Do Women Supply More Public Goods than Men? Preliminary Experimental Evidence from Matrilineal and Patriarchal Societies

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Some 35 years ago, the Club of Rome published a book that sold more than 30 million copies across 30 different translations (Donella Meadows et al. 1972). The book predicted the collapse of modern society if population growth, resource depletion, and pollution proceeded unabated. More recently, the Millennium Ecosystem Assessment echoed similar sentiments, documenting the loss of vital ecosystem services and predicting a dismal future unless drastic measures were taken. The underlying causes of our rapacious attitude toward the Earth has been conjectured to be linked to several factors, including *Homo sapiens*'s selfishness and lack of empathy for other humans and other species.

The selfishness hypothesis has been studied extensively in experiments. One popular approach is to use variants of the simple prisoner's dilemma game. For example, public goods experiments, which are *n*-person simultaneous move games, are designed to make individual contributions to the public good yield positive externalities, but noncontribution is a dominant strategy. A typical result in this setting is that subjects are sensitive to free-riding incentives, but nonetheless cooperate at a level that cannot be fully explained by the selfishness assumption.

Results from this class of games point to an interesting asymmetry between play across women and men—women appear more socially minded than men (see Catherine Eckel and Philip Grossman (forthcoming) and Rachel Croson and Gneezy (2008) for a review). Relatedly, nonexperimental evidence provides support for the hypothesis that gender-specific preferences matter for resource allocation. Ted Goertzel (1983), John Lott and Lawrence Kenny (1999), and Lena Edlund and Rohini Pande (2001) argue that men and women may have different policy preferences. Raghabendra Chattopadhyay and Esther Duflo (2004) exploit the Indian system of random political reservations for women to show that gender has an impact on policy decisions—notwithstanding theoretical predictions of the "Downsian" voting model (where voter preferences determine policies). The evidence suggests that female politicians favor policies that reflect the preferences of women. Relatedly, David Dollar, Raymond Fisman, and Roberta Gatti (2001) argue that increased female participation in politics is negatively correlated with corruption measures.

In this research agenda, our overarching theme is to explore the source of the observed gender differences. This paper represents our first step, which is a simple economic experiment conducted in three different Indian societies situated closely geographically—yet, a major difference is that one is matrilineal and two are patriarchal societies.[1] Our main objective in this first step is to examine, in a simple experiment, whether agents in female-dominated societies

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[1] A matrilineal society is one where offspring join the mother's group automatically at birth and stay members throughout life. A matrilineal society does not automatically confer all decision-making power to women; however, empirically, matriliny is associated with greater decision-making power for women than is found in other societies. There is no clear definition among anthropologists of matriarchy. Yet, some consider it the opposite of patriarchy; in this case, men would have inferior rights as well as lower social status.

provide public goods at a different level than agents in nonmatrilineal societies.

We report some suggestive results. First, fewer agents are strong free-riders in the matrilineal society compared to the nonmatrilineal societies. Second, public good provision is higher in the matrilineal society. Third, this higher level of provision is due primarily to *male, rather than female,* differences in contributing to the public good. We view these results as providing only preliminary insights into the underpinnings of the factors hypothesized to be important determinants of resource depletion. We conclude by outlining the work that must be done to proceed in an informative manner.

I. Experimental Design

The experiment was conducted in similar environments within three different societies in North East India: a Khasi village, and two Assamese villages. The Khasi of Meghalaya, India, are a matrilineal society and inheritance and clan membership is organized around the mother's house, headed by the grandmother who lives with her unmarried daughters, her youngest daughter (even if she is married), and her youngest daughter's children. Though Khasi women do not generally assume the roles held by men in patriarchal societies (they do not become warriors or hunters, for example) they always live in households in which they or their mother have authority over most household decisions. For a more patient description of the Khasi society see Gneezy, Kenneth L. Leonard, and List (2008).

The experiment with the Assamese was conducted in two geographically separated villages in the Guhuwarti region in Assam of North East India. The two patriarchal Assamese societies are situated closely to the Khasi in India. The Assamese of Assam, India, have myriad ethnic practices and assimilated beliefs. The region is predominately a patriarchal Hindi society, though patriarchal Islam was introduced to the region in the thirteenth century. Both Hindi and Muslim tribes and villages are spread across the plains of Assam in small and large clusters. Our two patriarchal societies are mainly populated by Hindi and Muslims and, in contrast to the Khasi, in these societies lineage is traced through males. To attenuate confounds between nurtured culture and religion, we chose two distinct societies in Assam. In this spirit, we have

two distinct patriarchal societies in which to compare behavior in the matrilineal society

While we attempted to consider the balance of observables and unobservables beyond the power of women across the societies, there might remain a critical vector of other variables that varies between the societies other than the role of women. Clearly, this issue is central to inference made from data gathered across any distinct groups, and highlights that care should be taken when making inference from the data patterns observed. Ultimately, what is necessary to shed light on these issues is to build on our work by studying other societies. In particular, the villages we examined also differed in religion. While the people in the Khasi village we study were mostly Christian, one of the patriarchal villages was Hindi while the other was Muslim. We return to this issue below.

Similar experimental procedures were used across the societies. We recruited the participants in advance and asked each potential subject to show up at the village school at a given time. This attenuated selection problems since everyone was interested in participating in the experiment after they were made aware of the pecuniary incentives involved. The structure was such that subjects had a private area where they were instructed in the task. We called participants to the experimental area one by one. After subjects had completed the tasks, they waited outside the experimental area. Once enough subjects had completed the experiment to ensure anonymity, subjects were randomly assigned to groups and their payments were made. Subjects who awaited payment were kept aside from subjects waiting to participate.

Participants were asked to choose the amount of money to place in the individual exchange and the group exchange.[2] We employ the traditional public good game exactly from James Andreoni (1995), which includes two distinct frames: a *positive* and a *negative* framing. The difference in treatments is merely the wording

of the two investment types. In the *positive* framing, subjects are told, "Every Rupee you invest in the Individual Exchange will yield you a return of one. Every Rupee invested in the Group Exchange will yield a return of one half for every member of the group, not just the person who invested it." In the *negative* framing, subjects are told, "Every Rupee you invest in the Individual Exchange will yield you a return of one. However, each Rupee you invest in the Individual Exchange will reduce the earnings of the other players by one-half Rupee each." Thus, under both frames, allocating the entire endowment to the individual investment is the dominant strategy for those with purely selfish preferences, whereas the group investment maximizes the total group surplus.

We used a between-subject design whereby participants were told to allocate 60 Rupees under one of the two frames (Glenn Harrison and List (2004) call such an exercise an "artefactual" field experiment). This stakes level is relatively high compared to the literature, given that the average daily income of our subjects is roughly 60 Rupees. After choosing the allocation, participants completed an exit survey. As promised, they were never given the opportunity to learn with whom they were paired and were paid their earnings in private.

In total, we had 191 participants (79 Khasi, 61 Muslim Assamese, and 51 Hindi Assamese). Concerning specific participant observables, we find that our average subject was in the 25–30 age range, but the Khasi sample had slightly older subjects (30.1 versus 25.3 and 26.8 in the Assamese societies). The male/female compositions are roughly similar across the three groups, but slightly more men were in the Assamese Hindu sessions. There are also some slight marital status differences, with marriage rates slightly higher among the Khasi. Due to these differences, besides analyzing the raw data we also examine empirical models that control for these observables.

II. Experimental Results

Table 1 contains the aggregate data across gender for each society, as well as the finer data in the positive and negative frames. In Table 1, we define "strong free-riding" as not contributing anything to the public good. Table 2 presents the results from conditional analyses. From these data, we report a first result concerning the tendency for strong free-riding:

RESULT 1: *Fewer agents are strong free-riders in the matrilineal society than in the nonmatrilineal societies.*

Evidence to support this result is contained in Tables 1 and 2. In Table 1, we report that, in aggregate, and across both the positive and negative frames, the Khasi were considerably more likely to contribute a portion of their endowment to the public good. Indeed, using a test of proportions, we find that the percentages of strong free-riders are significantly different across the Khasi and non-Khasi groups at the $p < 0.05$ level for each comparison.

While the raw data provide initial evidence that strong free-riding and society are linked, there has been no attempt in these unconditional tests to control for observables. In columns 1–5 in Table 2 we present estimates from a Probit regression model in which we regressed whether the individual was a strong free-rider on a dummy variable for society and individual specific observables collected from our survey (using the Assamese Muslim group as the baseline). Empirical results from the various specifications suggest that regardless of which specification is preferred, empirical results are consonant, and further suggest that the Khasi are less likely to be strong free-riders than agents from the other societies. For example, results in column 1 suggest that the Khasi are roughly 73 percent less likely to be strong free-riders than the Assamese Muslim. Further, the Khasi are significantly less likely to be strong free-riders than the Assamese Hindi, but in the positively framed treatment, this difference is significant only at the $p < 0.16$ level.

Concerning total provision of the public good, we find:

RESULT 2: *Agents in the matrilineal society tend to contribute more to the public good than agents in the other societies.*

Table 1 presents preliminary empirical support for this result, revealing that aggregate investment in the public good among the Khasi was more than 27 units, whereas investment among the Assamese Muslim and Assamese Hindi is roughly 5 and 23, respectively.

TABLE 1—EXPERIMENTAL OUTCOMES

	Khasi mean (Std. dev.)	Assamese Hindi mean (Std. dev.)	Assamese Muslim mean (Std. dev.)
Aggregate:			
Investment	27.3	23.3	4.6
	(14.6)	(24.7)	(13.4)
Male	25.9	18.2	3.2
	(16.4)	(23.8)	(11.9)
Female	28.8	32.8	6.0
	(12.5)	(24.2)	(14.8)
Strong free-riders	10.0 percent	47.1 percent	86.9 percent
Male	15.0 percent	57.7 percent	90.3 percent
Female	5.0 percent	27.8 percent	83.3 percent
N	79	51	61
Positive treatment:			
Investment	27.2	32.3	8.3
	(14.7)	(23.4)	(17.6)
Male	29.0	22.7	6.25
	(15.5)	(24.3)	(16.3)
Female	25.3	45.5	10.7
	(13.9)	(14.4)	(19.4)
Strong free-riders	12.8 percent	26.9 percent	76.6 percent
Male	15.0 percent	46.6 percent	81.3 percent
Female	10.5 percent	0.0 percent	71.4 percent
Negative treatment:			
Investment	27.5	14.0	1.0
	(14.7)	(22.9)	(5.4)
Male	22.8	14.4	0.0
	(17.1)	(23.3)	(0.0)
Female	32.1	12.9	1.86
	(10.4)	(23.6)	(7.5)
Strong free riders	7.5 percent	68.0 percent	96.8 percent
Male	15.0 percent	66.6 percent	100.0 percent
Female	0.0 percent	71.1 percent	93.7 percent

Notes: Investment denotes money invested in the public good. *Strong free-riders* denotes the share of subjects investing zero in the public good.

We provide regression evidence in support of Result 2 in columns 6–10 in Table 2, where we use a Tobit specification to model the individual contributions. Empirical results suggest that the Khasi contribute roughly 36–69 more units to the public good than the Assamese Muslim. Such differences are large, as they represent deviations of several hundred percent in the negative framed treatment. The regression results also reveal the differences that exist between the Khasi and the Assamese Hindi in the negative framed treatment, but this result reverses in the positive treatment, though not statistically so. Much like the probit results in columns 1–5, the parameter estimates are robust to inclusion of individual specific covariates.

Upon digging a level deeper into the data, we find that these results are not driven primarily by Khasi women contributing more than their cross-society female counterparts; rather, the evidence on women's giving is mixed, whereas men in the Khasi society tend to contribute more than their male counterparts in other societies. This represents the basis of our next result:

RESULT 3: *The higher public good provision observed in the matrilineal society is due more to male differences in giving across societies than to female differences.*

Evidence for this result can be found in Table 1. In both framing conditions, Khasi males, on average, contribute more than Assamese Hindi and Assamese Muslim males. The evidence for females is consistent with this finding across the Khasi and Assamese Muslim, yet the result

TABLE 2—REGRESSION RESULTS

	Model I–Probit					Model II–Tobit				
	All	Positive		Negative		All	Positive		Negative	
Constant	1.12	0.73	−1.67	1.84	0.53	−24.3	−11.1	24.6	−42.9	−22.3
	(0.20)	(0.25)	(1.96)	(0.44)	(1.07)	(5.6)	(6.4)	(28.4)	(11.4)	(16.0)
Khasi	−0.73	−0.57	−0.61	−0.90	−0.93	50.2	36.5	37.7	69.4	68.1
	(0.05)	(0.09)	(−0.09)	(0.06)	(0.05)	(6.4)	(7.6)	(7.6)	(12.3)	(11.2)
Hindi	−0.40	−0.40	−0.42	−0.50	−0.56	39.7	39.9	40.8	43.4	42.5
	(0.07)	(0.09)	(0.09)	(0.15)	(0.16)	(6.7)	(8.1)	(7.8)	(12.1)	(11.6)
Male			0.29		0.25			−11.5		−10.8
			(0.12)		(0.17)			(5.7)		(6.0)
Age			0.05		0.03			−1.8		−0.8
			(0.05)		(0.03)			(1.9)		(0.8)
Age^2			0.00		0.00					
			(0.00)		(0.00)			(0.0)		(0.0)
Married			0.26		−0.07			−7.0		8.9
			(0.19)		(0.19)			(7.5)		(6.6)
N	191	95	94	96	93	191	95	94	96	93

Notes: Dependent variable for probit model is *Strong Free-Rider* and takes on a value of one if the participant opted not to contribute, and zero otherwise. Explanatory variables are reported as marginal effects on dummies. Standard errors are in parentheses. Dependent variable for tobit model is *Investment* and takes on the amount of money invested in the public good. Standard errors are in parentheses. Due to missing age information on one participant for the positive framing and three for the negative, these observations are omitted in the conditioned regressions. Probit estimates are partial derivatives computed at sample means or the discrete change of dummy variables from zero to one.

reverses for the Khasi/Assamese Hindi, where Khasi females contribute less than their female counterparts.

We interpret Result 3 as suggestive of the underpinnings of the factors hypothesized to be important determinants of the observed gender differences. Some commentators have argued that the underlying factors responsible for the observed differences in cooperation rates across gender are innate. For example, Simon Baron-Cohen (2003, 256) argues that males, on average, are biologically predisposed to be "forgetful of others," whereas females are, on average, innately designed to care more for others. Our data patterns lend some support to the notion that innate differences are not the sole driver.

Our final result corroborates an earlier methodological insight due to Andreoni (1995):

RESULT 4: *In the nonmatrilineal societies, framing matters.*

Evidence for this result can be found in Tables 1 and 2. For example, both tables reveal that strong free-riding is greater in the negatively framed treatment among the Assamese groups. Yet, among the Khasi, the frame does not influence the tendency for strong free-ridership. These insights are supported via a series of pro-

portion tests, which show that the frame does not matter for the Khasi group, but is an important determinant of strong free-riding among the Assamese. There exist stark differences in contribution patterns across the Assamese in these treatments.

We view these results as evidence in support of Andreoni's (1995) findings, and highlight the power that the frame can have in these games.

III. Concluding Remarks

Ecosystem services are integral to the sustainability of the human race. A result in the literature that has recently surfaced suggests that resources would be used in a more friendly manner if women held the major responsibilities for environmental stewardship. Yet, such conjecture clearly relies on speculative data, and to our knowledge little formal evidence exists that supports this hypothesis. Our goal in this study is to provide some preliminary, and merely *suggestive*, insights into this issue. We stress that our simple environment is one where the results should be used with caution.

Our data are consistent with the notion that societal structure is critically linked to public good provision. We find not only that matrilineal societies have fewer strong free-riders (agents

who contribute nothing to the public good), but also that the level of public good provision tends to be higher in the matrilineal society. This result is not driven primarily by females in the matrilineal society contributing extraordinary amounts; rather, this insight is also due to Khasi men contributing more to the public good than their Assamese male counterparts. We believe that these results provide some initial insights into the underpinnings of the factors hypothesized to be important determinants of resource depletion.

An important caveat to our findings concerns the potential confound between religion and matrilineality across villages. The two patriarchal villages we studied differed significantly in the amount contributed *and* in the religion of the people. When designing the experiments, we did not predict such a strong influence of the religion of the participants. In this sense, religion appears to be strongly correlated with individual contributions in simple public goods games. Further research is needed to disentangle this potential confound in our data.

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