

## **Economic Game Behavior Among the Shuar**

H. Clark Barrett and Kevin J. Haley

Center for Behavior, Evolution, and Culture

Department of Anthropology

University of California, Los Angeles

### **Introduction**

Previous research shows that the economic behavior of individuals across a number of populations—as measured by experimental economic game results—consistently deviates from the predictions of traditional economic models (Camerer & Thaler, 1995; Henrich et al. 2004). While a number of factors have been demonstrated to affect behavior in such experiments conducted in laboratory settings, there is reason to believe that some differences in player behavior may be a result of differences in degrees of engagement in various market activities, and in exposure to economic theories themselves (Ensminger, 2004; Henrich, 2000). In addition, a variety of other factors may influence how people in a particular society play economic games, including cultural norms of social interaction, the strategic nature of the local economic environment, and framing effects, i.e., effects of the particular decision-making structures that individuals map onto the game setting.

The Shuar of Ecuador are traditionally a fiercely individualistic society, living in low populations densities in the Amazon forest, in household units loosely clustered into villages (Harner, 1972). However, the Shuar have recently experienced major changes in ecology and subsistence, including a growing importance of a cash economy, aggregation

into larger and more centralized communities for the purposes of access to resources such as schools and labor, and relatively recent wealth differences. We were therefore intrigued by the question of how the Shuar would play economic games such as the Dictator Game, the Ultimatum Game, and the Third Party Punishment Game. Would they exhibit relatively self-interested behavior, like the Machiguenga (Matsigenka), a group with traditionally similar household-level organization (Henrich, 2000; Johnson, 2000), or would they exhibit a tendency towards fairer offers in the games, as seen in societies with greater exposure to market economies (Henrich et al., 2004)?

### **Study population**

The Shuar are a hunter-horticulturalist society in the Upper Amazon region of eastern Ecuador and northwestern Peru. Traditionally, the Shuar had little or no political or social organization above the level of the household, except for limited purposes such as trade in specific resources such as blowgun arrow poison, or temporary alliances in warfare (Harner, 1972; Karsten, 1935). Even within villages, the Shuar attitude could be characterized as highly individualistic, at least at the level of individual family units, and this attitude persists today. Anyone who has spent time in a Shuar village, or among the culturally similar Achuar (Patton, 2004), will note that the Shuar, as individuals, do not like to be told what to do, and there is a strong cultural norm towards the rights of individuals to make decisions on their own. This manifests itself in frequent within-village feuds, and in the fact that people in traditional Shuar villages will often simply leave, with their family, when conditions are not to their liking.

These cultural norms seem to work well in the low population densities and relative isolation in which many Shuar lived until recently. In areas of the Amazon basin where huge areas of land are uninhabited by people, it is possible for a family to live in relative isolation, supporting itself with the help of a few nearby households. Today, however, the living conditions of most Shuar people are in a period of transition as roads, electricity, and commerce encroach ever more rapidly into the Amazon region, and as population densities increase and land is divided into permanent parcels by the local government. These changes have forced many Shuar to live in situations for which their norms of family-level independence are not well-suited.

Where roads and commerce have existed for long periods of time, as in Macas, Sucua, and the surrounding areas, Shuar culture has had substantial time to accommodate to the cash economy of Ecuador (Harner, 1972). In more remote areas, certain cultural changes resulting from the efforts of missionaries are noticeable (e.g. reduced homicide rates), but subsistence practices, as well as other traditional elements of Shuar culture, remain relatively unaffected by the modern Ecuadorian economy, as one might expect given the absence of roads and the poor navigability of most rivers in the upper Amazon area. To anyone who has visited this region, roads are an obvious factor in culture change. In areas located within a day's walking distance from a road, or where a road has recently arrived, change in economic and subsistence-related practices is palpable, though the Shuar language and many aspects of Shuar culture remain, based on comparison with previous ethnographic work with the Shuar (Harner, 1972; Karsten, 1935).

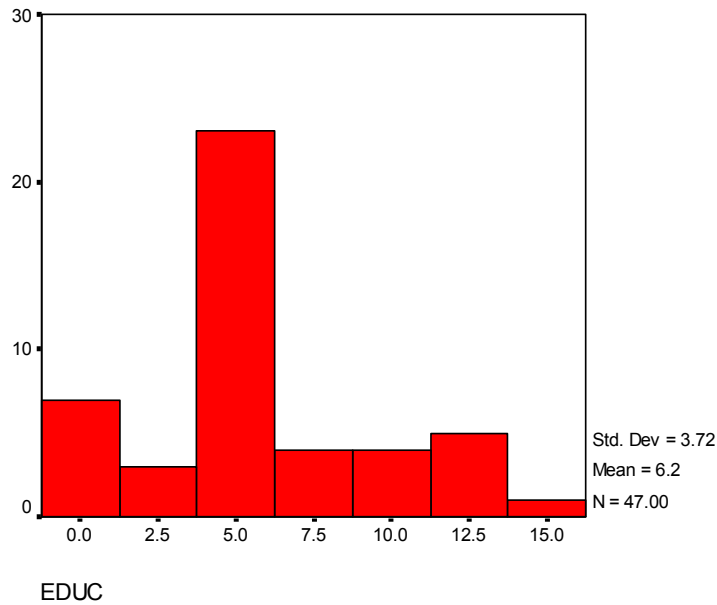
### Basic Setting

This study was conducted in the Shuar *centro* (village) of Chinimpi, which is located in the northwest corner of Morona Santiago province, just south of the town of Palora, at approximately 1°50' S, 77°50' W. Of the many aspects of this village that we might mention, some are quite typically Shuar, and others make it rather unusual for a Shuar village. Because the basic features of Shuar culture have been described elsewhere (see Harner, 1972; Karsten, 1935; for an ethnography of the closely related Achuar culture, see Descola, 1996), we will refrain from describing them here.

Internally, the political organization of Chinimpi is typical of Shuar villages today. Landholding heads of household (mostly men but a few women) are *socios* of the village, which gives them voting rights as well as the obligation to participate in *mingas*, or community work parties. There are approximately 50 socios, and the total population of the village is about 300 (relatively large for a Shuar village), though a smaller population participates regularly in village life. The village has several officials elected yearly by a vote of the socios, including a president, vice-president, secretary, and treasurer. There is a school that has recently begun to offer high-school level classes, taught by Spanish / Shuar bilingual teachers (the average adult in Chinimpi has had approximately 6 years of formal education; see Figure 1 for distribution of years of

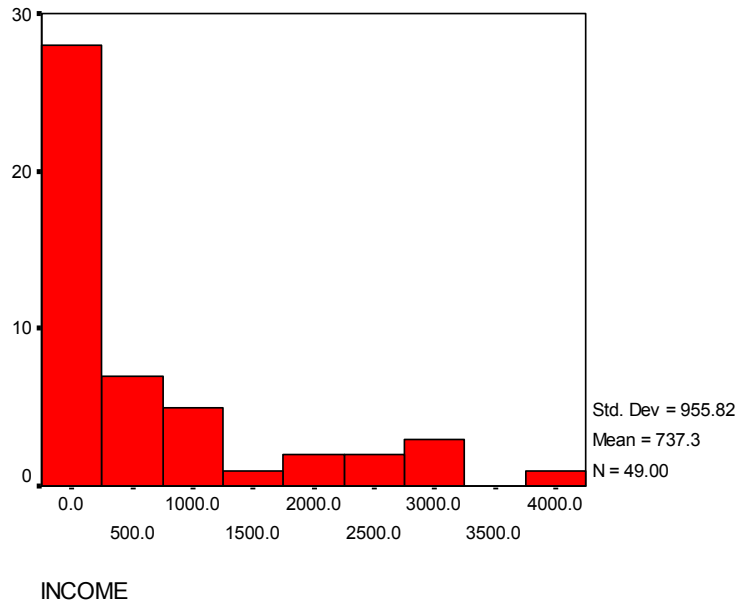
schooling in study participants), and electricity has arrived, though frequently cut off by the power company for lack of payment.

Figure 1. Distribution of years of schooling among participants



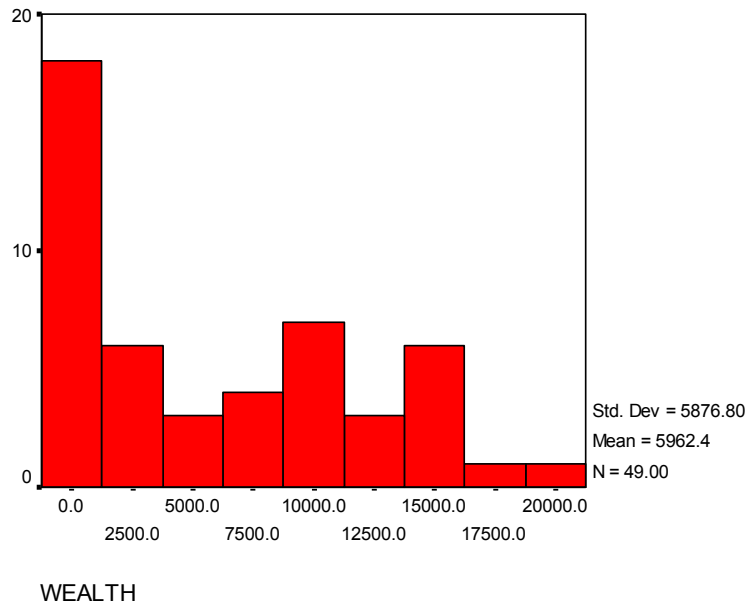
Note: Number below each bar shows mean number of years of formal schooling in the interval represented by that bar. Vertical axis shows number of participants. Figure shows data for participants in all three games, pooled.

Figure 2. Distribution of individual yearly income



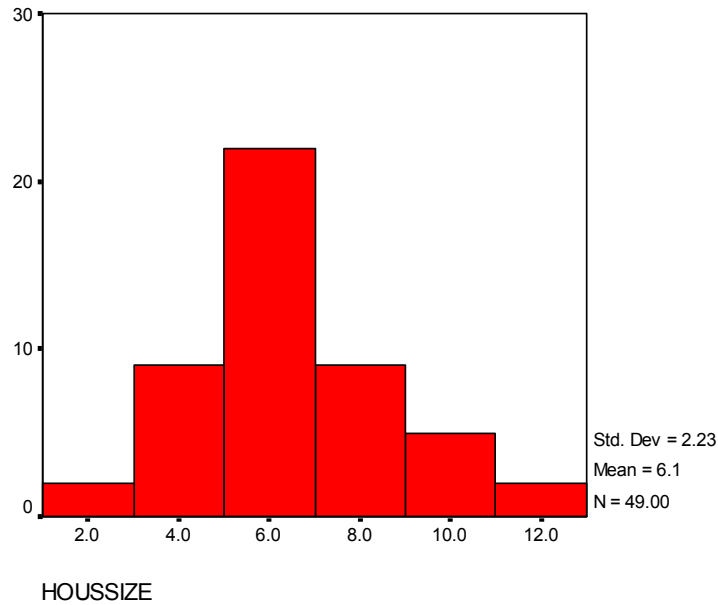
Note: Number below each bar shows mean reported annual income, in US dollars, in the interval represented by that bar. Vertical axis shows number of participants. Figure shows data for participants in all three games, pooled.

Figure 3. Distribution of reported wealth



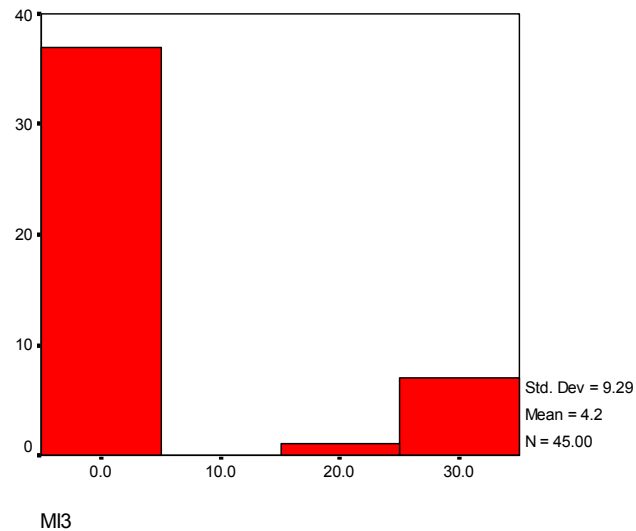
Note: Number below each bar shows mean reported wealth, in US dollars, in the interval represented by that bar. Vertical axis shows number of participants. Figure shows data for participants in all three games, pooled.

Figure 4. Distribution of household sizes



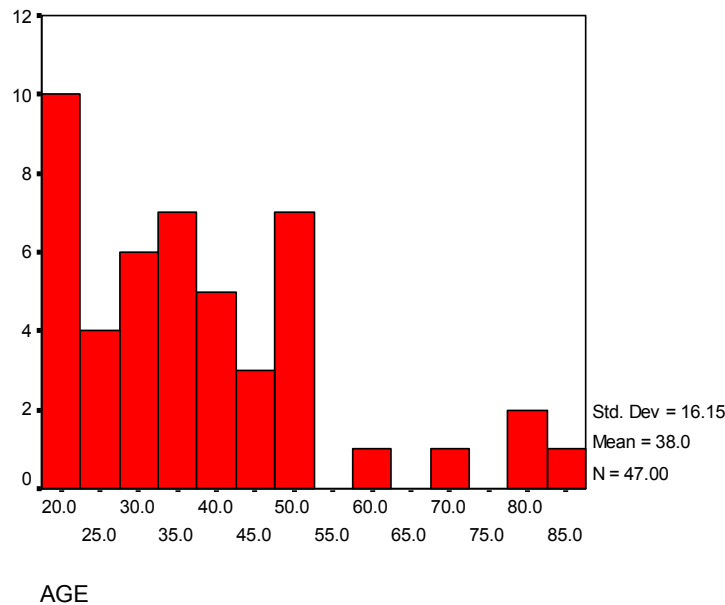
Note: Number below each bar shows mean reported household size, in number of individuals, in the interval represented by that bar. Vertical axis shows number of participants. Figure shows data for participants in all three games, pooled.

Figure 5. Frequency of wage labor in previous month



Note: Number below each bar shows mean number of days engaged in wage labor in previous month. Vertical axis shows number of participants. Figure shows data for participants in all three games, pooled.

Figure 6. Distribution of participant ages



Note: Number below each bar shows mean age in years in the interval represented by that bar. Vertical axis shows number of participants. Figure shows data for participants in all three games, pooled.

### Subsistence, Income, and Wealth

Due to the depletion of animal resources, the Shuar in Chinimpi have lost many of their traditional methods of making a living, and while most of them are familiar with a cash economy, they have limited opportunities for engaging in modern market activities. Many household heads periodically engage in the cutting and sale of wood, a practice that provides a sporadic source of income at best. Through approximately the year 2000, the sale of wood for lumber was fairly common, but this has tapered off as trees within hauling distance from the road have been depleted, and since the Ecuadorian government passed a law regulating the size of felleable rainforest trees. As a result of limited opportunities to engage in market activities, villagers in Chinimpi, in general, have low levels of income and wealth by the measures we used. The average reported annual income per household in Chinimpi is US\$ 737 (s.d. 956; see Figure 2), and most households engage in no active renting, selling, or trading of goods in markets. A few households own cattle, and/or pigs, which are typically sold in a market setting, though

this is not widespread, and there is significant wealth disparity in this regard (mean reported cattle wealth \$US 712.04; s.d. 1420.00). Nearly all household heads do own fincas, averaging 32.09 Ha (s.d. 23.78), and worth approximately US\$ 4846.53 (s.d. 4974.00; for distribution of overall household wealth, see Figure 3; for distribution of household sizes, see figure 4.). It is possible for households to sell their land, though rare. Most families rely mainly on their own labor on their fincas to provide them with their food resources and other subsistence materials. The average household in Chinimpi acquires less than a quarter of its nutrition from the Sunday markets of Palora. However, some individuals participate frequently in wage labor (Figure 5). The distribution is bimodal, with most individuals engaging in zero wage labor, but with another, smaller group almost continuously employed.

### **Cooperation, norms, and institutions**

Chinimpi's location on a road, along with its size and the fact that it is the geographic nucleus of several surrounding Shuar villages that are accessible only by foot, led to its being selected as the site for a World-Bank-funded sugar cane processing project. The funded part of this project, which was the construction of a small zinc-roofed shelter for a motor-powered sugar cane grinder and drying vats, was recently completed. However, no profit has been generated. No stable labor force is assembled, and the plant has yet to see any activity other than the testing of the equipment. This is, arguably, largely due to the fact that the World Bank and its subcontractors simply built the plant, conducted some initial training sessions, and then left, abandoning the project to people with insufficient expertise to run it (see Tindall & Wilkinson, 2004, for more details). The people of Chinimpi, like many Shuar, have had some experience with small-scale, dyadic trading and monetary exchange with outsiders for some time, but they have no experience running a collective economic enterprise of any kind. They have been unable to get the sugar mill project off the ground. An initial attempt to form a sugar-cane growers' cooperative to provide raw material for the plant, using the *minga* model but with discrete personal contributions of growing land to a collective pot, collapsed within a year (see Price, 2005).

*Mingas* are community-level cultural institutions (seen throughout Ecuador) that appear to be stabilized by the power of shame-based sanction and reputation in fairly small groups, and that work reasonably well for things like clearing grass from airstrips or soccer fields once a month. People who don't show up are chastised, and helping is seen as part of one's duty in being a "good" community member. One can't profitably shirk for long in a small community where absences are noticed; showing up and making at least some contribution is the only way to avoid negative reputation effects, which likely affect—traditionally anyway—prospects for mates, social exchange partners, and other profitable social interactions. However, Shuar informants agree that there are substantial differences in actual effort expended during *mingas* (Price, 2005), and the means of fine-grained monitoring and regulation of effort are poor. *Mingas* might not, therefore, be stable when scaled up to cases where more is at stake and people stand to benefit substantially from the contributions of others, as in profit-based collectives. Even in the case of regular community-wide *mingas*, at which the participation of all socios is required, the population size of Chinimpi—and the ecological and social changes, which have left individuals relying on individual efforts in *fincas* and wood cutting, rather than hunting—seems to be undermining the traditional reputation-based sanctioning system.

In terms of norms of sharing, fairness, and reciprocity, the Shuar exhibit food-sharing norms that are fairly typical of hunter-horticulturalist societies (Hames, 1990; Kaplan & Hill, 1985): high-variance foods, in particular, meat, are shared widely between families, whereas low-variance foods, such as garden foods (manioc, plantains, etc.), are mostly consumed within the family. Outside of foods, one gets the impression of a kind of need-based ethic: individuals will approach others and say, "I need X. Please help me." In such cases, the burden seems to lie on the solicited individual to either provide X, or to come up with some reasonable excuse not to (interestingly, we have rarely observed cases where the request is handled by questioning whether there is legitimate need; perhaps requests without genuine need are rarely made). Our impression is that this is, or at least is derived from, a family-based norm. People in need tend to ask family members, or, if not, to treat the individual asked "as" family. Family, here, includes not just kin by descent but affinal kin as well.

### **Disequilibrium and Cultural Inertia**

In terms of cultural evolution, it is likely that Shuar communities like Chinimpi are in a state of disequilibrium. The norms and social institutions that underlie and stabilize cooperation and sharing are adapted to patterns of subsistence and social organization that have been stable for long periods of time: small, family-based villages that subsist entirely on hunted and gardened foods, and that trade with neighboring communities for essential items like machetes, salt, and blowgun dart poison. For the kinds of activities and interactions that characterize such environments, Shuar social norms are quite adequate and it is our impression that, for the most part, the Shuar of Chinimpi still use these norms to guide social interactions. However, over the past few decades, the environment has changed substantially, and these changes are only just now beginning to have palpable effects. For example, depletion of animal resources has been going on for some time. This has accelerated in recent years so that now, many game animals and fish are gone. Population pressure prevents expansion of hunting grounds to more distant areas, because adjacent areas are all occupied. Gradually, hunting as a practice has tapered off. The frequency of fishing has also drastically declined, though people still fish and express surprise that streams do not replenish between fishing events. The fact that expectations are violated even among people who have lived their entire lives in the area points to the absence of personal and cultural adjustment to recent changes in local ecology.

Consistent with these ecological changes, Shuar in Chinimpi have carved up the local landscape into discrete, individually owned plots, where they focus on private subsistence activities. Because of differences in land holdings and other factors, there are now significant income and wealth disparities among families. This, together with other factors—the arrival of the road, electricity, and the sugar-cane processing plant, for instance—has contributed to a current state of disequilibrium and anxiety about the future among many Shuar. Many families are nutritionally stressed (see Hagen, Barrett, & Price, in press), and people are in search of labor or other means to acquire foods and other necessities. The Shuar are gradually being forced to turn to outside markets, and the effect this will have on cultural norms and practices is unclear.

## Methods

We recruited 49 individuals, ages 19 – 80 (mean age 37.96; s.d. 16.15; see Figure 5) to play 3 different economic games—the Dictator, Ultimatum, and 3<sup>rd</sup> Party Punishment Games (DG, UG, and 3PP, respectively)—spread across two consecutive days of game play. Recruitment took place as follows. Several weeks before the games were to take place, we arranged a village-wide meeting during which we explained the purpose of the larger project to community members and sought community consent to host the experimental games. While potential subjects were informed that we would be playing games with money, casual comments indicated that subjects did not anticipate any details about the structure of the game settings. In the days leading up to the first day of experiments, the president of the community made announcements to community members reminding them of the approach of the games, their voluntary nature, and their serious experimental nature.

The experiments themselves took place in a small building, one of three used for school classes and village meetings, all located at the far end of the village. All subjects congregated in one room as standard instructions were read, after which they observed as each of them drew a numbered ticket from a hat, used to determine the order of game play.

On the first day of game play, we accomplished running 41 subjects (26 males, 15 females) for the DG in a morning session, and for the UG in an afternoon session. Standard procedures were followed as closely as possible, and we had no noticeable problems with contamination or collusion. We recruited a number of people to prepare lunch and refreshments that we provided as incentive to remain in the experiment area, and to make easier the job of monitoring subjects during the games. We additionally appointed several participants to positions as monitors in the waiting areas. With groups separated, refreshments and a volleyball game in a central courtyard kept waiting subjects occupied.

During the second day, 48 individuals (28 males, 20 females), participated in the 3PP. Because of the small number of active community members in Chinimpi, we were unable to recruit a large number of fresh subjects to play on the second day. Only eight fresh subjects were available for the 3PP. Six of these new subjects were also recruited

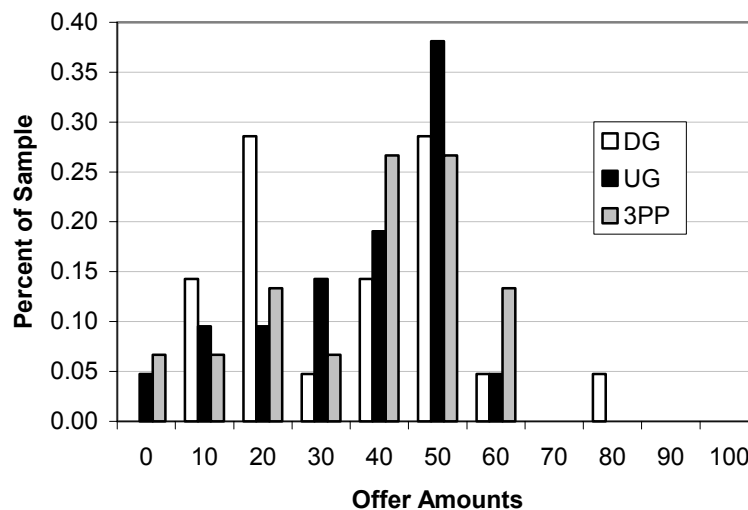
to play the DG and the UG on the second day of overall game play, after they played the 3PP. Note that data for three individuals for whom we were unable to find partners were discarded.

In the days following the games, we conducted post game interviews with a number of individuals. The interviews confirmed our impressions that subjects anticipated neither the structure nor the content of the games, and we were aware of no problems with collusion or contamination. However, our relatively small sample sizes lead us to approach our data with caution.

### Results

We analyzed data for twenty pairs of individuals who played both the DG and the UG. The mean offer in the DG was 35.24% (s.d. 19.14) of the stake size, with modes at both 20% and 50% (see Figure 6).

Figure 6. Player 1 offer amounts in DG, UG, and 3PP games



We examined possible effects of six different variables on Dictator Game offers, using the standardized regression method employed in all of the chapters in this volume, and employed for all of the regressions reported here. First, we re-scaled all of the

variables, with the exception of sex (which was entered as a dummy variable, 0 = male, 1 = female), by dividing each data point by the standard deviation for that variable among the sample of participants making DG offers. We then performed a linear regression using all six variables (Model 1). In addition, five more regressions were performed (Models 2 through 6), removing each of the six variables one at a time, in the following order: age, sex, education, income, wealth, and household size. The results of these regressions are shown in Table 1. Histograms showing the distribution of the independent variables used in the regressions (with the exception of sex), raw (not re-scaled by standard deviation), are shown in Figures 1 through 6.

*Table 1. Linear Regression of Shuar Dictator Game Offers*

Variable (Div by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Age	-.365 (.342)						-.341 (.316)	
Female	-.714 (.501)	-.587 (.489)					-.307 (.511)	
Education	-.334 (.384)	-.0154 (.244)	.0362 (.243)				-.391 (.356)	
Individual Income	.117 (.277)	-.0169 (.248)	.0501 (.245)	.0659 (.214)			.110 (.255)	
Household Wealth	-.531* (.286)	-.474 (.283)	-.338 (.262)	-.335 (.254)	-.347 (.245)		-.281 (.296)	-.154 (.200)
Household Size	.230 (.337)	.0405 (.288)	-.102 (.265)	-.0941 (.252)	-.0988 (.245)	-.292 (.209)	.287 (.312)	
Frequency of wage labor in previous month							.524* (.281)	.532** (.207)
Constant	3.523*** (1.18)	2.529*** (.730)	2.297*** (.713)	2.333*** (.652)	2.419*** (.573)	2.524*** (.583)	2.761** (1.162)	1.735*** (.326)
Observations	21	21	21	21	21	21	21	21
Model Significance	0.421	0.422	0.470	0.303	0.161	0.179	0.224	.011
Adjusted R- squared	0.023	0.014	-0.014	0.045	0.093	0.045	.170	.339

**Note:** Standard errors in parentheses. All coefficients are scaled (divided by) the std. dev.

\*\*\* Coefficient significant at < 0.01 level in two-tailed test.

\*\* Coefficient significant at < 0.05 level in two-tailed test.

\* Coefficient significant at < 0.10 level in two-tailed test.

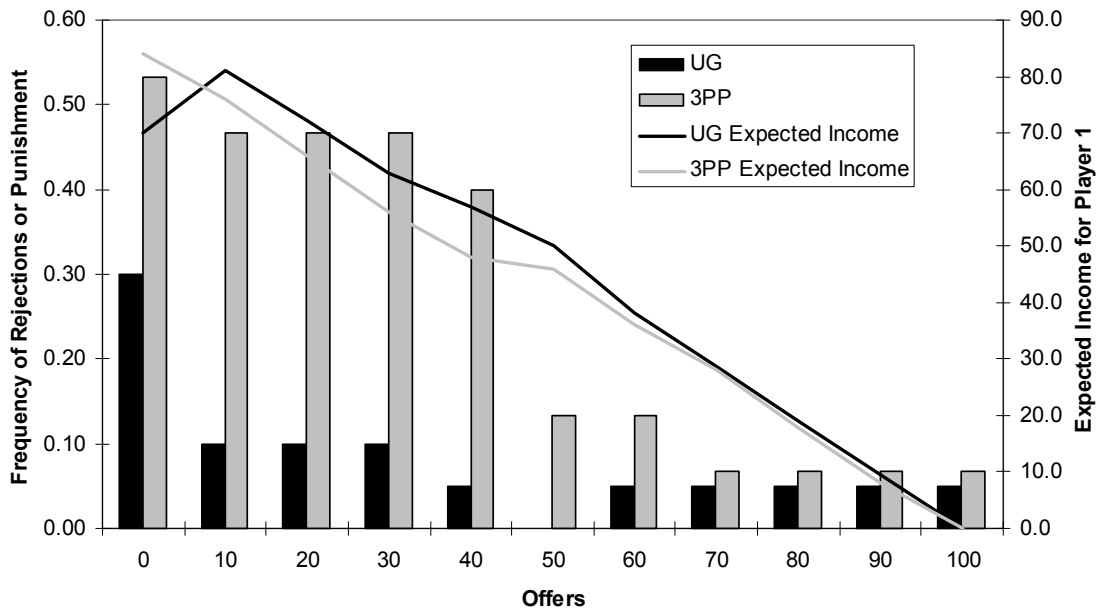
As Table 1 shows, none of the variables, with the exception of household wealth in Model 1, had a significant impact on DG offers. Household wealth was significant at  $p < .10$  in Model 1, with a coefficient of  $-.5$ , indicating a 50% decrease in offers with each standard deviation increase in household wealth. However, household wealth did not account for a significant amount of variance in Models 2 through 5. In addition, we found that one of the variables we measured as a proxy for market integration, frequency of wage labor in the past month, accounted for a significant amount of variance when entered in addition to the other variables in Model 1 (see Model 7). One standard deviation increase in frequency of wage labor increased offers by approximately 50%. Wage labor was negatively correlated with household wealth (Pearson R-squared =  $-.482$ ,  $p = .027$ ). In a final model, Model 8, we entered only household wealth and wage labor as variables, and found that the wage labor variable accounted for a significant amount of variance, while household wealth did not. In this model, again, one standard deviation increase in frequency of labor boosted contributions by about 50%.<sup>1</sup>

Ultimatum game offers were a mean of 36.67% (s.d. 16.53) of the stake size, and a prominent mode at 50% (see Figure 6). UG offers were not significantly higher than DG offers (Wilcoxon test,  $Z = .287$ ,  $p = .774$ ). Player 2s expressed relatively low levels of stated propensity to reject low offers. Most subjects indicated that they would be willing to accept offers of zero. Thirty percent (6 of 20) of player 2s indicated that they would reject an offer of 0 (see Figure 7).

---

<sup>1</sup> As a robusticity check, we generated scatterplots of both wage labor and household wealth against dictator game offers, and found that these effects were not driven by outliers. Additionally, separate correlation analyses showed significant correlations between wage labor and DG offers (Pearson R-squared =  $.614$ ,  $p = .003$ ) and between household wealth and DG offers (Pearson R-squared =  $-.420$ ,  $p = .058$ ).

Figure 7. Frequency of rejections or punishment in UG and 3PP games



Possible effects of our six target variables were examined using regression in the manner reported above. Results of the regression are shown in Table 2. Of the six variables examined, only household size had a significant, positive, impact on UG offers (in Models 2, 5, and 6). This was a positive effect, with one standard deviation in household size increasing offers by 35 to 50 percent, depending on the model.<sup>2</sup> Because wage labor had a significant impact on offers in the DG, in some models, we looked for effects of this variable on UG offers using regression analysis, but found none, so these analyses are not reported here. Finally, to examine the question of consistency in player offers across games, we computed the correlation between DG offers and UG offers within players, but found no significant correlation (Pearson R-squared = .169,  $p = .465$ ).

<sup>2</sup> As a robusticity check, we plotted household size against UG offers to confirm that there was a positive relationship between the two variables that was not driven by outliers. Household size and UD offer were significantly correlated (Pearson R-squared = .467,  $p = .033$ ).

Table 2. Linear Regression of Shuar Ultimatum Game Offers

Variable (Divided by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	.159 (.297)					
Female	-.350 (.435)	-.406 (.412)				
Education	-.0189 (.334)	-.158 (.206)	-.122 (.202)			
Individual Income	-.147 (.240)	-.0887 (.209)	-.0423 (.203)	-.0952 (.180)		
Household Wealth	-.0288 (.249)	-.0536 (.238)	.0405 (.049)	.0321 (.213)	.0481 (.207)	
Household Size	.396 (.292)	.478 * (.242)	.380 (.459)	.352 (.212)	.359 * (.207)	.386 ** (.168)
Constant	.813 (1.025)	1.246 * (.730)	1.085 * (.593)	.965 * (.547)	.840 * (.484)	.825 * (.468)
Observations	21	21	21	21	21	21
Model Significance	0.437	0.332	0.300	0.200	0.106	.033
Adjusted R-squared	0.014	0.061	0.063	0.098	0.134	0.177

Note: Standard errors in parentheses. All coefficients are re-scaled (divided by std. dev.)

\*\*\* Coefficient significant at < 0.01 level in two-tailed test.

\*\* Coefficient significant at < 0.05 level in two-tailed test.

\* Coefficient significant at < 0.10 level in two-tailed test.

Another variable of interest in the Ultimatum Game is the Minimal Acceptable Offer: the smallest offer that was not rejected by Player 2. We computed MAOs for the UG and performed the standard series of regressions described above. Results are shown in Table 3. Here, the only variable that had a significant impact on UG MAOs was household wealth, in Models 3 and 5. However, scatterplot analysis revealed that this effect was being driven by two individuals, who expressed minimal acceptable offers of 40 and 50 percent of the stake, respectively, and both of whom were greater than half a standard deviation above the mean wealth. These two individuals were removed from the analysis and Model 5 was run again. The result, reported in Table 3 as Model 7, shows that the effect of household wealth on UG MAOs disappears when these two individuals are removed.

**Table 3. Linear Regression of Shuar Ultimatum Game Minimal Acceptable Offers**

Variable (Div by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Age	1.501 (3.734)						
Female	-.257 (8.544)	-.632 (8.234)					
Education	2.690 (4.741)	1.805 (4.071)	1.934 (3.581)				
Individual Income	2.954 (3.860)	3.410 (3.577)	3.482 (3.336)	3.935 (3.157)			
Household Wealth	6.558 (4.121)	6.569 (3.995)	6.474 * (3.672)	7.092 * (3.411)	7.632** (3.439)		-.390 (1.155)
Household Size	-6.099 (3.891)	-5.964 (3.759)	-5.966 (3.632)	-5.657 (3.506)	-4.513 (3.439)	-.662 (3.277)	1.212 (1.054)
Constant	3.728 (15.742)	8.598 (9.744)	8.283 (8.537)	9.726 (7.926)	9.088 (8.037)	7.667 (8.843)	-1.262 (2.565)
Observations	20	20	20	20	20	20	20
Model Significance	0.462	0.338	0.209	0.124	0.113	.842	.489
Adjusted R-squared	.002	0.062	0.124	0.163	.135	-0.053	-.030

**Note: Standard errors in parentheses. All coefficients are scaled (divided by) the std. dev.**

**\*\*\* Coefficient significant at < 0.01 level in two-tailed test.**

**\*\* Coefficient significant at < 0.05 level in two-tailed test.**

**\* Coefficient significant at < 0.10 level in two-tailed test.**

Finally, we analyzed data from the Third Party Punishment Game. Because of an error in subject assignment, we had to throw out data for 3 subjects in the TPP game. Analyzing data for 45 subjects, we found that as in the UG, offers were generally higher in the 3PP, with a mean of 37.93% (s.d. 17.92) of the stake size, and modal offers at both 40% and 50% (see Figure 6). Levels of stated willingness to punish were moderate. Approximately half of the player 3s indicated that they would pay to punish offers of 0, 10%, or 20%, with this willingness abating for higher offers up to 50% of the stake (see Figure 7).

*Table 4. Linear Regression of Shuar Third-Party Punishment Game Offers*

Variable (Divided by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	-.108 (.418)					
Female Dummy (not divided by std. dev.)	1.057 (.727)	1.101 (.669)				
Education	.148 (.455)	.243 (.256)	.145 (.269)			
Individual Income (in USD)	.365 (.273)	.349 (.252)	.241 (.263)	.278 (.245)		
Household Wealth (in USD)	.573 (.391)	.591 (.364)	.206 (.302)	.228 (.289)	.217 (.292)	
Household Size	-.253 (.462)	-.311 (.384)	.117 (.306)	.146 (.291)	.107 (.292)	.226 (.240)
Constant	.764 (1.339)	.484 (.741)	.828 (.769)	.959 (.706)	1.369 ** (.613)	1.346 ** (.602)
Observations	15	15	15	15	15	15
Model Significance	0.532	0.379	0.604	0.469	0.516	.365
Adjusted R-squared	-0.039	0.068	-0.091	-0.020	-0.045	-0.009

Note: Standard errors in parentheses. All coefficients are re-scaled (divided by std. dev.)

\*\*\* Coefficient significant at < 0.01 level in two-tailed test.

\*\* Coefficient significant at < 0.05 level in two-tailed test.

\* Coefficient significant at < 0.10 level in two-tailed test.

Using the same method as above, we performed a series of linear regressions on 3PP game offers. The results are shown in Table 4. As before, the overall level of variance in offers explained by the models were low, and none of six independent variables had a significant effect on offers. On analogy to the MAO in the UG, we computed the lowest acceptable offer not punished in the 3PP. The results are shown in Table 5. No significant effects of any of the six variables on lowest unpunished offers was found. Of the 15 offers made by Player 1s, 5 were punished (33.3%).

*Table 5. Linear Regression of Shuar Lowest Unpunished Offers in 3PP Game*

Variable (Divided by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	-1.583 (1.518)					
Female Dummy (not divided by std. dev.)	1.253 (2.742)	3.163 (2.051)				
Education	-1.514 (1.614)	-.362 (1.182)	-.260 (1.259)			
Individual Income (in USD)	2.089 (1.361)	1.917 (1.358)	1.258 (1.375)	1.090 (1.056)		
Household Wealth (in USD)	-.543 (1.043)	-.788 (1.021)	-1.209 (1.050)	-1.257 (.978)	-.934 (.929)	
Household Size	.857 (1.298)	1.467 (1.164)	.796 (1.152)	.741 (1.071)	.187 (.929)	-.0355 (.903)
Constant	3.562 (10.737)	-5.576 (6.237)	-0.255 (5.542)	-0.256 (5.296)	2.757 (4.429)	2.971 (4.425)
Observations	15	15	15	15	15	15
Model Significance	.509	0.511	0.746	.575	0.615	.969
Adjusted R-squared	-0.020	-0.030	-0.172	-0.070	-0.076	-0.077

Note: Standard errors in parentheses. All coefficients are re-scaled (divided by std. dev.)

\*\*\* Coefficient significant at < 0.01 level in two-tailed test.

\*\* Coefficient significant at < 0.05 level in two-tailed test.

\* Coefficient significant at < 0.10 level in two-tailed test.

Because few fresh subjects were available to play the 3PP game, we made role assignments as follows. All 8 fresh players were assigned to the role of Player 3. For the remainder, we attempted to keep each player in the same role across games. Thus, 15 players played role 1 in all three games, and 15 players played role 2 in all three games. However, in order to balance the players for the 3PP, we had to shift roles for 7 players. 4 people played the role of Player 1 in the DG and UG, and then shifted to Player 3 in the 3PP. 3 people played the role of Player 2 in the first two games, and shifted to Player 3 for the 3PP game. Data from 3 players had to be discarded because partners could not be found.

For repeat players, was there consistency, or patterned inconsistency, between their play in 3PP and earlier games? For repeat Player 1s, there was no significant correlation between offers in TPP and DG (Pearson R-squared = .045,  $p = .873$ ), nor

between offers in TPP and UG, though TPP and UG offers were closer to significant positive correlation (Pearson R-squared = .404,  $p = .135$ ). There was no significant difference in overall level of offers between UG and 3PP, DG and 3PP, or DG and UG (Wilcoxon Signed Ranks Test). In general, we could find no significant patterned relationship in play by the same players across games.

### **Discussion**

Our small sample sizes make it difficult to make broad claims about our results. However, we note several general effects, and here make speculations about how they might be interpreted in our research setting.

Compared to other societies examined in this volume and elsewhere, the Shuar fall within the normal range of economic game behavior in certain ways, but they are also unusual in some regards. Using the UG as a benchmark, the Shuar are certainly more selfish than university students in a variety of countries, whose UG offers range between 42 and 48 percent (Henrich et al., 2004). However, when compared to a previous cross-cultural study of Ultimatum Game behavior (Henrich et al., 2004), the mean of Shuar offers in the UG, at 37%, is within the range of observed mean offers of a diverse set of fifteen cultures, which ranged from 25% to 57% of the initial stake size (interestingly, the Shuar mean UG offer of 37% found here was somewhat lower than the 43% found for the Achuar, a culturally similar group, by Patton, 2004). On the other hand, the Shuar appear to have a low rejection rate in the UG, when compared to other populations; among the societies studied in this volume, they were tied for the lowest rejection rate in the UG with Fijians and the Tsimane. This does not indicate that the Shuar are never punitive, however, as 3PP punishment rates were relatively high compared to these populations.

For the DG, the Shuar mean offers, at 35% (with modes at 20% and 50%), were between those seen for other populations. For example, the Shuar were more generous than university students, who show a mean at 25% and a mode at zero, and less generous than the rural U.S. population of adults in Missouri reported by Ensminger (this volume), who show a mean offer of 47%, with a mode at 50%. As far as offers go, the Shuar do not appear to be on either end of the distribution of stinginess to generosity seen in other cultures, though they may be towards the less generous end. With regard to rejecting

offers in the UG, the Shuar are relatively tolerant; but as third-party punishers, they are less so.

The DG can be particularly revealing of economic preferences because of the lack of opportunity of other players to respond. As in some other populations, we observe two distinct modes in the DG, one fair, and another more consistent with money maximization (though still significantly above zero). We speculate that this bimodal distribution, which is apparent in various games in other populations (Camerer & Fehr, 2004; Ensminger, 2004; Ruffle, 1998), may reflect the presence of distinct strategies, or game framing effects, amongst the players. There are several possibilities for what these distinct playing styles might be. These might include: (1) differences in interpretation of the money at play in the game, with some subjects interpreting it as a public windfall (leading to a sharing expectation) and others interpreting it as a private gift (leading to a private property interpretation); (2) differing degrees of responsiveness to the anonymity of the games; (3) differing degrees of adherence to norms of fairness; (4) differences in motivation to engage in reciprocity interactions (and perhaps differing degrees of awareness that no positive or negative reciprocity would be possible in the DG).

Higher offers in the DG came mainly from individuals who engaged more frequently in wage labor (Table 1, Models 7 and 8), a variable negatively related to individual and household wealth. While in the DG higher offers came from less wealthy people who do more wage labor, in the UG we found that wealthier people required higher offers to accept the split proposed by player 1 (Table 3, Models 3-5). In other words, wealthier people are giving less in the dictator game, and expecting more in the ultimatum game. This is one of the few patterns we found that held across more than one game.

Among the Orma of East Africa, Ensminger (2004) found a similar effect of wage labor on offers in the UG, in the same direction: individuals engaging in wage labor offered significantly higher fractions of the initial stake when in the position of Player 1. Ensminger notes that these results are consistent with the overall findings of the Henrich et al. (2004) fifteen-society study, in which greater “fairness” was associated with increasing degrees of market integration. Ensminger suggests that “among those selling either their labor or their goods, there may be a higher premium placed upon reputation,

and... one way of signaling a good reputation is to behave fair-mindedly” (Ensminger, 2004, p. 380). We agree, though we suggest that subjects might also seek to generate, rather than merely signal, a good reputation through such behavior.

In the context of Shuar living in Chinimpi, it might be the case that individuals who engage frequently in wage labor – who are poorer – have a greater motivation to initiate and maintain profitable reciprocity relationships such as contractual labor exchange interactions. They may more readily import a schema of reciprocal economic exchange into the game setting, causing them to make higher offers. In the same way that some players among the Au and Gnau of New Guinea make hyper fair offers consistent with social practices of incurring social credit through competitive gift giving (see Tracer, 2004), less wealthy wage laborers may behave as individuals attempting to initiate reciprocal exchange relationships, and to establish an initial reputation for generosity and good will. This is consistent with the UG MAO data suggesting that they have more forgiving thresholds for the termination of exchange. However, this is speculative, and awaits confirmation in further work.

While we find that the decision-making exhibited by our Shuar population exhibited a pattern that was different than any of the other societies studied here – yet also not out of bounds of the observed variation – it remains to be seen whether the Shuar are approaching the game with culturally specific norms. We feel that the question of how individual play is influenced by interpretation of the stylized situations presented by behavioral economic games is an important area for future research. Of particular interest is the question of how money, which is evolutionarily novel for all people and culturally novel for many, interacts with preexisting cultural norms and intuitive inference systems in populations that have little experience with it.

## References

- Camerer, C. & Fehr, E. (2004). Measuring social norms and preferences using experimental games: A guide for social scientists. In Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., and Gintis, H. (Eds.) *Cooperation, Reciprocity and Punishment: Experiments in 15 Small Scale Societies*. New York: Oxford University Press.
- Camerer, C. & Thaler, R.H. (1995). Anomalies: Ultimatums, Dictators, & Manners. *J. of Economic Perspectives*, **9**(2) 209-219
- Descola, P. (1996). *The Spears of Twilight: Life and Death in the Amazon Jungle*. New Press, New York.
- Ensminger, J. (2004). Market Integration and Fairness: Evidence from Ultimatum, Dictator, and Public Goods Experiments in East Africa. In Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., and Gintis, H. (Eds.) *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*. New York: Oxford University Press.
- Hagen, E.H., Barrett, H.C., & Price, M.E. (in press). Do human parents face a quantity-quality tradeoff? Evidence from a Shuar community. *American Journal of Physical Anthropology*.
- Hames, R. (1990) Sharing among the Yanomamö: Part I: The Effects of Risk. In E. Cashdan, ed., *Risk and Uncertainty in Tribal and Peasant Economies*, Pp. 89-106. Westview Press: Boulder.
- Harner, M. (1972). *The Jivaro: People of the sacred waterfalls*. Berkeley: University of California Press.
- Henrich, J. (2000). Does culture matter in economic behavior? Ultimatum game bargaining among the Machiguenga of the Peruvian Amazon. *American Economic Review*, *90*, 973-979.
- Henrich, J., Boyd, R. Bowles, S., Gintis, H. Fehr, E. and McElreath, R., eds. (2004). *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*. New York: Oxford.
- Johnson, A. (2000). *Families of the Forest: The Matsigenka of the Peruvian Amazon*. University of California Press.
- Kaplan, H., & Hill, K. (1985). Food sharing among Ache foragers: tests of explanatory hypotheses. *Current Anthropology*, **26**: 223-245.

Karsten, R. (1935). *The head-hunters of western Amazonas: The life and culture of the Jíbaro indians of Eastern Ecuador and Peru*. Helsinki: Societas Scientiarum Finnica.

Marlowe, F. (2004). Dictators and Ultimatums in an Egalitarian Society of Hunter-Gatherers, the Hadza of Tanzania. In Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., and Gintis, H. (Eds.) *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*. New York: Oxford University Press.

Patton, J. Q. (2004). Coalitional Effects on Reciprocal Fairness in the Ultimatum Game: A Case from the Ecuadorian Amazon. In Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., and Gintis, H. (Eds.) *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*. New York: Oxford University Press.

Price, M.E. (2005). Punitive sentiment among the Shuar and in industrialized societies: Cross-cultural similarities. *Evolution and Human Behavior*, 26, 279-287.

Ruffle, B.J. (1998). More is better, but fair is fair: Tipping in dictator and ultimatum games. *Games and Economic Behavior*, 23: 247-265.

Tindall, A., & Wilkinson, J. (2004). Unpublished Master's thesis, UCLA Department of Public Policy.

Tracer, D.P. (2004). Market Integration, Reciprocity and Fairness in Rural Papua New Guinea: Results from a Two-Village Ultimatum Game Experiment. In Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., and Gintis, H. (Eds.) *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*. New York: Oxford University Press.