal groups represented in the sample are the Kuba, Sala, Mbala, Kete, Lele, Chokwe and Kongo. Thirty nine percent of the sample reported being from a tribe identified as matrilineal. The remaining individuals are from patrilineal groups. In 47 percent of the sample, patrilineal individuals were married to other patrilineal individuals. Twenty five percent of the sample was in a fully matrilineal marriage (where both partners are from a matrilineal society) and 28 percent were in a mixed marriage, where one partner was of matrilineal descent and the other of patrilineal descent. Figure 4 presents a map of the locations of the villages of origin for the sample and the location of the field site, Kananga.[7] The villages of origin are coded in blue for those who identify as from a matrilineal ethnic group and in green for those who identify as from a patrilineal ethnic group. The map also includes the delineation of the matrilineal belt, a border that separates matrilineal groups, which are in blue, from patrilineal groups, which are in green.

3.2. Experimental Visits

Couples were visited at their homes three different times by a team of enumerators. Each team of enumerators comprised one male enumerator and one female enumerator. In the first visit, participants completed a long survey. This survey had questions on demographics, economic activities, land ownership, family history, and a child roster. During the second visit, individuals played two versions of the dictator game (DG), three versions of a household public goods game (PG) and completed a second shorter survey. The wife and husband completed the second visit simultaneously, with a female enumerator meeting with the wife and a male enumerator meeting with the husband. This helped ensure the privacy of the respondent and prevent coordination in

[6] I selected 442 individuals who reported being in a monogamous marriage in a screening survey to ask them (and their spouses) to participate in the study. Of these 442 individuals selected to be in the sample, 223 were from matrilineal groups and 219 from patrilineal groups. Of these 442 individuals, 320 of them and their spouses agreed to participate. Individuals were unable or ineligible to participate for a variety of reasons. The primary reason for not participating is that one spouse was traveling for an extended duration. Other reasons for not participating include: illness, death, a spouse who lives outside of Kananga, divorce, or inability to locate.

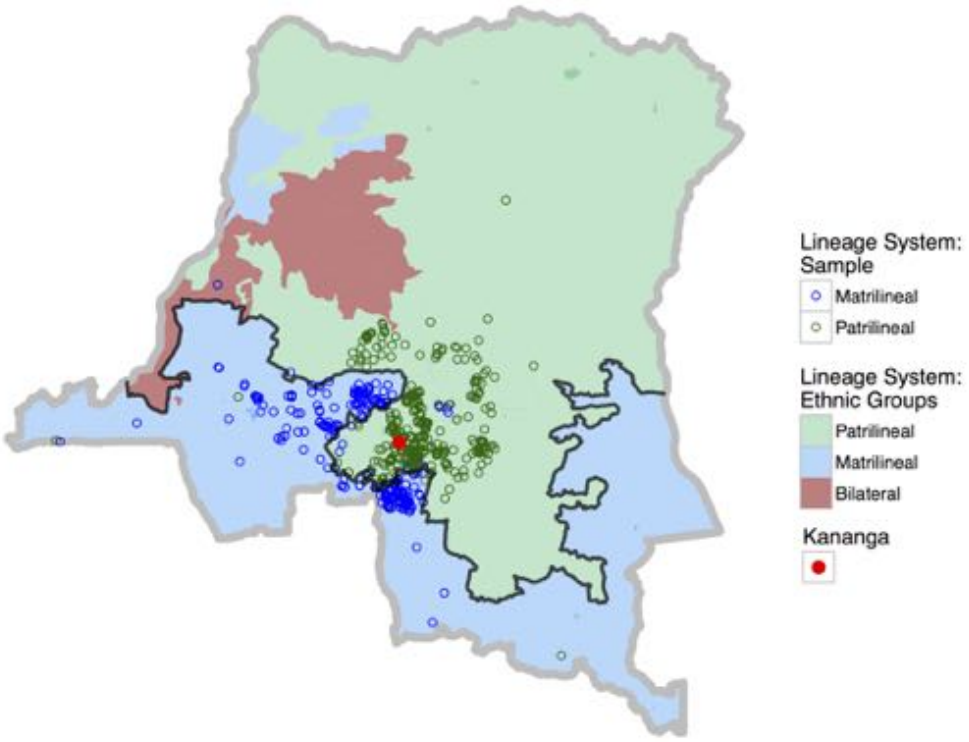
[7] Village of origin is a well understood concept in this context. It does not necessarily mean where an individual was born, but rather where an individual's family come from. It can be thought of as their ancestral village.

Table 2: Ethnic Groups in Sample

Matrilineal Groups		*Patrilineal Groups*	
Name	Count	Name	Count
Bunde	5	Bindi	37
Chokwe	18	Dekese	29
Kete	32	Kuchu	3
Kongo	18	Kusu	1
Kuba	52	Luba	44
Lele	28	Luba Katanga	1
Lualua	10	Luluwa	135
Lunda/Rund	3	Luntu	51
Mbala	35	Mfuya	4
Pende	6	Nyoka	2
Sala	38	Songe	37
Yansi	4	Tetela	40
Suku	1	Other	6
Total	250	**Total**	390

Notes: The "Other" patrilineal tribes not listed in the table are: Angola, Mongo, Nyambi, Nyoka, and Orendo.

Figure 4: Matrilineal Belt and Villages of Origin for Sample



game play. The order of DG and PG game play was randomized across participants, as was the order of the versions of each game. The randomization of game order was stratified on gender and on matrilineal status. All questions pertaining to views on marriage and gender were asked in the second survey after participants had completed the experiments to avoid priming game play with the survey questions. The surveys and activities were administered in either French or Tshiluba, the languages spoken in this area of DRC.

In the final visit, individuals completed two versions of the ultimatum game (UG), a gender Implicit Association Test (IAT), and a third short survey module. The majority of the sample completed the third visit at their homes, as they had done for the previous two visits. However, a subset of the sample was invited to a laboratory to complete the third visit. The lab was an office space in the center of the city of Kananga. The lab was set up to allow for the collection of physiological data during game play. Participants wore devices designed to record physiological responses while making their experimental decisions. These devices recorded data on heart rate, electro-dermal activity, temperature, and movement. Of the 614 individuals that completed the third visit, 172 completed the third visit in the lab. The remaining 442 individuals completed the third visit in the field. Of the initial sample of 640 individuals, 26 people (or 13 couples) did not complete the third visit for various reasons (primarily traveling outside of Kananga during this round of data collection).[8]

3.3. Summary Statistics

Individuals from matrilineal and patrilineal ethnic groups may vary on important dimensions. Therefore, Table 3 presents basic summary statistics on the sample respondents broken down by matrilineal and patrilineal and by sex. On average, the patrilineal sample is slightly older than the matrilineal sample. Patrilineal individuals have been married slightly more times, though there is no difference in the number of current wives across matrilineal and patrilineal individuals.[9] Though brideprice is traditionally associated with patrilineal ethnic groups, today most ethnic groups pay bride price. Virtually everyone in the sample reports having paid a bride price for

[8]For a table summarizing the timing of visits, the activities and surveys done in each visit, and the timing of the payments, see Appendix B Table 3.

[9]Polygamy is common in this area. I specifically recruited monogamous couples, but ended up with several polygamous couples in the sample because women generally report they are in a monogamous relationship, even if their husband has multiple wives. A total of 13 couples are in a polygamous marriage. See Appendix C.2 for robustness checks controlling for polygamy.

their wife. One of the primary differences between matrilineal and patrilineal individuals in the sample is years of education. Matrilineal individuals have on average 11 years of education relative to 9 years of education for patrilineal individuals. There are no significant differences in age at which married spouse, current employment status or weekly income.

Additionally, I examine migration characteristics for individuals in the sample. Matrilineal individuals are less likely to have been born in Kananga and have lived more years in their village of birth. They are more likely to have migrated to Kananga because of education opportunities, rather than other reasons for migration. Importantly, they are no more likely to have migrated to Kananga because they are an outcast, because of a disagreement, or to be with family, reasons that could feasibly be correlated with cooperation (see Table 2 in Appendix B for more details on reasons for migration).

3.4. Experimental Design

Respondents participated in three types of experiments, a dictator game (DG), a public goods game (PG), and an ultimatum game (UG). The PG is similar to a standard public goods game, but with some modifications meant to reflect the cooperation problem that couples face on a daily basis. In the most basic variation of the PG, couples met with an enumerator of the same sex and were separated from each other physically. The enumerator then explained the rules of the game in either French or Tshiluba and asked a series of test questions to ensure that the respondent understood the game. Respondents were given an initial endowment of 1,000 CF, which is equivalent to approximately one US dollar. Unlike a standard public goods game, they were then given the opportunity to roll a die with three black sides and three white sides. They were told if they rolled the die and saw the black side, they would receive a "bonus" of 500 CF. Thus, those who rolled the die and saw a black side received a total endowment of 1,500 CF to use in the game. The rest received the standard endowment of 1,000 CF. The outcome of the die roll was private knowledge, i.e. the respondent's spouse would not know whether the respondent received an initial endowment of 1,000 CF or 1,500 CF. The spouses did know that their partners were given the opportunity to roll the die however, and so they know that with 50% probability their partner received 1,500 CF. The endowment was given in increments of 100 CF bills (so either 10 bills or 15 bills depending on the outcome of the die roll).

Table 3: Sample Summary Statistics

Panel A: All of Sample

	Matrilineal	**Patrilineal**	SE	(p-value)
Age	39.5	41.6	1.192	0.088
Age Married	23.2	22.9	0.566	0.606
Age Lived with Spouse	23.3	22.9	0.545	0.517
Number of Marriages	1.11	1.18	0.036	0.044
Number of Wives	1.016	1.041	0.016	0.118
Matrilocal	0.060	0.051	0.018	0.651
Left Spouse	0.289	0.337	0.038	0.216
Years Education	11.1	9.4	0.334	0.000
Employed	0.705	0.686	0.037	0.615
Weekly Income	30.7	26.3	3.083	0.151
Savings	0.414	0.341	0.039	0.061
Obs.	640			

Panel B: Men Only

	Matrilineal	**Patrilineal**	SE	(p-value)
Age	42.7	45.9	1.63	0.054
Age Married	26.9	26.8	0.781	0.845
Age Lived with Spouse	26.9	26.7	0.752	0.717
Number of Marriages	1.18	1.29	0.065	0.085
Number of Wives	1.03	1.08	0.032	0.101
Matrilocal	0.039	0.047	0.023	0.739
Paid Bride Price	0.992	1.00	0.006	0.218
Left Spouse	0.352	0.356	0.055	0.935
Years Education	13.2	10.7	0.444	0.000
Employed	0.922	0.891	0.034	0.356
Weekly Income	37.2	31.9	5.32	0.327
Savings	0.375	0.351	0.055	0.660
Obs.	320			

Panel C: Women Only

	Matrilineal	**Patrilineal**	SE	(p-value)
Age	36.2	37.4	1.63	0.474
Age Married	19.3	19.1	0.541	0.736
Age Lived with Spouse	19.4	19.2	0.506	0.711
Number of Marriages	1.03	1.07	0.026	0.146
Matrilocal	0.081	0.056	0.029	0.372
Left Spouse	0.219	0.317	0.054	0.070
Years Education	8.98	8.13	0.420	0.044
Employed	0.480	0.487	0.058	0.895
Weekly Income	24.1	20.8	2.97	0.275
Savings	0.455	0.332	0.056	0.027
Obs.	320			

Notes: *Age* is the individuals current age. *Age Married* is the individual's age at marriage. *Age Lived with Spouse* is age at which the individual first began living with their spouse. *Number of Marriages* is the number of times the individual has been married. *Number of Wives* is the number of wives a man has currently (if polygamous). *Matrilocal* is whether the individual reports having lived with the wife's family after marriage. *Bride Price Paid* is whether the individual reports a bride price was paid at the time of marriage. *Left Spouse* is whether the individual reports having ever left their spouse for an extended period of time. *Years Education* is the number of years of education the individual has completed. *Employed* is a indicator variable equal to 1 if the individual is currently employed. *Weekly Income* is the individual's personal weekly income in dollars. *Savings* is an indicator variable equal to 1 if the individual has a savings account of some sort (formal or informal).

The respondent was then told to allocate their endowment across two envelopes: an envelope for themselves and a "shared" envelope. They were told that the amount they contribute to the shared envelope would be combined with the amount their spouse contributed to the shared envelope. This amount would then be increased by 1.5 by the researchers and divided evenly between the couple. The total amount of money each respondent received would thus be the sum of what they put in the envelope for themselves plus half of the increased amount in the shared envelope. To assist with understanding the payoffs associated with various allocation decisions, respondents were given a table that showed them how much money they would make for various allocations. The respondent made their allocation to the two envelopes in the privacy of a tent using actual money. The enumerator then collected the two envelopes and brought them back to the study office. The money allocated to the envelopes was counted in the office and the total amount of money each respondent earned was calculated and returned to the respondent within one week.[10]

Respondents also played an additional version of the game in which the amount contributed to the shared envelope was increased by 2, rather than by 1.5. This means that regardless of what the respondent's partner contributes to the shared envelope, the respondent will at least receive as much as they put in. This treatment makes it more costly to not cooperate with the other player.[11]

The household public goods game combines several key features of interactions between couples. First, there is some chance of getting additional income that is unobserved by the spouse. Individuals must then decide how much of their money to keep for themselves and how much to contribute to the household. Contributions made to the household have a positive return, but there is some chance your partner may free ride and not make contributions. Additionally, money contributed to the household can reveal information on the initial endowment size. To maximize household income, each partner would need to contribute their entire endowment to the shared envelope. Any deviations from this strategy results in an income loss at the household level.

[10]The payouts for all versions of the DG and PG were paid approximately one week later. The payments were delivered to respondents in an envelope with the lump sum of the payments for the games.

[11]For the English translation of the protocols, see Appendix G.

4. Testing Spousal Cooperation

4.1. Empirical Strategy

To examine the impacts of matrilineal kinships systems on intra-household outcomes, I estimate two specifications. First, I estimate a parsimonious OLS specification with a matrilineal indicator. The specification is as follows:

$$y_{i,e} = \alpha + \gamma Matrilineal_{i,e} + \mathbf{X}_i\beta + \varepsilon_{i,e} \tag{1}$$

where $y_{i,e}$ is the outcome of interest for individual i from ethnic group e; $Matrilineal_e$ is an indicator equal to 1 if ethnic group e practices matrilineal descent systems; $\mathbf{X}_i$ is a vector of covariates for individual i such as age, age squared and sex. Additional specifications include a matrilineal and female interaction term and a matrilineal and won bonus interaction term.

One concern with specification (1) is that the matrilineal indicator variable is capturing the effect of something other than the practice of matrilineal kinship. Causal identification in this context is complex. From the perspective of the individual, assignment to "treatment" is exogenous in the sense that individuals do not choose their ethnic group affiliation. Rather, they are assigned an ethnicity based on their parents' ethnic group membership. However, this does not mean a matrilineal indicator variable allows for the identification of the causal effect of membership in a matrilineal ethnic group on behavior in the household for several reasons. First, omitted variable bias may be an issue. A matrilineal kinship system may be correlated both historically and currently with many traits. For example, matrilineal systems may be more likely in certain ecological environments. Thus, a matrilineal indicator captures the net effect of a bundle of goods. Second, reverse causality may also be an issue if groups that were initially more "pro-women" became more likely to adopt matrilineal kinship systems. In that case, a matrilineal indicator is capturing the effect of having this initially more favorable view toward women.[12]

To address identification concerns, I estimate a geographic regression discontinuity specification using the border of the matrilineal belt and the location of an individual's village of origin, v. The matrilineal belt is the delineation created by the borders of ethnic groups that practice matrilineal descent alongside groups that practice patrilineal descent. The intuition behind this

[12]However, this concern may be mitigated if we believe that the initial adoption of matrilineal systems in antiquity is effectively exogenous to outcomes today.

specification is that the matrilineal belt border is determined by the borders of multiple matrilineal and patrilineal ethnic groups. The boundaries themselves between these multiple ethnic groups are arbitrary and along the border these areas are quite similar. This allows me to estimate the causal effect of matrilineal institutions on cooperation in the household using the following regression discontinuity (RD) specification:

$$y_{i,v} = \alpha + \gamma Matrilineal_{i,v} + f(location_v) + \mathbf{X}_i\beta + \varepsilon_{i,v} \tag{2}$$

where $y_{i,v}$ is the outcome of interest for individual i from a village of origin v; $Matrilineal_{i,v}$ is an indicator equal to 1 if the village of origin v is on the matrilineal side of the matrilineal belt and equal to 0 otherwise; $\mathbf{X}_i$ is a vector of covariates for individual i; and $f(DB_v)$ is the RD polynomial, which controls for smooth functions of geographic location for village v. For the baseline RD results I use a linear polynomial in latitude and longitude following recent work by Gelman and Imbens (2016). I use various forms of the RD polynomial as robustness checks. For the baseline RD specification, I limit the analysis to observations within 100 kilometers of the matrilineal belt as this restricts the range in which unobservable parameters can vary around the border of the matrilineal belt. In Appendix C I present the results for 200 kilometers and 50 kilometer bandwidths.[13] Our coefficient of interest is γ: the effect of originating from a village just inside the matrilineal belt on the outcome of interest.

The RD approach presented in equation (2) requires two identifying assumptions. The first assumption is that all relevant factors vary smoothly at the matrilineal belt border except treatment. This assumption is needed to ensure that individuals located on one side of the matrilineal belt are a reasonable counterfactual for those located on the other side of the matrilineal belt. To assess the plausibility of this assumption, I estimate equation (2) using geographic characteristics as an outcome variable. The identification assumption requires that $\gamma = 0$ for exogenous geographic characteristics that might affect the outcome of interest.

The second important assumption for this regression discontinuity approach is that there was no selective sorting across the RD threshold. The assumption would be violated if, for example, more cooperative individuals sorted from the matrilineal side of the border to the patrilineal side of the border. Given that location relative to the RD border is determined by village of origin and

[13] I can also calculate the Imbens-Kalyanaraman optimal bandwidth with the running variable as distance to matrilineal belt border. Depending on the outcome of interest, the optimal bandwidth is generally between 75 and 125 kilometers.

that village of origin is determined by where one's ancestors are from, the sorting would have had to occur generations ago. Additionally, rural to rural migration in this context is difficult because access to land is often determined through your kinship group. This mitigates some concerns about selective migration along the matrilineal belt boundary.[14]

As highlighted in Section 2.1, data collection in Kananga also offers certain advantages for addressing identification concerns. By collecting data from an urban sample, individuals share a common institutional and ecological environment currently. Additionally, I am able to hold many other factors constant, making groups more comparable. For example, access to agricultural land and residence patterns after marriage are less important in this urban context. This helps address concerns about the particular bundle of goods that a matrilineal indicator captures.

To generate the matrilineal belt border used in the RD, I digitize maps from Vansina (1966) that provide detailed ethnic group boundaries for over 350 ethnic groups in the DRC, improving upon the boundaries delineated by Murdock.[15] This allows me to create an accurate matrilineal belt border for the DRC. Figure 5 is a map of the borders as delineated by Vansina. Again, matrilineal groups are in blue and patrilineal groups are in green. Groups that Vansina identifies as bilateral are in red. Generally, only one ethnic group is assigned to a polygon, though for some polygons, multiple ethnic groups are denoted as living there. Using the Vansina ethnic group boundaries in this figure, I construct a matrilineal border, as seen in Figure 5. In the RD specification, individuals are assigned matrilineal status not based on their ethnic affiliation, but rather based on the location of their village of origin relative the matrilineal belt border.[16]

4.2. Balance on Geographic and Cultural Characteristics

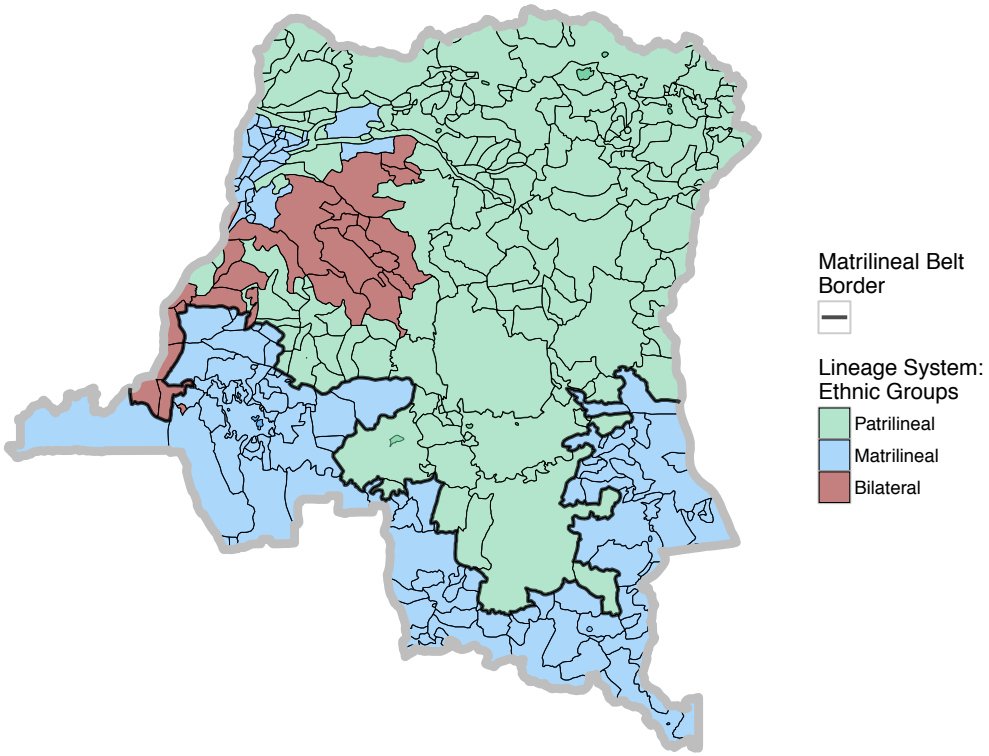
To test for balance on geographic characteristics, I estimate equation 2 where the outcome is a series of geographic characteristics including elevation, precipitation, soil suitability, temperature,

[14]Appendix 2 presents reason for migration by matrilineal and patrilineal. Importantly, there does not appear to be differential selection based on how cooperative individuals are.

[15]In their work on the role of pre-colonial institutions on present day development, Michalopoulos and Papaioannou (2013b) use the ethnic group boundaries delineated by Murdock. However, they note that doing an RD along these boundaries is problematic for several reasons. First, there is drawing error in the Murdock map. Second, each polygon delineated by Murdock is assigned to a single ethnic group, while in practice groups likely overlap. Using the Vansina borders addresses these two concerns, as the Vansina maps are more detailed and represent more ethnic groups in DRC. Additionally, he assigns multiple ethnic groups to certain polygon boundaries when substantial minority groups are present.

[16]Interestingly, villages of origin, self reported ethnicities and the Vansina boundaries align for most of the individuals in my sample, suggesting that the Vansina boundaries are actually reasonable approximations of ethnic group homelands.

Figure 5: Ethnic Group Boundaries



plough suitability and Tsetse fly suitability. I present the results in Table 4 for three bandwidths: 200 kms, 100 kms, and 50 kms. Conley standard errors are presented in brackets to account for spatial auto-correlation, and robust standard errors, clustered at the village and ethnicity levels, are in parentheses. While areas around the matrilineal border appear to be balanced on elevation, precipitation, soil suitability and plough suitability, they are not balanced on temperature or TseTse fly suitability. However, the estimated differences are quite small relative to the means. For example, matrilineal areas are 1% colder than patrilineal areas and 1% more suitable for TseTse fly relative to patrilineal areas. Additionally, I test for balance on important cultural practices in Panel C, including whether bride price was paid, amount of bride price payment, and practice of matrilocality within my sample. I do not find any differences across these practices. Because there are no substantive differences in observables across the matrilineal belt border, this suggests that the geographic RD is a reasonable approach in this setting.

Table 4: Balance on Geographic and Cultural Characteristics

	Panel A								
	Elevation			*Precipitation*			*Soil Suitability*		
Sample Within:	200 kms (1)	100 kms (2)	50 kms (3)	200 kms (4)	100 kms (5)	50 kms (6)	200 kms (7)	100 kms (8)	50 kms (9)
In Belt	18.812	18.242	14.750	-1.565	-0.248	-0.086	0.039	0.020	0.021
	(19.213)	(13.274)	(9.619)	(1.240)	(0.513)	(0.390)	(0.028)	(0.025)	(0.025)
	[16.086]	[11.205]	[8.269]	[1.152]	[0.475]	[384]	[0.023]	[0.020]	[0.021]
Observations	614	509	330	614	509	330	555	479	319
Village Clusters	494	418	286	494	418	286	447	392	277
Ethnicities	34	27	19	34	27	19	30	25	18
Mean Dep. Var.	650.4	657.7	677.6	134.7	135.2	134.8	0.168	0.166	0.165
	Panel B								
	Temperature			*Plough Suitability*			*TseTse Fly Suitability*		
Sample Within:	200 kms (1)	100 kms (2)	50 kms (3)	200 kms (4)	100 kms (5)	50 kms (6)	200 kms (7)	100 kms (8)	50 kms (9)
In Belt	-0.285**	-0.286***	-0.240***	0.001	-0.001	-0.001	-0.010***	-0.007***	-0.004**
	(0.141)	(0.099)	(0.072)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.002)
	[0.123]	[0.090]	[0.065]	[0.001]	[0.001]	[0.001]	[0.003]	[0.002]	[0.002]
Observations	614	509	330	614	509	330	614	509	330
Village Clusters	494	418	286	494	418	286	494	418	286
Ethnicities	34	27	19	34	27	19	34	27	19
Mean Dep. Var.	24.35	24.31	24.20	0.126	0.125	0.125	0.632	0.634	0.632
	Panel C								
	Paid Bride Price			*Bride Price Amount*			*Matrilocal*		
Sample Within:	200 kms (1)	100 kms (2)	50 kms (3)	200 kms (4)	100 kms (5)	50 kms (6)	200 kms (7)	100 kms (8)	50 kms (9)
Matrilineal	-0.005	-0.006	0.003	0.066	-0.038	-0.031	-0.023	-0.029	-0.048
	(0.004)	(0.004)	(0.005)	(0.212)	(0.165)	(0.156)	(0.028)	(0.033)	(0.036)
	[0.005]	[0.005]	[0.005]	[0.209]	[0.185]	[0.205]	[0.046]	[0.049]	[0.053]
Observations	614	509	330	614	509	330	306	257	173
Village Clusters	494	418	286	494	418	286	267	225	155
Ethnicities	34	27	19	34	27	19	32	24	19
Mean Dep. Var.	0.993	0.992	0.991	5.628	5.690	5.800	0.0588	0.0584	0.0809

Notes: The estimated regressions use a linear polynomial in latitude and longitude as the RD polynomial. I include province fixed effects. Elevation, precipitation and temperature come from the Global Climate Database created by Hijmans et al. (2005). This data provides monthly average rainfall in millimeters and elevation measures in meters. *Elevation* calculates the average elevation in meters for each village of origin. *Precipitation* is a measure of the average yearly precipitation (in millimeters of rainfall per year) for each village of origin. *Temperature* is a measure of the average yearly temperature (in degrees Celsius) for each village of origin. *Soil Suitability* is from Ramankutty et al. (2002) and Michalopoulos (2012). It is an index from 0-1, with higher values indicating higher soil suitability for agriculture. *Plough suitability* is the sum of the FAO crop suitability measures for wheat, barley and rye normalized by the share of land suitable for agriculture within a 50 km buffer around each village of origin. *TseTse Fly Suitability* is the estimated tsetse fly suitability measure from Alsan (2015) for each village of origin. *Paid Bride Price* is an indicator variable equal to 1 if individuals in my sample report that bride price was paid at time of marriage. *Bride Price Amount* is the amount of bride price paid at the time of marriage, with response options from 0 to 5, with larger values indicating larger amounts. *Matrilocal* is whether the individual reports matrilocal residence after marriage. To account for spatial autocorrelation, I present Conley standard errors in [ ] (assuming a cut-off window of 50 kms) and two-way clustered standard errors, clustered at the village of origin level and ethnicity level, in ( ). * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

4.3. Cooperation with Spouse

I first test whether matrilineal individuals cooperate less with their spouse by examining contributions in the public goods game. More cooperative individuals contribute more to the shared envelope. Panel A of Table 5 presents the OLS results on contributions to the public good and Panel B presents the RD specification. In columns 1 to 3, I stack the versions of the game with the spouse in which contributions to the shared envelope are increased by 1.5 and the version in which contributions are increased by 2. Therefore, there are two observations per individual and standard errors are clustered at the individual level. A first order observation is that, in general, both matrilineal and patrilineal individuals do not cooperate with their spouses - i.e. the average amount contributed to the shared pot is approximately 525 CF, which is well below the full endowment of either 1,000 CF or 1,500 CF. Second, matrilineal individuals contribute less than their patrilineal counterparts. Column 1 shows that matrilineal individuals contribute approximately 50 CF less to the shared envelope. Column 2 includes an interaction term for matrilineal and female. Interestingly, both matrilineal men and matrilineal women are contributing less to the shared envelope.

Column 3 presents results with a won bonus indicator, which is equal to one if the individual won the bonus for that particular version of the game and an interaction term for matrilineal and won bonus. The coefficient for the won bonus indicator variables suggests that when individuals win the bonus, their contribution to the shared envelope increases by approximately 90 CF, which is much less than the 500 CF increase in their endowment size. Now, the matrilineal indicator variable is no longer significant and the matrilineal and won bonus interaction term has a large negative and significant coefficient. Matrilineal individuals behave differently than their patrilineal counterparts, but only when they win the bonus. When they win the bonus, they contribute over 100 CF fewer to the shared envelope relative to patrilineal individuals who win the bonus. These results suggest that the plausible deniability about the initial endowment size is important for determining the contribution of matrilineal individuals. The unobservable income shock results in a sizable decrease in the amount contributed to the shared envelope relative to patrilineal individuals who win the bonus, resulting in greater monetary losses at the household level. It is worth noting that couples in general are failing to achieve productive efficiency, but that matrilineal coupes experience even larger monetary losses. Panel B presents the results from the RD specification for individuals with villages of origin within 100 kilometers of the matrilineal

Table 5: Contributions in Public Goods Games

	Dep. Var.: Amount Contributed to Shared Pot						
	Panel A: Baseline OLS						
	With Spouse			With Stranger			All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Matrilineal	-49.549**	-59.558*	3.317	-65.984**	-83.029**	-90.519**	-84.487**
	(24.067)	(35.506)	(35.519)	(26.250)	(37.588)	(42.179)	(39.961)
Female	-31.188	-39.267	-32.718	2.447	-11.312	-10.293	-25.197
	(25.426)	(33.611)	(33.264)	(26.589)	(34.151)	(34.235)	(29.470)
Matrilineal*Female		20.124	14.135		34.271	31.624	19.819
		(48.599)	(48.417)		(52.018)	(52.141)	(44.028)
Won Bonus			87.165***			18.517	19.418
			(24.812)			(33.377)	(33.453)
Matrilineal*Won Bonus			-105.027***			16.048	20.140
			(37.843)			(51.752)	(51.725)
Matrilineal*Won Bonus*Spouse							-124.274*
							(64.930)
Observations	1,280	1,280	1,280	640	640	640	1,920
Clusters	640	640	640	-	-	-	640
Mean Dep. Var.	525.9	525.9	525.9	448.1	448.1	448.1	499.9
	Panel B: Linear Polynomial in Latitude and Longitude - 100 kms from Matrilineal Belt						
	With Spouse			With Stranger			All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Matrilineal	-68.858**	-88.042*	-34.392	-82.188**	-88.732*	-100.063*	-108.507**
	(33.329)	(46.020)	(45.655)	(36.399)	(48.534)	(53.283)	(49.054)
Female	-19.347	-35.303	-42.590	21.475	16.031	17.544	-13.928
	(28.502)	(39.815)	(37.208)	(29.350)	(39.965)	(40.115)	(34.745)
Matrilineal*Female		35.491	36.453		12.108	9.069	23.086
		(54.401)	(53.609)		(57.902)	(57.889)	(48.706)
Won Bonus			78.919***			40.759	41.646
			(28.750)			(39.112)	(39.234)
Matrilineal*Won Bonus			-95.601**			28.681	35.861
			(42.885)			(56.689)	(56.521)
Matrilineal*Won Bonus*Spouse							-130.639*
							(72.922)
Observations	1,006	1,006	1,006	503	503	503	1,509
Clusters	503	503	503	-	-	-	503
Mean Dep. Var.	515.6	515.6	515.6	448.7	448.7	448.7	493.3

Notes: The data are stacked game play in the baseline HH PG and the increased returns version of the HH PG for the spouse regressions in columns (1) to (3). The data are stacked game play in the spouse and stranger versions in column (7). Standard errors are clustered at the village of origin level. Regressions control for age and age squared and include province fixed effects. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal in Panel A, and in Panel B it is an indicator variable equal to 1 if the respondent's village of origin is in the matrilineal belt. *Female* is an indicator variable equal to 1 if the respondent is a woman. *Won Bonus* is an indicator variable equal to 1 if the respondent won the bonus in that round of the game. To conserve space the spouse indicator and interaction terms in Column (7) are not shown. *Amount Contributed to HH Pot* is the quantity of money the respondent contributed to the HH envelope. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

belt border. Thus, the sample size decreases relative to the OLS specification, as individuals from villages over 100 kilometers from the border are dropped. However, the results are quite consistent with the OLS specification.

4.4. Cooperation with a Stranger

It is possible that matrilineal individuals just behave differently than patrilineal individuals, and that the behavior observed in the public goods game with a spouse is not specific to the spouse. Thus, individuals played another version of the PG game in which the other player is a random individual from Kananga of the opposite sex. This allows me to examine whether game play is specific to the spouse or if the individual treats all members of the opposite sex in the same way. Given that spouses know each other and are involved in repeated interactions, the expectation is that they should be better able to capture the gains from cooperation.[17]

Columns (4) to (6) of Table 5 present the results from the PG game in which the other player is a stranger of the opposite sex. Reassuringly, the average contribution when the other player is a stranger is lower than when it is the spouse. Now, matrilineal individuals contribute less when they do not win the bonus. However, winning the bonus has no differential effect on matrilineal individuals when their partner is a stranger of the opposite sex. Thus, while matrilineal individuals are willing to cooperate less with their spouses when they have plausible deniability about the size of their initial endowment, they do not act any differently from patrilineal individuals when they win the bonus and the partner is a stranger. This suggests that plausible deniability is no longer important to matrilineal individuals when their partner is a stranger. Finally, Column (7) stacks the three versions of the game. The matrilineal, spouse, and won bonus interaction term is negative and significant. Matrilineal individuals contribute less to the public good than patrilineal individuals when they play with their spouses and win the bonus. Again, the results from the RD specification in Panel B are consistent with the results from the OLS specification.

[17]Models of household interactions often assume that the Folk theorem of noncooperative game theory applies, which states that Pareto optimal outcomes can be achieved in repeated games if players are sufficiently patient (Fudenberg and Tirole, 1991). The folk theorem might reasonably apply to spousal interactions, since spouses have long term repeated interactions and good information about each other, while this is likely not the case for strangers.

4.5. Hiding and Rule Breaking

There are two ways to be non-cooperative in the PG game. The first way to be non-cooperative is for an individual to "hide" money by contributing 1000 CF or less to the shared envelope when they win the bonus. By contributing 1,000 CF or less, the individual essentially does not reveal that they won the bonus and had an initial endowment larger than 1,000 CF. The intuition is similar to the Jakiela and Ozier (2016) experiment in Kenya, where participants can pay to conceal that they won the larger of two potential endowment sizes. Table 6 presents results on hiding behavior in the PG game; Panel A is the OLS specification and Panel B is the RD specification. This analysis is only for people who won the bonus, since hiding requires having an initial endowment of more than 1,000 CF. While almost everyone displays hiding behavior (the mean of the dependent variable is 92%), both men and women from matrilineal groups hide even more. Matrilineal individuals are 6 percentage points more likely to hide when they are paired with a spouse, rather than with a stranger.

A second way to be non-cooperative in the PG game is to break the rules of the game. I define "rule breaking" in the PG as taking the money directly (e.g. to put the money in a pocket) rather than allocating it to the envelope for self or the shared envelope. This is possible because the allocation decisions are made privately in a tent using real money. The money is put into envelopes, and then the envelopes are sealed and returned to the enumerator. By putting the money in their pocket, rather than into one of the two envelopes, the respondent ensures that they receive the money with the benefit of plausible deniability (e.g. "I did not win the bonus") when the payouts from the game are given. While not following the rules is similar to hiding in that it is non-cooperative, it also signals a greater desire to maintain control over the money. Appendix D explores alternative explanations for rule breaking to demonstrate that rule breaking cannot be explained by differences in understanding the rules, trust in researchers, or time and risk preferences.

Table 7 presents results on rule breaking. In Columns (1) and (2) there is no difference between rule breaking between matrilineal and patrilineal individuals when they play with their spouse. However, in Column (3), once we control for whether the individual won the bonus and add a matrilineal and won bonus interaction term, matrilineal individuals are more likely to break the rules. Thus, when matrilineal individuals win the bonus, they are 17 percentage points more likely to take money directly rather than allocating it to their envelopes when they play with their

Table 6: Hiding in Public Goods Games

	Dep. Var.: Hid Money in Public Goods Game				
	Panel A: Baseline OLS				
	With Spouse		With Stranger		All
	(1)	(2)	(3)	(4)	(5)
Matrilineal	0.059***	0.060**	0.012	0.002	0.007
	(0.020)	(0.030)	(0.021)	(0.028)	(0.026)
Female	0.011	0.012	-0.005	-0.013	0.004
	(0.024)	(0.034)	(0.019)	(0.025)	(0.025)
Matrilineal*Female		-0.003		0.020	0.004
		(0.041)		(0.039)	(0.032)
Spouse					-0.056***
					(0.020)
Matrilineal*Spouse					0.050*
					(0.026)
Observations	718	718	336	336	1,054
Clusters	521	521	-	-	592
Mean Dep. Var.	0.926	0.926	0.964	0.964	0.938
	Panel B: Linear Polynomial in Latitude and Longitude - 100 kms from Matrilineal Belt				
	With Spouse		With Stranger		All
	(1)	(2)	(3)	(4)	(5)
Matrilineal	0.051	0.083*	-0.011	-0.041	0.005
	(0.034)	(0.044)	(0.022)	(0.028)	(0.031)
Female	0.011	0.038	-0.024	-0.049*	0.010
	(0.025)	(0.040)	(0.021)	(0.027)	(0.029)
Matrilineal*Female		-0.061		0.056	-0.023
		(0.046)		(0.045)	(0.036)
Spouse					-0.055**
					(0.024)
Matrilineal*Spouse					0.058**
					(0.030)
Observations	572	572	268	268	840
Clusters	413	413	268	268	473
Mean Dep. Var.	0.931	0.931	0.962	0.962	0.941

Notes: The data are stacked game play in the baseline HH PG and the increased returns version of the HH PG for the spouse regressions in columns (1) and (2). The data are stacked game play in the spouse and stranger versions in column (5). Standard errors are clustered at the individual level. Regressions control for age and age squared. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal in Panel A, and in Panel B it is an indicator variable equal to 1 if the respondent's village of origin is in the matrilineal belt. *Female* is an indicator variable equal to 1 if the respondent is a woman. *Won Bonus* is an indicator variable equal to 1 if the respondent won the bonus in that round of the game. *Spouse* is an indicator variable equal to 1 if the game is with the respondent's spouse, rather than with a stranger. *Hid Money in Public Goods Game* is an indicator variable equal to 1 if the respondent won the bonus but contributed 1,000 CF or less to the shared pot. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

spouse. Columns (4) to (6) present results of game play with the stranger of the opposite sex. As seen in column (6), the matrilineal and won bonus interaction term is not significant when the other player is a stranger of the opposite sex. Finally, Column (7) stacks game play from the stranger and spouse versions of the game. Importantly, the matrilineal, spouse, won bonus indicator is significant. Thus, it is only when matrilineal individuals win the bonus playing with their spouse that they are more likely to break the rules. Again, the RD results in Panel B are consistent with the OLS results. Across these three measures of cooperation in the public goods game, matrilineal individuals consistently cooperate less when they are paired with a spouse. They contribute less to the public good, particularly when they win the bonus, are more likely to hide money, and are more likely to break the rules of the game.

4.5.1. Heterogeneity by Couple Type

My sample comprises fully patrilineal couples, in which both partners are from a patrilineal ethnic group, fully matrilineal couples, in which both partners are from a matrilineal ethnic group, and mixed couples, in which one of the two spouses is from a matrilineal group and the other is from a patrilineal group. Table 8 presents results on contributions in the household public goods game by couple type to explore if it matters which partner in the couple is matrilineal or if both partners in the couple must be matrilineal to observe differences in cooperation. Couple types include having a matrilineal woman and a patrilineal man, a matrilineal man and a patrilineal woman, and both spouses matrilineal.

The results from the two versions of the PG played with the spouse are stacked. The regressions are at the individual level, but the standard errors are clustered at the couple level since the independent variable of interest - couple type - is defined at the couple level. Column (1) presents the results of a regression controlling for two variables: "one matrilineal", an indicator variable equal to 1 if either the individual themselves is matrilineal or their spouse is matrilineal, and "both matrilineal',' an indicator variable equal to 1 if both the individual and their spouse are from a matrilineal ethnic group. The coefficient when both spouses are matrilineal is sizable and significant. While the coefficient on one of the spouses being matrilineal is not significant, the coefficient size is still quite large. Columns (2) through (4) present the results from separate regressions, each controlling for other variations on couple type, including: having a matrilineal woman in the couple, having a matrilineal man in the couple, having at least one matrilineal per-

Table 7: Rule Breaking in Public Goods Games

	Dep. Var.: Broke Rules in Public Goods Game						
	Panel A: Baseline OLS						
	With Spouse			With Stranger			All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Matrilineal	0.006	0.028	-0.034	0.025	0.045	0.043	0.043
	(0.030)	(0.042)	(0.038)	(0.040)	(0.057)	(0.057)	(0.050)
Female	-0.007	0.010	0.038	-0.044	-0.028	-0.002	0.025
	(0.031)	(0.040)	(0.037)	(0.041)	(0.052)	(0.045)	(0.032)
Matrilineal*Female		-0.043	-0.082		-0.041	-0.091	-0.085*
		(0.060)	(0.050)		(0.081)	(0.067)	(0.044)
Won Bonus			0.471***			0.517***	0.517***
			(0.032)			(0.042)	(0.043)
Matrilineal*Won Bonus			0.177***			0.039	0.032
			(0.045)			(0.067)	(0.067)
Matrilineal*Won Bonus*Spouse							0.146*
							(0.077)
Observations	1,280	1,280	1,280	640	640	640	1,920
Clusters	640	640	640	-	-	-	640
Mean Dep. Var.	0.445	0.445	0.445	0.436	0.436	0.436	0.442
	Panel B: Linear Polynomial in Latitude and Longitude - 100 kms from Matrilineal Belt						
	With Spouse			With Stranger			All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Matrilineal	-0.010	0.002	-0.047	-0.005	0.028	0.100	0.066
	(0.046)	(0.059)	(0.051)	(0.059)	(0.078)	(0.074)	(0.062)
Female	-0.006	0.004	0.032	-0.062	-0.035	-0.016	0.016
	(0.034)	(0.046)	(0.042)	(0.047)	(0.063)	(0.052)	(0.036)
Matrilineal*Female		-0.021	-0.071		-0.061	-0.091	-0.078
		(0.067)	(0.057)		(0.091)	(0.076)	(0.050)
Won Bonus			0.484***			0.564***	0.558***
			(0.038)			(0.049)	(0.049)
Matrilineal*Won Bonus			0.149***			-0.059	-0.058
			(0.052)			(0.075)	(0.075)
In Belt*Won Bonus*Spouse							0.208**
							(0.088)
Observations	1,006	1,006	1,006	503	503	503	1,509
Clusters	503	503	503	-	-	-	503
Mean Dep. Var.	0.452	0.452	0.452	0.437	0.437	0.437	0.447

Notes: The data are stacked game play in the baseline HH PG and the increased returns version of the HH PG for the spouse regressions in columns (1) to (3). The data are stacked game play in the spouse and stranger versions in column (7). Standard errors are clustered at the individual level. Regressions control for age and age squared. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal in Panel A, and in Panel B it is an indicator variable equal to 1 if the respondent's village of origin is in the matrilineal belt. *Female* is an indicator variable equal to 1 if the respondent is a woman. *Won Bonus* is an indicator variable equal to 1 if the respondent won the bonus in that round of the game. *Spouse* is an indicator variable equal to 1 if the game is with the respondent's spouse, rather than with a stranger. To conserve space the spouse indicator and interaction terms in Column (7) are not shown.*Broke Rules in Public Goods Game* is an indicator variable equal to 1 if the amount of money in the individual and shared envelope for an individual does not equal the endowment of 1,000 when they don't win the bonus or 1,500 CF when they do win the bonus. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

son in the couple and having exactly two matrilineal people in the couple. The coefficients across the four regressions are consistent in magnitude and direction: having one or two matrilineal people of either sex leads to lower contributions to the public good at the individual level. These results suggest that matrilineality matters when both spouses are matrilineal, but may still matter even if just one spouse is matrilineal.

Table 8: PG Contributions by Couple Type

	Dep. Var.: Amount Contributed to Shared Pot				
		Woman Matrilineal	**Man Matrilineal**	**Any Matrilineal**	**Both Matrilineal**
	(1)	(2)	(3)	(4)	(5)
One Matrilineal	-35.850				
	(33.848)				
Both Matrilineal	-67.014*				
	(34.167)				
		-43.913	-52.505*	-51.178*	-54.496*
		(28.860)	(28.330)	(28.466)	(31.358)
Observations	1,280	1,280	1,280	1,280	1,280
Clusters	320	320	320	320	320
Mean	525.9	525.9	525.9	525.9	525.9

Notes: The data are stacked game play in the baseline HH PG and the increased returns version of the HH PG played with the spouse. Standard errors clustered at the couple level. Regressions control for female, age and age squared. *One Matrilineal* is an indicator variable equal to one if there is only one matrilineal person in the couple. *Both Matrilineal* is an indicator variable equal to one if both the husband and wife are matrilineal. *Woman Matrilineal* is an indicator variable equal to 1 if the woman in the couple is from a matrilineal ethnic group. *Man Matrilineal* is an indicator variable equal to 1 if the man in the couple is from a matrilineal ethnic group. *Any Matrilineal* is an indicator variable equal to 1 if there is at least one matrilineal person in the couple. *Amount Contributed to HH Pot* is the quantity of money the respondent contributed to the HH envelope. *** p<0.01, ** p<0.05, * p<0.1

4.6. IAT Evidence

Given that matrilineal kinship systems affect spousal cooperation, matrilineal individuals may have different implicit views of the other sex. In order to measure implicit views of the other sex, I conducted two Single-Target Implicit Association Test (ST-IAT) where the targets are men or women to measure implicit attitudes towards men or towards women. The ST-IAT, developed by Bluemke and Friese (2008), is a variant of the original IAT that measures an individual's association with a single target rather than an individual's relative association between two targets as in the original IAT. Recent work in DRC has used IATs to measure associations with various targets including ethnic groups, chiefs, and historical figures (Lowes et al., 2015; Lowes

and Montero, 2016; Lowes et al., 2016). In this case, the target groups are men and women. For details of the administration of the IATs, see Appendix H.

During an IAT, the respondent sorts happy words to the left, sad words to the rights, and words related to women (men) to either the left or the right depending on the block (round) of the IAT. The intuition behind the IAT is that if a respondent has a positive view of women (men), the respondent will have an easier time sorting words related to women (men) to the left with happy words than to the right with sad words. The IAT is intended to identify if the respondent uses a subconscious heuristic that "good things go left and bad things go right" (Lowes et al., 2015). By examining the difference in the speed at which the respondent sorts the words related to women (men) across the two blocks I can infer their implicit view of women (men).[18]

The IAT allows me to test whether matrilineal individuals have different implicit views of their own sex and the other sex. Unfortunately, the implementation of the IAT does not allow me to create a stranger counter factual, as I am able to do for the experimental measures. Rather the IAT measure will include implicit views toward all members of the same and opposite sex. Table 9 presents the results from the gender IATs. Columns (1) and (2) present the results for the IAT examining implicit views on men and columns (3) and (4) present the results for the IAT examining implicit view on women. Matrilineal women in particular have very strong positive implicit views of women. Columns (5) and (6) present an analysis of own-sex preference: this subtracts the individual's D-score for the opposite sex from their D-score for their own sex, so that a more positive value signifies a greater own sex preference. Interestingly, both matrilineal men and women have stronger own sex preferences than patrilineal individuals. This is consistent with greater polarization within the household for matrilineal individuals.

5. Physiological Evidence on Spousal Interactions

In an attempt to better understand the emotional states of individuals during game play, a subset of respondents were asked to complete the ultimatum game (UG) in a laboratory setting while wearing a device designed to monitor electrodermal activity (EDA). EDA describes the

[18] I follow Lowes et al. (2015) and calculate the standard *D-Score* as the inferred measure of the implicit view of women (men) for a given respondent. The *D-Score* is defined as: $\textit{D-Score} = [Mean(latency^{-ve}) - Mean(latency^{+ve})]/SD(latency^{+ve\,and\,-ve})$, where $Mean(latency^{-ve})$ is the average response time in milliseconds for the block in which the women (men) words are sorted to the right, $Mean(latency^{-ve})$ is the average response time for the block in which the women (men) words are sorted to left, and $SD(latency^{+ve\,and\,-ve})$ is the standard deviation in response times across both blocks. In this *D-Score*. more positive values will indicate more positive implicit views.

Table 9: D-Scores for Man ST-IAT and Woman ST-IAT

	Dep. Var.: D-Scores for Man ST-IAT and Woman ST-IAT					
	Man ST-IAT		Woman ST-IAT		Prefer Own Sex	
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	0.034	0.075	0.020	-0.054	0.118*	0.129
	(0.042)	(0.061)	(0.042)	(0.060)	(0.060)	(0.087)
Female	-0.002	0.031	0.061	0.001	-0.027	-0.017
	(0.041)	(0.052)	(0.044)	(0.053)	(0.061)	(0.077)
Matrilineal*Female		-0.082		0.150*		-0.023
		(0.084)		(0.084)		(0.121)
Observations	614	614	614	614	614	614
Mean	0.07	0.07	0.067	0.067	0.019	0.019

Notes: The data are the D-Scores calculated for the man ST-IAT and woman ST-IAT for each individual. Robust standard errors are in parentheses. Regressions control for age and age squared. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal. *Female* is an indicator variable equal to 1 if the respondent is a woman. *D-Score* is the inferred measure of an individual's implicit view of men(women). *Prefer Own Sex* is an individual's D-Score of the IAT where the target is their own sex minus the D-Score where the target is the opposite sex. A positive value indicates an implicit preference for own sex. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

autonomic, or involuntary, changes in the electrical properties of the skin. Skin conductance describes how well the skin conducts electricity. With increased arousal, the body increases sweat activity and the skin is better able to conduct electricity. Skin conductance can be measured by applying electric potential between two points of skin contact and measuring the current flow between them. Greater skin conductance is generally associated with increased stress. The benefit of examining physiological responses to game play is that these are automatic responses that individuals cannot control. Therefore, this type of data may provide insight into how an individual is responding internally to various stimuli. Additionally, models of household cooperation rarely address the psychological costs that individuals may experience during household negotiations. These effects may be non-negligible, particularly in resource constrained environments where spouses have different priorities.

5.1. Data Collection

The lab space consisted of four rooms, two rooms in one building and two rooms in a neighboring building. Two couples were invited to the lab at a time, with the women assigned to rooms in one building and the men assigned to the rooms in the other building. This was to ensure each respondent sufficient privacy from their spouse. Respondents were asked their consent to wear

devices that they were told would measure their emotional responses to the activities. These devices look similar to watches and are worn around the wrist. They were also asked their permission to have the session video recorded. For more details on the lab set up, see Appendix I. The enumerator would then begin the assigned activities with the respondent. In this case, the activities were an ultimatum game with a spouse and with a stranger. Given the set up in the lab, participants were assigned only the role of a player 1 or a player 2, rather than participating in the activities as both a player 1 and a player 2 as participants in the field did. The order of game play and assignment of player 1 or player 2 was randomized and stratified along gender and couple type.

In order to analyze a respondent's reaction to a particular stimuli, I asked enumerators to record the time of particular pre-specified events in the UG. This allowed me to sync the events with the EDA data recorded by the watch. For respondent's assigned to be a player 1, these events were: (1) when the respondent announced the offer he would send to the other player and (2) when the respondent received the player 2's response to his offer. If the respondent was a player 2, the events of interest were: (1) when the respondent received the offer from the player 1 and (2) when the respondent announced whether he would accept or reject the offer from player 1. In order to make these events well defined, enumerators were given specific scripts to read for each of the above events. Thus for each respondent, I have four event times, two for each version of the UG they play. Given the sensitivity of EDA analysis to the exact event timing, I also precisely coded up the event time by watching the video data and noting when the particular scripts for each event were read.[19]

5.2. Electrodermal Activity Data

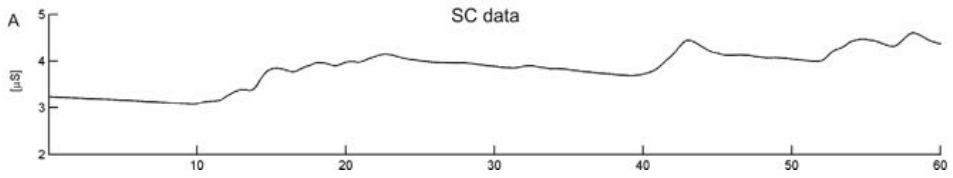
Lab participants wore Empatica E4 Wristbands that allowed for the collection of real-time physiological data. These are wearable devices that collect the following types of data: (1) electrodermal activity, (2) skin temperature, (3) blood volume pulse, (4) heart rate inter-beat interval and (5) movement (6) time.[20] For the analysis in the paper, I use the electrodermal activity (EDA) data generated by the Empatica E4 Wristbands.

[19]The event times recorded by the enumerator were used as a guide while watching the video, but by reviewing the video myself, I was able to ensure that the times used in the analysis were as accurate as possible, given that the relevant response window is within 1 to 5 seconds of the stimulus.

[20]For more information on the E4 Wristband, see https://www.empatica.com/e4-wristband.

Times series data of skin conductance is composed of two types of activity. The first type of activity is called *tonic* activity, which varies slowly and is captured by the *skin conductance level* (SCL). The second type of activity is the fast varying *phasic* activity and is captured by the *skin conductance response* (SCR). A SCR occurs when the sympathetic nervous system, which is responsible for the body's "fight or flight" response, sends a signal to the fibers that control the sweat glands.[21] The amplitude of the SCR is a linear function of the number of activated sweat glands, and is thus considered a measure of sympathetic activity. SCRs can be stimuli-specific or they can be non-event related. A SCR is characterized by a steep incline in skin conductance followed by a slower decline in skin conductance. EDA is measured in microSiemens, denoted μS. See Figure 6 for an example of skin conductance data over time.

Figure 6: Skin Conductance Data Example



This figure is taken from Benedek (2016).

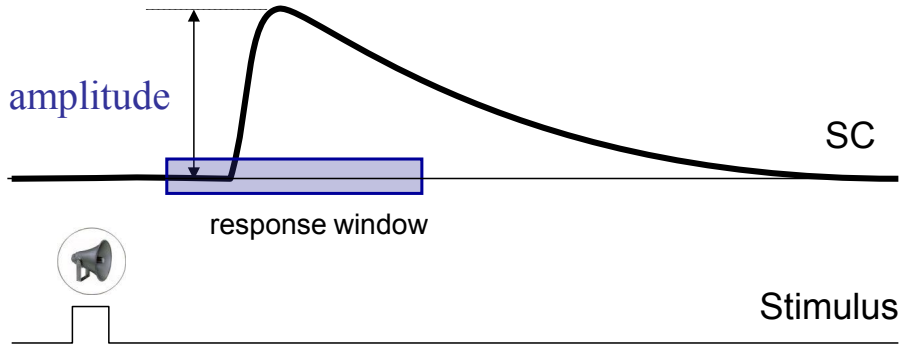
Importantly, a SCR is involuntary and occurs shortly after arousal of the sympathetic nervous system. Given that EDA is easily measured, cannot be consciously controlled, and captures changes in sympathetic activity, it can be used to measure changes in emotional states. Research across various fields have confirmed that EDA can be used as a measure of emotional arousal (Boucsein, 1992). In the present setting, it can provide evidence on the experience of the decision making process itself, rather than just observing the outcome of the lab experiment. The typical way to quantify SCRs is with trough-to-peak (TTP) analysis. The SCR amplitude is measured as the difference in the skin conductance values at the peak and the preceding trough within a particular time window, as in Figure 7.

The data was analyzed using Ledalab (version 3.4.9), a MatLab based program.[22] I imported the raw data produced by the Empatica E4 Wristbands as well as text files with the event time

[21]The activity of sweat glands is regulated by sudomotor fibers. A sympathetic nervous system response affects the firing rates of sudomotor fibers, which in turn trigger changes in the activity of sweat glands. A sudomotor nerve burst, i.e. activity in the sympathetic nervous system, is the concurrence of multiple sudomotor fibers firing. Thus, sudomotor nerve bursts are associated with observable skin conductance responses (Benedek and Kaernbach, 2010).

[22]For more information on Ledalab, visit http://www.ledalab.de/.

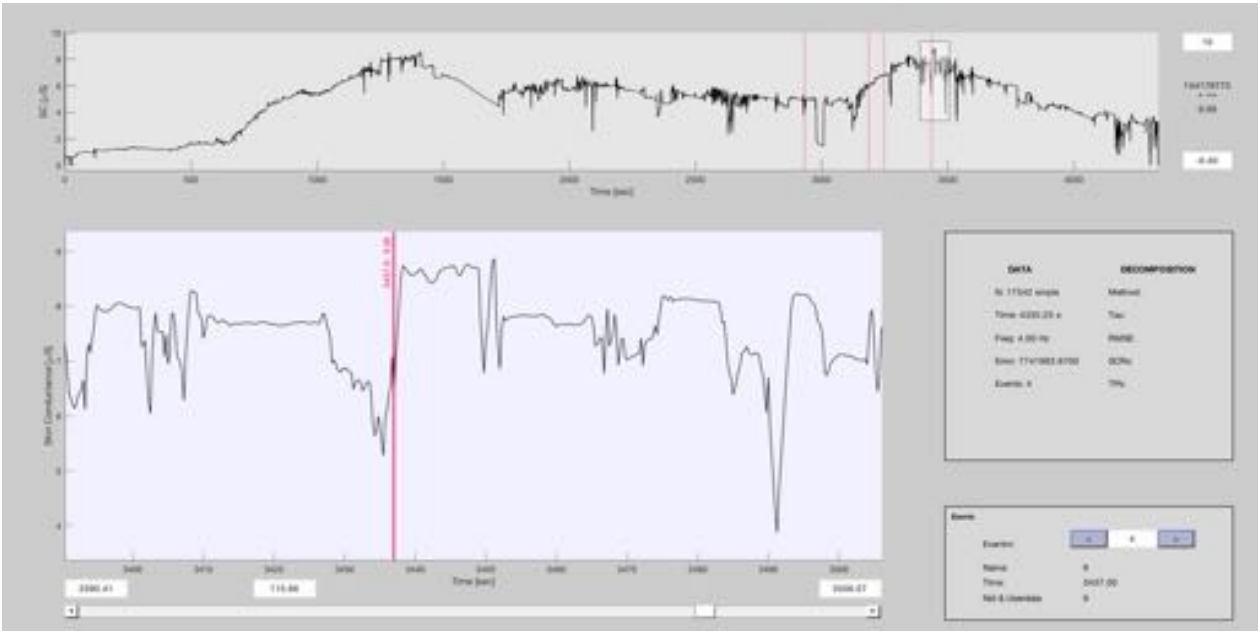
Figure 7: Example of TTP Measurement



This figure is from Benedek (2016).

markers into Ledalab. The resulting files thus had the skin conductance data for an individual for the duration of the experiment with markers denoting when a particular event of interest occurred. For an example of what the data looks like, see Figure 8. At the top of the figure is all of the skin conductance data over the course of the lab session. The lower panel is a zoomed in version of a portion of the top panel. The event times of interest are denoted by red lines.

Figure 8: Example of Data Analysis in Ledalab



The data was analyzed to detect event related SCRs.[23] SCRs of a pre-specified minimum

[23]There are also non-specific SCRs, which occur in the absence of identifiable stimuli.

amplitude that occur within several seconds of a particular stimulus can be attributed to that stimulus. A response window of 1 to 4 seconds after the event was used with a minimum amplitude threshold criterion of 0.01 μS. The resulting variable of interest for the TTP analysis is the sum of the SCR-amplitudes of significant SCR responses during the 1 to 4 second window.

Table 10 presents the results from the analysis of the EDA data, in which all events are stacked and the outcome of interest is the SCR amplitude. As seen in column (1), matrilineal individuals have a larger SCR amplitude when they are paired with their spouse relative to a patrilineal individual. Column (2) controls for the amount that the player 1 sent to the player 2 and Column (3) includes session fixed effects, to control for the time of day that the participant did the experiment. In terms of standardized effects, being matrilineal and playing the UG with a spouse is associated with a 0.289 standard deviation increase in the TTP measure, regardless of the amount of money offered by the player 1. Column (4) presents SCR amplitude when paired with a stranger in the UG. The coefficient on matrilineal is negative and small in magnitude. Finally, columns (6) to (9) present the results from stacking the event responses in game play with spouse and with stranger. The interaction term of matrilineal and spouse is positive and significant, suggesting that when a matrilineal individual is paired with their spouse they have a larger physiological response during UG game play.

Table 10: Skin Conductance Responses in Ultimatum Game - All Players

	Dep. Var.: TTP Analysis of SCR Amplitude (in μS) for Player 1s and 2s								
	With Spouse			With Stranger			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Matrilineal	0.116*	0.121*	0.130*	-0.013	-0.011	-0.007	-0.013	-0.011	-0.004
	(0.067)	(0.073)	(0.074)	(0.047)	(0.048)	(0.049)	(0.047)	(0.048)	(0.049)
Amount Sent		-0.013	-0.011		-0.012	-0.017		-0.013	-0.013
		(0.022)	(0.022)		(0.015)	(0.012)		(0.013)	(0.013)
Spouse							-0.036	-0.017	-0.016
							(0.038)	(0.047)	(0.046)
Matrilineal*Spouse							0.129**	0.132**	0.132**
							(0.062)	(0.062)	(0.063)
Session FE	N	N	Y	N	N	Y	N	N	Y
Observations	320	320	320	320	320	320	640	640	640
Mean Dep. Var.	0.159	0.159	0.159	0.138	0.138	0.138	0.148	0.148	0.148

Notes: The data are SCR responses to two events in ultimatum game play with spouse in columns (1) and a stranger in columns (2). The data are stacked SCR responses in column (3). Standard errors are clustered at the individual level. Regressions control for female. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal. *Spouse* is a indicator variable equal to one if the partner is the spouse and 0 if the partner is a stranger. *SCR Amplitude* is the sum of the SCR amplitudes of significant SCRs during the 1 to 4 second response window after the event.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

I also present the results for player 1s only in Panel A of Table 11. The results are consistent with Table 10. Regardless of the amount offered to the player 2, matrilineal individuals experience

more stress when paired with their spouse relative to patrilineal individuals. Finally, Panel B of Table 11 presents a slightly different analysis for the player 2s. Before receiving the offer from a player 1, the player 2 was asked to report how much they expected to receive from the other player. The variable "Difference" is the amount they expected to receive as an offer minus the amount they were actually offered. Thus, a positive value denotes that an individual received less money from the player 2 than they expected to receive. Column (1) shows that matrilineal individuals exhibit larger EDA responses the larger the difference in their expectation from reality, but that is not the case in Column (4) when the partner is a stranger. Column (7) presents the stacked results and suggests that when matrilineal individuals play with their spouses and receive less than expected, they have larger skin conductance responses. Interestingly, this does not seem to be driven by differences in ability to predict offers sent by a player 1 (both matrilineal individuals and patrilineal individuals are equally bad at guessing what their spouse will send). In general, individuals over estimate how much they will receive from a spouse.

These EDA results provide evidence of the matrilineal puzzle at the physiological level: matrilineal individuals physically experience greater stress when playing a simple bargaining game with their spouses. While usually in experimental data we only observe the choices of the participants, in this case I have evidence that regardless of the outcome of the game, the experience of the decision making process itself is different for matrilineal individuals.

6. Implications for Development

Matrilineal individual appear to cooperate less with their spouses, resulting in inefficiencies at the household level in a public goods game. However, if matrilineal women retain greater control over their earnings relative to patrilineal women, this may have important implications for the well-being of children. It is therefore natural to examine whether children of matrilineal women fare better. To test this, I examine my survey data and outcomes in the DHS. Respondents completed a household roster, with information on the number of children in the household, their education levels, and whether the children had been sick in the last month. Table 12 presents the results of having a matrilineal mother on child outcomes using the RD specification. Consistent with matrilineal women being more empowered, and thus better able to enact their preferences, children of matrilineal women are significantly less likely to have been sick in the last month.

Table 11: Skin Conductance Responses in Ultimatum Game - By Player 1 and 2

	Dep. Var.: TTP Analysis of SCR Amplitude (in μS) for Player 1s								
	With Spouse			With Stranger			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Matrilineal	0.211*	0.220*	0.250*	0.014	0.012	0.038	0.013	0.009	0.037
	(0.122)	(0.132)	(0.134)	(0.083)	(0.081)	(0.073)	(0.084)	(0.081)	(0.077)
Amount Sent		-0.027	-0.026		-0.015	-0.025		-0.021	-0.026
		(0.045)	(0.041)		(0.027)	(0.024)		(0.028)	(0.026)
Spouse							-0.039	-0.021	-0.018
							(0.068)	(0.078)	(0.077)
Matrilineal*Spouse							0.199*	0.211*	0.213*
							(0.112)	(0.116)	(0.117)
Session FE	N	N	Y	N	N	Y	N	N	Y
Observations	160	160	160	160	160	160	320	320	320
Mean	0.211	0.211	0.211	0.160	0.160	0.160	0.186	0.186	0.186
	Dep. Var.: TTP Analysis of SCR Amplitude (in μS) for Player 2s								
	With Spouse			With Stranger			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Matrilineal	-0.007	0.004	0.006	-0.009	-0.008	-0.005	-0.009	-0.008	-0.006
	(0.047)	(0.053)	(0.051)	(0.050)	(0.050)	(0.052)	(0.050)	(0.050)	(0.051)
Difference	-0.026***	-0.037**	-0.036**	0.014	0.009	0.008	0.014	0.007	0.007
	(0.009)	(0.015)	(0.017)	(0.015)	(0.017)	(0.017)	(0.015)	(0.017)	(0.017)
Matrilineal*Diff.	0.026**	0.027**	0.026*	-0.010	-0.009	-0.011	-0.010	-0.009	-0.010
	(0.012)	(0.012)	(0.013)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Amount Sent		-0.022	-0.022		-0.013	-0.015		-0.018	-0.018
		(0.022)	(0.023)		(0.015)	(0.015)		(0.015)	(0.016)
Matrilineal*Spouse*Diff.							0.035*	0.035*	0.034*
							(0.020)	(0.020)	(0.020)
Session FE	N	N	Y	N	N	Y	N	N	Y
Observations	160	160	160	158	158	158	318	318	318
Mean Dep. Var.	0.159	0.159	0.159	0.138	0.138	0.138	0.148	0.148	0.148

Notes: The data are SCR responses to two events in ultimatum game play with spouse in columns (1) and a stranger in columns (2). The data are stacked SCR responses in column (3). Standard errors are clustered at the individual level. Regressions control for female. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal. *Amount Sent* is the amount Player 1 sent to Player 2 *Spouse* is a indicator variable equal to one if the partner is the spouse and 0 if the partner is a stranger. textitDifference is the difference between what Player 2 expected to receive and what Player 2 actually received from Player 1. *SCR Amplitude* is the sum of the SCR amplitudes of significant SCRs during the 1 to 4 second response window after the event. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

The effect size is quite large at 8 to 10 percentage points.[24] Additionally, children of matrilineal women have more years of education. Columns (2) and (4) control for characteristics of the mother, including her years of education, age and age squared.[25]

Table 12: Child Health and Education in Sample

	Linear Polynomial in Latitude and Longitude			
	Within 100 kms of Matrilineal Belt			
	Child Sick in Last Month		*Years of Education*	
	All Ages	All Ages	Age>5	Age>5
	(1)	(2)	(3)	(4)
Matrilineal	-0.079*	-0.093**	0.607***	0.462***
	(0.045)	(0.044)	(0.186)	(0.160)
Mother's Char.	N	Y	N	Y
Observations	831	831	503	503
Clusters	196	196	166	166
Mean Dep. Var.	0.280	0.280	4.57	4.57

Notes: Robust standard errors in parentheses. Standard errors are clustered at the village of origin level. Regressions control for age and age squared of child and province fixed effects. Columns (2) and (4) control for the mother's education level, age and age squared. *Matrilineal* is an indicator variable equal to 1 if the mother of the child is matrilineal. *Child Sick in Last Month* is whether the child has been sick in the last month; the response options were 0 for No and 1 for Yes. *Years of Education* is number of years of education completed by the child. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

In order to examine whether these results are unique to my sample, or if similar patterns can be found in other matrilineal groups, I estimate the RD specification described in equation 2 using the Demographic and Health Surveys for DRC from 2007 and 2014 (see Appendix E.1 for robustness to alternative RD specifications). I use the geo-referenced DHS clusters for the geographic RD. I assign individuals the status of matrilineal or patrilineal based on the cluster location in relation to the matrilineal belt.[26] This matching strategy means that all individuals in the same cluster receive the same ethnic affiliation. See Figure 9 for the distribution of DHS clusters and the matrilineal belt border.

I examine health and education outcomes for children. Women are asked to report the number of children they have had who have died. Women who are matrilineal have fewer children who

[24]This analysis restricts to households that currently have children in the household. Standard errors are clustered at the village of origin level.

[25]The results are also robust to controlling for measures of income.

[26]Ideally, I would know an individual's self-reported ethnic group, however the DRC DHS only reports very aggregated ethnic affiliations.

Figure 9: DHS Clusters and Matrilineal Belt

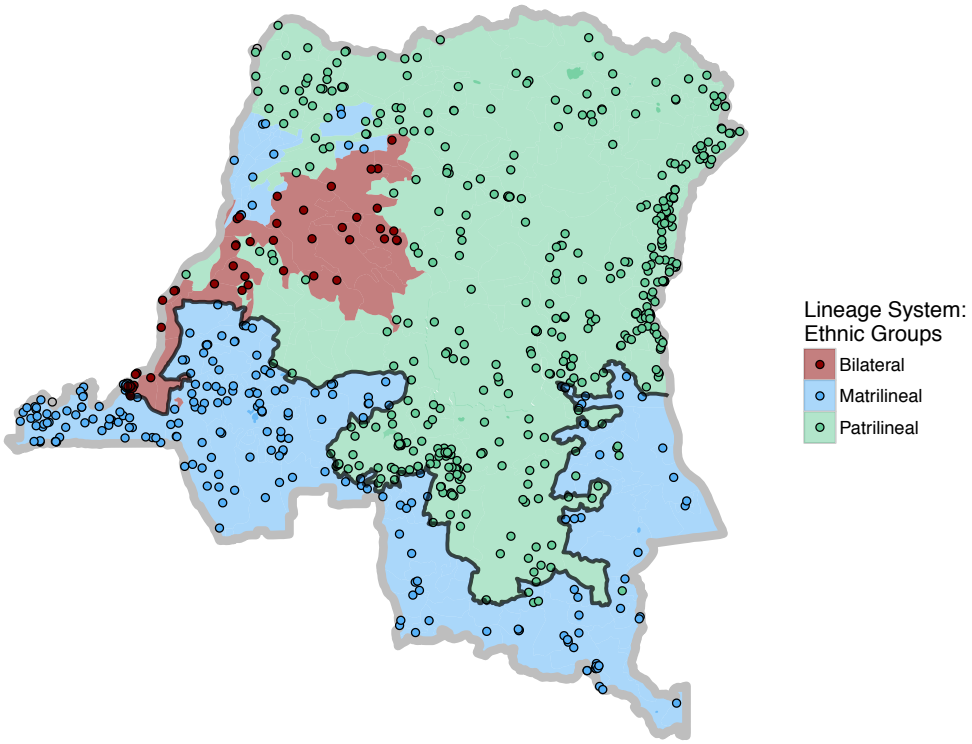


Table 13: Child Health and Education in DHS

	Linear Polynomial in Latitude and Longitude					
	Num. Children Died Women Respondents			*Years of Education Children Ages 6 to 18*		
Sample Within:	200 kms (1)	100 kms (2)	50 kms (3)	200 kms (4)	100 kms (5)	50 kms (6)
Matrilineal	-0.155***	-0.138***	-0.120*	0.120*	0.144**	0.151*
	(0.044)	(0.049)	(0.072)	(0.066)	(0.067)	(0.089)
Observations	13,915	9,291	4,727	23,513	15,456	7,712
Clusters	399	264	131	414	273	137
Mean	0.553	0.577	0.633	2.698	2.674	2.508

Notes: Standard errors in parentheses clustered at the DHS cluster level. Columns (1) to (3) are women only. Columns (4) to (6) are all children in households of any respondent. *Matrilineal* is an indicator variable equal to 1 if the respondent is from a DHS cluster in the matrilineal belt. *Num. of Children Died* is the number of the respondent's children that have died if the respondent has had any children. *Years of Education* is the number of years of education completed by members of the household between ages 6 and 18. *Controls* include age, age squared and a rural indicator for all columns. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

have died. I can also look at years of education for school age children in the households of DHS respondents. I define school age children as children between the ages of 6 and 18. The coefficient on matrilineal is positive and significant, suggesting children in matrilineal areas are better educated. The results from the DHS data are consistent with the results observed in my sample. Despite that matrilineal individuals are less cooperative with their spouses, matrilineal women seem to be better able to invest in their children, and this has important effects for the well-being of their children.

7. Model

The evidence above suggests that matrilineal individuals cooperate less with their spouses. In order to examine the channels through which matrilineal kinship systems affect cooperation, I first discuss models of bargaining in the household and present a non-cooperative model of household decision making.

7.1. Models of Intra Household Bargaining

Broadly, there are three classes of household decision making models: the unitary model, collective models, and non-cooperative models. In the unitary model of the household, families maximize a single utility function. This can either be justified with an "altruistic dictator" as in Becker (1974; 1981) or a consensus model as in Samuelson (1956). One of the key empirical implications of the unitary model is that the family pools income and uses that income to maximize the objective function. Collective models of bargaining recognize that there are two agents making decisions in the household. The models assume Pareto efficiency, and use Nash bargaining to determine the allocation of resources within the marriage. Greater bargaining weights within the marriage yield resource allocations more favorable to that individual. Individuals' threat points are determined by their outside option or by their non-cooperative solution within the marriage (as in Lundberg and Pollak (1993); Browning and Chiappori (1998)).

Empirical tests of collective models of intra-household bargaining examine whether Pareto optimality is achieved. Research in Mexico fails to reject efficiency in household expenditures (Bobonis, 2009; Attanasio and Lechene, 2014). However, a growing body of theoretical and empirical work suggests that these models are not the appropriate approach to understanding household behavior. For example, Udry (1996) examines household behavior in Burkina Faso.

He finds that household agricultural production does not meet the Pareto-efficient assumption of collective models of the household. Additional work in Cote d'Ivoire and Kenya also provides evidence of efficiency failures (Duflo and Udry, 2004; Robinson, 2012). Finally, recent lab experiments have also rejected productive efficiency between couples in a variety of settings including Ethiopia, Uganda and India (Kebede et al., 2013; Iversen et al., 2011; Castilla, 2013).

In non-cooperative models, agents take the actions of their spouse as given and have a strategy profile such that their strategy is the best response to the other player's strategy. Non-cooperative solutions often lead to multiple equilibria and do not shed light on the particular equilibria that might arise. Lundberg and Pollak (1994, p.134) suggest that social conventions might be used to determine equilibrium choice.

There is a large literature building extensions of basic non-cooperative models of household bargaining. For example, Doepke and Tertilt (2011) develop a non-cooperative model of the household with a continuum of public goods. In one version of this model, women and men differ in their relative appreciation of the different public goods. Interestingly, this model predicts that public goods provision in the household is minimized when the husband and wife each have one-half of the household income and is maximized when one of the two spouses controls the household income. Malapit (2012) develops a non-cooperative model of the household in which individuals choose a budget share to allocate to personal consumption and a budget share to allocate to household cooperation. The model predicts that as women have higher bargaining weights, the effect on equilibrium contributions depends on the relative trade off between the wife's valuation of getting a larger share of the public good and the offsetting response of the husband, or his elasticity benefit, from his decreased share of the public good. This model therefore allows for a potential trade off between women's empowerment and total contributions to the public good. Ziparo (2014) builds on standard non-cooperative models to examine incentives for communication when income is not observable.

7.2. Non-Cooperative Model

I present a non-cooperative model of contributions to a public good to structure examination of channels. There is a household with two adult members, in this case, a husband and a wife ($i = h$,w). Household members earn an income Y_i and must decide how much of that income, q_i, to contribute to a public good subject to the budget constraint, $Y_i \leq C_i + q_i$. Each household

member's utility function depends on their private expenditure C_i and the public good Q, where $Q = q_h + q_w$. The functions $u(.)$ and $v(.)$ satisfy the following assumptions that $u' > 0$, $v' > 0$, $u'' < 0$, $v'' < 0$, $u'(0) = \infty$, $v'(0) = \infty$, $u(0) = v(0) = -\infty$. Assuming separable utility, each individual's utility function is as follows:

$$U_i = u(C_i) + v(q_h + q_w),\ for\ i = h,w \tag{3}$$

I solve for the Nash equilibrium contributions to the public good. Each individual maximizes their own utility by choosing their private consumption level (C_i) and their contribution to the public good (q_i) given their income Y_i, taking the contribution of the other player to the public good, (q_j), as given. The optimality condition requires that the individual's marginal utility from private consumption must equal the marginal utility from the public good.[27]

Proposition 1 *With an interior solution, an individual decreases their contribution to the public good as the other player's contribution to the public good increases to equilibrate the marginal utility from private consumption and the public good.*

Proposition 2 *When both spouses contribute to the public good, the total public good Q^* is under provided relative to Pareto Efficient allocation.*

A variation of the non-cooperative model above includes an altruism parameter. Under altruistic preferences, individuals care about their own consumption and the consumption of their spouse. This extension is motivated by the work in anthropology that suggests matrilineal systems may create split allegiances between matrilineal couples. In the context of the model, we expect that $\delta_{mat} < \delta_{pat}$. Thus, the utility function takes the following form, where δ is the altruism parameter and $0 \leq \delta \leq 1$. When δ equals 1 the individual values the consumption of the spouse equally with their own consumption. When δ is 0 this the case of egoistic preferences above.

$$U_i = u(C_i) + v(Q) + \delta[u(C_j + v(Q)],\ for\ i = h,w \tag{4}$$

Proposition 3 *As δ increases, contribution to the public good increases. Contributions with altruism are always higher than with egoistic preferences.*

[27]See Appendix F for more details on the model.

7.3. Non-Cooperative Model with Bargaining Weights and Punishment

I consider a variation of the basic non-cooperative model. First, I include bargaining weights (μ, $1-\mu$, where $\mu \leq 1$) that determine the allocation of the public good. This parameter reflects that the public good itself may be allocated or chosen according to the preferences of one of the partners. Higher values of μ indicate higher levels of bargaining power for the husband, e.g. that the public good is more aligned with his preferences than those of his wife.

Second, women face a cost of allocating money to private consumption. This cost can be thought of as the punishment a woman faces if she "hides" income from her spouse by allocating it to private consumption and she is caught. This is reflected in the model by $p(.)$, which effectively is a tax on the woman's private consumption. This is consistent with evidence from focus groups and interviews, where both men and women say that women should not hide money from their husbands and that hiding money can lead to spousal conflict, including domestic violence. The tax is decreasing in a woman's relative bargaining power so that as the woman's bargaining power increases, the effective tax on her private consumption decreases.

I include bargaining weights and punishment based on the insights from anthropology that suggest that in matrilineal societies, men have less authority over their wives. In a model, this can translate into women having greater bargaining power (e.g. $(1-\mu_{mat}) > (1-\mu_{pat})$). Additionally, the effect of having greater bargaining power may have important implications in a context with high levels of domestic violence. I expect that matrilineal women are less subjected to domestic violence because of their higher outside option. By including $p(.)$ I can examine how contributions to the public good change with threat of violence.

For ease of exposition, I assume log utility and that the cost function $p(.)$ takes the form $(1-\mu)^2$. The utility functions for the husband and the wife are as follows:

$$U_h = ln(C_h) + \mu ln(q_h + q_w)$$

$$U_w = (1-\mu)^2 ln(C_w) + \ (1-\mu) ln(q_h + q_w)$$

The bargaining power parameters have straightforward implications for the contributions of men to the public good.

Proposition 4 *For men, contributions to the public good are increasing in relative bargaining power, μ.*

For women, changes in bargaining power have two effects. First, the tax women face on private consumption is a function of her bargaining power and it effectively decreases the return on investments to the private good for women. If a woman has less bargaining power, the husband is more able to credibly threaten punishment, and the tax the woman faces on private consumption is higher.

Proposition 5 *For women, contributions to the private good are decreasing in punishment.*

Second, increasing a woman's bargaining power increases the share of the public good she receives. As described above, it also decreases the tax she faces on contributions to the private good because with more bargaining power the husband is less able to threaten violence. Depending on her level of bargaining power, she may actually decrease her contribution to the public good, because she was under-investing in the private good relative to the case without punishment.

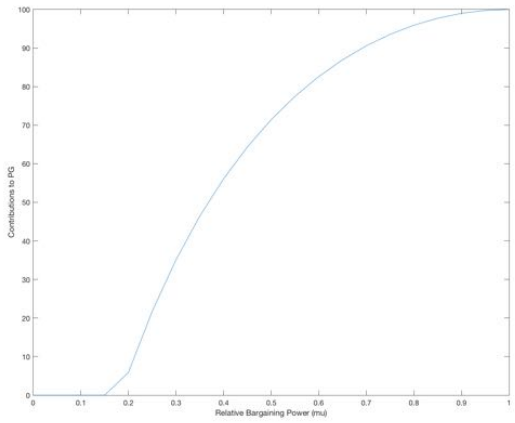
Proposition 6 *For women, there is a non-monotonic relationship between bargaining power and contributions to the public good.*

Women's contributions to the public good depends on their level of bargaining power. At low levels of women's bargaining power, women contribute a lot to the public good. This is due to a threat of punishment from their husbands if they are perceived as not being cooperative. At very high levels of bargaining power, women also contribute a lot, but this is due to their ability to capture a larger share of the public good. Their contributions are reduced at intermediate levels of bargaining power. As bargaining power increases, fear of punishment decreases, and women are now able to allocate money to their private consumption without fear of reprisal. The contributions to the public good for men and women for various values of μ are plotted for the case when men have higher income than women in Figure 10.

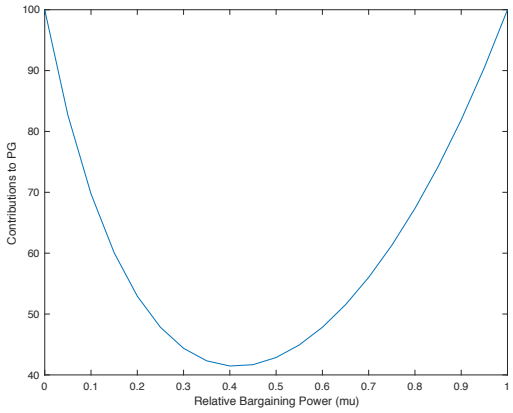
7.4. Theory and Channels

I now link the model to the empirics of the paper and to understanding differences in cooperation between matrilineal and patrilineal individuals. As observed empirically for both matrilineal and patrilineal individuals, the non-cooperative model predicts under provision of the public good. Matrilineal individuals cooperate even less with their spouse than patrilineal individuals, leading to greater under-provision of the public good. The model predicts that when women face less fear of punishment, they will contribute less to the public good. Winning the bonus has the nice

Figure 10: Contributions to the PG by bargaining power



(a) Men's contributions and bargaining power.



(b) Women's contributions and bargaining power.

feature of decreasing the cost of contributing to the private good, because women can easily claim that they did not win the bonus. A decrease in ability to punish corresponds with an upward shift of the contribution curve for men and a downward shift of the contribution curve for women in Figure 10. Empirically, we observe that matrilineal women respond to this decreased ability to punish with decreased contributions to the public good.

Table 14: Model Predictions

	Contributions to PG		
	Altruism δ	Bargaining μ	Punishment $p(.)$
Men	+	+	-
Women	+	+/-	+

Table 14 summarizes the key predictions of the model. The model provides some guidance on potential channels through which matrilineal kinship affects bargaining in the household. First, matrilineal kinship may affect spousal altruism, δ. If that is the case, then matrilineal individuals will contribute less on average to the public good. Second, if matrilineal men have less bargaining power relative to patrilineal men, they will contribute less to the public good. If matrilineal women have more bargaining power than patrilineal women, the prediction from the model is ambiguous and depends on the level of bargaining power the woman has. For relatively low levels of bargaining power, an increase in bargaining power leads to a decrease in contributions to the public good. Finally, if matrilineal men are less able to threaten domestic violence, matrilineal women will contribute less to the public good (it could be that matrilineal

men are less able to threaten violence in general; additionally, winning the bonus may decrease the likelihood of violence even more for matrilineal women).

8. Channels Through Which Matrilineality Matters

The results from the public goods game support the hypothesis proposed in the matrilineal puzzle, that matrilineal individuals cooperate less with their spouses. In an experimental setting, this leads to monetary losses at the household level. Additionally, matrilineal individuals exhibit larger stress responses to experimental game play with spouses and have more polarized implicit views of the opposite sex. I identify two possible channels through which matrilineality might affect spousal cooperation based on evidence from anthropology and on the predictions of a non-cooperative model of household decision making. First, matrilineal individuals may be less altruistic toward their spouses than patrilineal individuals. The structure of matrilineal societies in which spouses have allegiance to their own lineage may lead to lower levels of altruism between spouses. In this case, lower levels of altruism can help explain lower contributions in the public goods game. Second, matrilineal women may have greater bargaining power than their patrilineal counterparts. Women from matrilineal societies have a greater outside option: e.g. they can threaten to return to their lineage if their husband is too "dictatorial," as noted by Richards (1950). Alternative explanations for differential cooperation by matrilineal individuals, including understanding of the rules of the game, education, trust in researchers, and risk and time preferences are addressed in Appendix D.

8.1. Altruism

To measure altruism respondents play the dictator game (DG). Respondents played two versions of the DG, one version with their spouse and one version with a stranger. Columns (1) and (2) of Table 15 present the results from the DG with spouse. Matrilineal individuals give about 30 CF less to their spouse than patrilineal individuals do relative to a mean of approximately 150 CF. Columns (3) and (4) present the results for the DG with a stranger. Again, matrilineal individuals seem less altruistic than patrilineal individuals. Column (5) stacks the data from the two versions of the game. The coefficient on matrilineal is still negative and significant. The coefficient on spouse suggests that on average people send more to their spouse than a stranger. The matrilineal and spouse interaction term is negative but not significant. Interestingly, the negative estimated

effect for matrilineal individuals when playing with their spouse is almost the same magnitude as the main effect for playing with a spouse, suggesting that they are about as altruistic toward their spouse as they are to a stranger. I also look at whether a respondent chooses to send 0 CF to the other player in the DG. As shown in Column (8) matrilineal individuals are less likely to send 0 CF to the other player when that player is a stranger. Stacking the results from both games in Column (10) suggests that individuals generally are more generous with their spouses. However, matrilineal individuals are actually more likely to send 0 to their spouse than to a stranger.

The results in Table 15 suggest that matrilineal individuals may be less altruistic towards their spouse than patrilineal individuals. While patrilineal individuals are more generous to their spouses relative to a stranger, matrilineal individuals treat their spouses similar to strangers. If I control for DG game play in the PG results, I find that amount given in the DG is strongly correlated with amount contributed to the public good. However, it only slightly reduces the matrilineal effect. This suggests that while some of the variation in observed differences may be explained by altruism, it does not seem to full explain the difference in cooperation.

8.2. Results on Bargaining Power

I take several approaches to demonstrate that matrilineal women appear to have greater bargaining power. First, I present results from an ultimatum game. Second, I present a series of survey results from my own sample and from the DHS.

8.2.1. Ultimatum Game with Spouse and Stranger

In addition to completing the PG and DG, the respondents also completed two versions of the ultimatum game (UG). The UG is a standard bargaining game used in economic experiments. In the UG, a player 1 is presented with an endowment, in this case 1,000 CF. The player 1 sends a proposed division of the endowment to a player 2, who can then choose to accept or reject the proposed division. If the player 2 accepts the proposed division, then they get the amounts that the player 1 proposed; however, if player 2 rejects the proposed division, then both players receive nothing. Because the UG was administered in the field, we asked the player 2's to tell us for each

Table 15: Giving in Dictator Game and Sending 0 to Player 2 in DG

	Dep. Var.: Amount Gave in Dictator Game				
	With Spouse		With Stranger		All
	(1)	(2)	(3)	(4)	(5)
Matrilineal	-27.998***	-24.884	-17.487*	-15.999	-15.441
	(10.735)	(16.045)	(10.274)	(14.236)	(14.221)
Female	-9.410	-6.897	1.099	2.300	-2.298
	(12.106)	(16.922)	(11.545)	(16.248)	(15.699)
Matrilineal*Female		-6.261		-2.991	-4.626
		(21.529)		(20.704)	(19.889)
Spouse					18.766***
					(5.155)
Matrilineal*Spouse					-10.001
					(7.066)
Observations	640	640	640	640	1,280
Clusters	-	-	-	-	640
Mean Dep. Var.	138.3	138.3	123.4	123.4	130.9
	Dep. Var.: Sent 0 in Dictator Game				
	With Spouse		With Stranger		All
	(1)	(2)	(3)	(4)	(5)
Matrilineal	0.002	0.025	-0.064*	-0.051	-0.045
	(0.035)	(0.048)	(0.037)	(0.051)	(0.048)
Female	0.039	0.058	0.023	0.034	0.046
	(0.036)	(0.046)	(0.038)	(0.050)	(0.044)
Matrilineal*Female		-0.047		-0.026	-0.037
		(0.071)		(0.074)	(0.066)
Spouse					-0.087***
					(0.018)
Matrilineal*Spouse					0.063**
					(0.030)
Observations	640	640	640	640	1,280
Clusters	-	-	-	-	640
Mean Dep. Var.	0.248	0.248	0.311	0.311	0.280

Notes: Robust standard errors are reported for all columns. Columns (5) and (10) present results from stacking game play in the DG with spouse and the DG with stranger. For Columns (5) and (10), standard errors are clustered at the individual level. Regressions control for age and age squared. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal. *Female* is an indicator variable equal to 1 if the respondent is a woman. *Spouse* is an indicator variable equal to 1 if the Player 2 is the spouse and equal to 0 if the Player 2 is a stranger.. *Gave in DG* is the quantity of money the respondent contributed to the Player 2 in the DG. *Gave 0 CF in DG* is an indicator variable equal to 1 if the respondent gave 0 CF to the Player 2 in the DG. $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

possible offer they could receive from a player 1, whether they would accept or reject that offer.[28]

Table 16 presents the results from the 442 individuals that completed the UG during a field visit for both amount offered to the player 2 and whether or not they would accept a 0 offer as a player 2. I present the results by sex because for the UG we are interested in the comparison between matrilineal and patrilineal within a sex.[29] In general, individuals send more to their spouse relative to a stranger, as shown in Column (3), which stacks game play with spouse and stranger. The coefficient for matrilineal women in Panel B is negative for amount sent to spouse and amount sent to stranger, as is the matrilineal and spouse interaction term. Matrilineal women seem to send less to other players in general, and I cannot reject that they treat spouses and strangers the same. Matrilineal men do not seem to make different offers than patrilineal men as player 1s.

Individuals are more likely to accept an offer of 0 as a player 2 when paired with their spouse (the mean is 73% for men when paired with their spouse and 38% when paired with a stranger in Column (4)). Matrilineal men are 12 percentage points more likely to accept a 0 offer relative to patrilineal men when paired with their spouse. In column (6) which stacks game play for men across the games with spouse and stranger, the matrilineal and spouse interaction term is positive but not significant for matrilineal men.

The UG results provide suggestive evidence that women in matrilineal societies may have more bargaining power. They are able to send lower offers to other players. Additionally, matrilineal men are more willing to accept a zero offer from their spouse, despite no monetary incentive to do so. These results seem to be specific to interactions with the spouse, though I am unable to reject that they treat their spouses and strangers same.

8.2.2. Survey Evidence on Bargaining

To examine how kinship systems affect women's bargaining power, I also use survey evidence to examine whether women from matrilineal ethnic groups appear to have greater bargaining power than patrilineal women. Women's bargaining power is a difficult concept to measure because it is multi-dimensional and there is no agreed upon definition. I focus on several potential indicators

[28] As described above, some of the couples completed the UG in the field and others were invited into the lab. I do not include the results from the individuals who completed the UG in the lab setting, since the set up of the game play was different: in the lab individuals were only a player 1 or a player 2 and they did not complete the strategy method as a player 2. Additionally, in the lab individuals found out real time whether their offers were accepted.

[29] The results are similar if I present the pooled data. See Appendix D.4

Table 16: Giving in Ultimatum Game and Acceptance of 0 Offers

	Amount Sent as Player 1			*Accept 0 as Player 2*		
	With Spouse	With Stranger	All	With Spouse	With Stranger	All
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Men					
Matrilineal	6.611	14.516	14.303	0.123**	0.045	0.050
	(20.409)	(22.614)	(22.250)	(0.057)	(0.069)	(0.068)
Spouse			91.429***			0.329***
			(15.725)			(0.053)
Matrilineal*Spouse			-7.478			0.066
			(23.826)			(0.082)
Observations	221	221	442	221	221	442
Clusters	-	-	221	-	-	221
Mean	350.7	262	306.3	0.733	0.380	0.557
	Panel B: Women					
Matrilineal	-43.319*	-9.547	-10.173	0.045	0.046	0.048
	(23.852)	(20.073)	(19.992)	(0.057)	(0.070)	(0.071)
Spouse			121.127***			0.232***
			(16.306)			(0.043)
Matrilineal*Spouse			-32.519			-0.005
			(24.253)			(0.082)
Observations	221	221	442	221	221	442
Clusters	-	-	221	-	-	221
Mean	305.4	195.9	250.7	0.787	0.557	0.672

Notes: Robust standard errors are reported for all columns. Columns (3) and (6) present results from stacking game play in the UG with spouse and the UG with stranger and standard errors are clustered at the individual level. Regressions control for age and age squared. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal.*Spouse* is an indicator variable equal to 1 if the Player 2 is the spouse and equal to 0 if the Player 2 is a stranger. *Amount Sent* is the quantity of money the respondent offered to the Player 2 in the UG. *Accept 0* is an indicator variable equal to 1 if the respondent said they would accept an offer of 0 as Player 2 in the UG. $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

of women's bargaining power. First, I use survey data to examine views on gender equality, views on domestic violence, and self reported happiness. The analysis is disaggregated by gender, which means I am comparing matrilineal women to patrilineal women and matrilineal men to patrilineal men. I present average effect size (AES) estimates of questions related to domestic violence and gender equality to avoid concerns with multiple hypothesis testing. AES coefficients standardize the effect size to a mean of 0 and a standard deviation of 1. All of the regressions control for age and age squared, and robust standard errors are presented in parentheses.

Table 17 presents results on views on gender equality. This aggregates a series of questions on the appropriate role of women. Matrilineal women have views that are more favorable toward equality for women. Additionally, women from matrilineal ethnic groups are less likely to agree that domestic violence is justifiable in various situations. Matrilineal men, however, are no less likely than patrilineal men to believe domestic violence is appropriate. While not a standard measure of women's empowerment Table 17 also presents results on self-reported happiness levels. Matrilineal women report being quite a bit happier than patrilineal women (they are also happier than men).

I can also examine analogous questions in the DHS. The DHS asks questions on control in decision making, views on domestic violence, and actual domestic violence experienced. While these are not the exact same measures as in my survey, they capture similar information on women's bargaining power. Table 18 reports the AES coefficients for matrilineal on decision making and domestic violence for three RD bandwidths. Women assigned matrilineal status report more autonomy in decision making and are less supportive of domestic violence. They are also less likely to have experienced actual domestic violence. This is consistent with my survey data, where matrilineal women have views more supportive of women's autonomy and less supportive of domestic violence. If matrilineal women face less threat of domestic violence, then it may be easier for them to cooperate less with their spouse, and they may face less fear of reprisal for keeping money for themselves.

I can look at heterogeneity in responses to the decision making and domestic violence questions by siblings, one potential measure of matrilineal women's outside option. I construct an indicator variable for above median number of brothers, which is equal to one if a woman has more than two brothers. I then re-estimate equation 2, splitting the sample into women with below or equal to median number of brothers and those above the median number of

Table 17: Survey Evidence on Women's Bargaining Power

	Views on Gender Equality (AES Coefficients)		*Domestic Violence (AES Coefficients)*		*Happiness Level*	
	Men	Women	Men	Women	Men	Women
	(1)	(2)	(3)	(4)	(5)	(6)
Matrilineal	0.059	0.093*	-0.015	-0.157*	0.041	0.361***
	(0.044)	(0.052)	(0.098)	(0.086)	(0.102)	(0.099)
Observations	320	320	319	319	319	319
Mean	-	-	-	-	2.69	2.69

Notes: Robust standard errors in parentheses. Regressions control for age and age squared. *Matrilineal* is an indicator variable equal to 1 if the respondent reports an ethnic group that is matrilineal.*Views on Gender Equality* presents Average Effect Size estimates for the following questions: how strongly do you agree that (1) mother responsible for child care, (2) man should have final say, (3) can divorce wife if infertile, (4) man decides when have sex, (5) women have same right to work and study as men, (6) women should tolerate beating, (7) only real woman once have child, (8) couple should decide number of children together, (9) women can suggest use condom, (10) men should help with household tasks, (11) as important for girls to go to school as boys, (12) better to have more sons, (13) men should eat first if limited food, (14) woman can go to health center without husband's permission, (15) woman can use family planning without husband's permission, (16) women should look at floor when talking to husband, (17) wife and husband are equal partners, (18) boys should receive education before girls if limited funds; all questions answered on a scale from (1) Strongly Agree to (5) Strongly Disagree. Response options adjusted so that more positive value means more woman friendly. *Domestic Violence* presents Average Effect Size estimates for the following questions: Domestic violence is justified if wife (1) goes out without husband's permission (2) neglects children (3) argues with husband (4) refuses sex (5) burns food; all questions answered with 1 Strongly Disagree to 5 Strongly Agree. *Happiness* presents estimates for the question: How happy are you where on a scale of (1) Very Unappy to (5) Very Happy. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 18: DHS Results on Women's Bargaining Power

	Linear Polynomial in Latitude and Longitude								
	Decision Making (AES Coefficients)			*Views of Domestic Violence (AES Coefficients)*			*Actual Domestic Violence (AES Coefficients)*		
Sample Within:	200 kms	100 kms	50 kms	200 kms	100 kms	50 kms	200 kms	100 kms	50 kms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Matrilineal	0.178***	0.147**	0.124	-0.191***	-0.130**	-0.041	-0.149**	-0.111*	-0.145*
	(0.062)	(0.072)	(0.103)	(0.047)	(0.051)	(0.070)	(0.059)	(0.066)	(0.084)
Observations	1,027	667	294	11,921	7,819	3,831	2,668	1,828	920
Clusters	281	188	88	396	261	128	247	167	82

Notes: Standard errors in parentheses clustered at the DHS cluster level. The data are for women only. *Matrilineal* is an indicator variable equal to 1 if the respondent is from a DHS cluster in the matrilineal belt. *Decision Making* presents Average Effect Size estimates for the following questions: Who is the person who usually decides on (1) using contraception, (2) how to spend respondent's earnings, (3) respondent's healthcare, (4) large household purchases, (5) visits to relatives, (6) how to spend husband's earnings ; all questions answered as a 1 to 3 categorical variable where 1 is Partner/Other Person, 2 is Respondent and Partner, and 3 is Respondent. *Views of Domestic Violence* presents Average Effect Size estimates for the following questions: is beating justified if wife (1) goes out without telling the husband (2) neglects the children (3) argues with husband (4) refuses to have sex with husband (5) burns the food; all questions answered as a 0 for no and a 1 for yes. *Actual Domestic Violence* presents Average Effect Size estimates for the following questions: (1) experienced control issues (2) experienced emotional violence (3) experienced less severe violence (5) experienced severe violence (6) experienced any sexual violence (7) experienced injuries. The response options are rescaled so that higher numbers indicate more domestic violence, with 0 for never, 1 for sometimes, and 2 for often. Controls include DHS year, age, age squared, years of education and wealth. DHS clusters within ethnic group boundaries coded as bilateral are excluded from the analysis. Kinshasa and Lubumbashi are also excluded. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 19: DHS Result Heterogeneity by Number of Brothers

	Linear Polynomial in Latitude and Longitude - 100 kms from Matrilineal Belt					
	Decision Making (AES Coefficients)		*Views of Domestic Violence (AES Coefficients)*		*Actual Domestic Violence (AES Coefficients)*	
	Below Median Num. of Bros	Above Median Num. of Bros	Below Median Num. of Bros	Above Median Num. of Bros	Below Median Num. of Bros	Above Median Num. of Bros
Matrilineal	0.159	0.155*	-0.065	-0.198***	-0.039	-0.159**
	(0.100)	(0.082)	(0.056)	(0.052)	(0.081)	(0.073)
Observations	323	327	3,936	3,557	918	830
Clusters	141	149	261	261	167	164

Notes: Standard errors in parentheses clustered at the DHS cluster level. The data are for women only. Below median number of brothers is 2 or fewer brothers.*Matrilineal* is an indicator variable equal to 1 if the respondent is from a DHS cluster in the matrilineal belt. *Decision Making* presents Average Effect Size estimates for the following questions: Who is the person who usually decides on (1) using contraception, (2) how to spend respondent's earnings, (3) respondent's healthcare, (4) large household purchases, (5) visits to relatives, (6) how to spend husband's earnings ; all questions answered as a 1 to 3 categorical variable where 1 is Respondent, 2 is Respondent and Partner, and 3 is Partner. *Views of Domestic Violence* presents Average Effect Size estimates for the following questions: is beating justified if wife (1) goes out without telling the husband (2) neglects the children (3) argues with husband (4) refuses to have sex with husband (5) burns the food. *Actual Domestic Violence* presents Average Effect Size estimates for the following questions: (1) experienced control issues (2) experienced emotional violence (3) experienced less severe violence (5) experienced severe violence (6) experienced any sexual violence (7) experienced injuries. Controls include DHS year, age, age squared, years of education and wealth. DHS clusters within ethnic group boundaries coded as bilateral are excluded from the analysis. Kinshasa and Lubumbashi are also excluded. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

brothers. The matrilineal coefficient is similar across the two samples for the decision making questions. Matrilineal women with more brothers have views less in favor of domestic violence. More importantly, women with more brothers are much less likely to have experienced domestic violence. This is consistent with the matrilineal kinship structure affecting a husband's ability to threaten and implement violence, and suggests that male siblings may be important for women's well being.

9. Conclusion

This paper examines how kinship systems affect spousal cooperation. In matrilineal kinship systems, lineage and inheritance are traced through female members, which may have consequences for spousal relations. First, because the spouses maintain close relations with their own lineage, rather than the wife being incorporated into the husband's lineage, there are conflicting allegiances within the household. This may translate into lower levels of altruism between spouses. Second, because a woman's family retains control of her children, the woman herself has greater control over the children and a potentially higher outside option. This may translate into greater bargaining power for women.

I examine cooperation in an experimental setting using a public goods game. I use a

geographic regression discontinuity design to demonstrate that matrilineal men and women contribute less to a household public good relative to patrilineal individuals. This is particularly the case when they realize an unobserved income shock and it becomes more feasible to hide income. I show that the results are specific to being paired with a spouse, and that being able to hide income is not important when playing with a stranger of the opposite sex. I use physiological data to provide complementary evidence of greater discord in matrilineal households. Matrilineal individuals experience greater stress during game play with their spouse relative to patrilineal individuals, even controlling for game play decisions, but do not experience differential stress when paired with a stranger.

I then examine outcomes for children of matrilineal women. Using survey data from my sample, I find that children of matrilineal women have significantly more years of education and are less likely to have been sick in the last month. These results suggest that women from matrilineal societies may be better able to implement their preferences. I examine similar outcomes in the DHS. Matrilineal women have fewer children that have died and children in matrilineal areas are better educated. Thus, despite that I find evidence of less cooperation between matrilineal spouses, I also find that there may be particular benefits of kinship systems that result in greater autonomy for women.

Based on the predictions from a non-cooperative model of contributions to a public good and from anthropological evidence, I explore the channels through which matrilineality matters for spousal cooperation. I provide suggestive evidence that differential cooperation by matrilineal individuals may be explained by a combination of decreased spousal altruism and increased women's bargaining power. Matrilineal individuals appear to be less altruistic towards their spouses, effectively treating them the same as they treat strangers, while patrilineal individuals are more generous with their spouses relative to strangers. I find some evidence that matrilineal women have greater bargaining power relative to patrilineal women across a variety of indicators, including game play in an ultimatum game and various survey measures. I use DHS data to examine outcomes for the DRC as a whole. I find evidence consistent with matrilineal women having greater bargaining power - they report having greater control in decision making and are less likely to support or have experienced domestic violence.

This paper offers evidence that broader social structures matter for understanding bargaining outcomes in the household. I provide evidence that matrilineal individuals cooperate less with

their spouses. They also experience greater stress during interactions with their spouse. An increase in discord means that households are less able to reap the benefits of joint production and are less efficient. However matrilineal women are better able to invest in the health and education of their children, indicating the benefits of a kinship system that gives women greater bargaining power. At low levels of women's bargaining power, there may be a trade off between cooperation in the household and an increase in women's bargaining power.

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