Reports

Are Peasants Risk-Averse Decision Makers?[1]

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For decades, researchers studying small-scale, subsistence-oriented farmers have sought to explain why these "peasants" seem slow to acquire new technologies, novel agricultural practices, and new ideas from the larger societies that have engulfed them. The early work on this question suggested that this "cultural conservatism" resulted from things like a rigid adherence to tradition or custom (Hoffman 1996), a cognitive orientation toward a "limited good" (Foster 1988), or ignorance and lack of education. In response to such explanations, much of the subsequent debate on this issue has focused on showing that this seeming conservatism actually results from rational cost benefit analysis in which individuals make risk-averse decisions because of their uncertain and precarious economic situations (e.g., Turner 1996, Netting 1993, Gladwin 1979, Ortiz 1979, Schluter and Mount 1976, Scott 1976, Norman 1974, Johnson 1971, Wharton 1971, Lipton 1968). To inform this approach, we have combined comparative experimental field studies with economically oriented ethnography among two groups of small-scale farmers, the Mapuche of Chile and the Sangu of Tanzania. Our experiments, which were designed to measure risk preferences directly, indicate that both the Mapuche and Sangu are *risk-preferring* (not risk-averse) decision makers in the standard economic sense—suggesting that subsistence farmers more generally may not be risk-averse either. Furthermore, while sex, age, land holdings, and income do not predict risk preferences and wealth is—at most—only marginally predictive, what does seem to predict risk preferences in our monetary gambles "cultural group." Although such experimental findings carry important caveats, they suggest that standard views of risk-averse decision making may not be the best theoretical tools for understanding "peasant conservatism" or the behavioral patterns often attributed to "rational risk aversion."

Our discussion proceeds as follows: First, we sketch two standard models of risk preferences that seek to capture what researchers mean when they describe behavior as "risk-averse." Second, we introduce the ethnographic field sites where the experimental and ethnographic research was performed and describe the methods used. Third, we report the basic experimental results. Fourth, we examine our results in light of the standard approaches to risk and discuss some caveats and challenges to interpreting our experimental risk data. Finally, we briefly introduce a theoretical alternative to generalized, risk-averse cost-benefit decision making that can generate patterns of adaptive risk-managing behavior without requiring individuals to make complex, risk-averse calculations.

WHAT RESEARCHERS MEAN BY "RISK AVERSION"

Many economic anthropologists have used the term "risk aversion" without definition, in imprecise ways, or in ways that may deviate from its standard usage in economics textbooks (Cashdan 1990, Chibnik 1990). Consequently, in order to clarify exactly how our evidence addresses previous work on risk and peasants, we have delineated two categories that seek to capture the ways in which anthropologists and peasant researchers have employed "risk aversion."

Decreasing marginal utility. Economists have attempted to capture the concept of risk aversion by formalizing the idea that as individuals get more and more of something they value each additional increment less and less. If we were giving you eggs, you might value the first two or three eggs quite highly (especially if you are planning breakfast), the 6th and 7th a bit less, and the 49th and 50th hardly at all. Mathematically, economists describe such individuals as having concave utility functions—as their wealth increases, the additional value (additional "utility") of an additional unit of wealth decreases. In this approach, individuals select among alternative practices or options by computing the expected utility associated with each option and then choosing the one with the higher expected utility. When at least one of the choices presents variable (risky) outcomes, individuals who are maximizing expected utility will sometimes make choices that offer lower average incomes but less income variation because their utility curves give greater values to initial gains than to subsequent gains. From this perspective, farmers are risk-averse because of the concave shape of their utility curves. In contrast, risk-neutral farmers would have straight-line utility curves and always prefer the option

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with higher expected income/wealth. Risk-prone farmers would have convex utility curves (accelerating upward instead of decelerating downward) and prefer options with more variation, even when the expected income from a high-variance option is less from than a low-variance option. Although this approach has been developed primarily by economists, anthropologists continue to make use of it (e.g., Kuznar 2001, Winterhalder, Lu, and Tucker 1999).

Risk and uncertainty. Many economists (e.g., Knight 1921) and anthropologists (e.g., Chibnik 1990, Cancian 1989) have worried about the difference between risk and uncertainty (or ambiguity). Traditionally, risk involves known probabilities, such as the chance of getting "heads" on flipping a coin. In contrast, uncertainty involves choices with unknown probabilities, such as the chances of finding a book entitled *The Internet's Swan Song* in the library today. In the real world, pure risk and absolute uncertainty are two poles of a continuum, and we are almost always somewhere in the middle. Even in coin flipping, where the probabilities of the two outcomes seem "known," there is always some unknown chance that the coin is a trick coin or unbalanced because of random variation in minting or design differences. At the other end of the continuum, in sowing a novel seed, for example, farmers at least know how similar seeds usually perform and what the upper and lower bounds of production are, so they are never completely uncertain. This continuum can incorporated into the expected utility framework described above, as long as individuals compute subjective probabilities or probability distributions based on what they know and then use these to maximize their expected utility. As we will show, our data indicate that Mapuche farmers treat risky and uncertain bets in similar ways (cf. Cancian 1989) and that wealth predicts neither risk nor ambiguity preferences.

Satisficing or safety-first. Researchers have also hypothesized that farmers, nonhuman animals, and foragers make decisions (i.e., select among alternative actions) in order to minimize their chances of falling below some subsistence minimum—which may be culturally or biologically defined, depending on the researcher (Winterhalder, 1990; Winterhalder, Lu, and Tucker, 1999; Real and Caraco, 1986; Johnson, 1971; Schultz 1964:31). Intuitively, these well-studied models propose that when individuals face a choice between economic strategies, they will select the strategy that gives them the lowest probability of falling below some "subsistence threshold" or "economic minimum," regardless of the expected yields generated by alternative strategies. For example, suppose that a farmer must choose between two crops, a traditional crop that provides a very reliable yield (with little variation) and a green-revolution technology that produces a higher average yield but is quite sensitive to fluctuating local conditions and the nuances of farmers' techniques (thus producing more variation in yields from year to year). Depending on the details, "safety-first" farmers may prefer the lower-yielding but more reliable traditional crop because the green technology's higher variation in yields may increase their chances of not being able to feed their families. Such models predict that wealthier individuals—those above the subsistence threshold—should be risk-averse while those below the threshold should be risk-seeking. These models are common both in studies of risk-sensitive foraging (Stephens and Krebs 1986) and in the analysis of capital assets and portfolio composition (Nicholson 1995). Roumasset (1976) has a discussion directly related to farming risk.

Ethnographic Context

Before digging into the research methodology and results, we provide a brief ethnographic sketch of the three cultural groups discussed. We assume that the reader is sufficiently familiar with the lifeways of the fourth group, undergraduates, at the University of California, Los Angeles, that no ethnographic description is warranted.

The Mapuche. This description of the Mapuche derives from Henrich's work in the farming communities of Carrareñi, Cautinche, and Huentelar, around the rural town of Chol-Chol. In this cool, wet, Mediterranean climate (similar to San Francisco's), Mapuche households live on widely scattered farms that range in size from 2 to 38 hectares, with an average size of around 9 hectares. All households practice a form of three-field cereal agriculture using steel plows and two-ox teams. Most households subsist primarily on wheat (consumed in the form of bread), but many also produce oats, used only as animal feed. Households supplement their diets with seasonably available vegetables (e.g., tomatoes, onions, garlic, and chiles), legumes (e.g., peas, lenntils, and beans) and livestock (chickens, cows, horses, sheep, and pigs), as well as some store-bought foods (e.g., salt, sugar, rice, noodles). Cash income to buy these foods and other goods such as cooking oil, chemical fertilizers, and school supplies derives from a number of other sources, including (listed in decreasing degree of importance) selling livestock (mostly cows and pigs), selling lumber (fast-growing pines and eucalyptus trees), performing part-time wage labor, and selling cottage crafts (often traditional Mapuche clothing).

Mapuche households are socially and economically quite independent. Although goods are frequently exchanged between neighboring households (which are almost always recognized as kin in some fashion), these are usually straight cash-for-goods transactions, though interest-free credit is readily extended. Families buy meat, vegetable seed, and homemade wine (*pulco*) from one another. Labor is most commonly exchanged reciprocally between friends and relatives. Group labor parties or *mingacos*, traditionally used during planting and harvesting, have become quite rare, except among elderly households. Land is rarely bought or sold (and it is now illegal for a Mapuche to sell land to a non-Mapuche). However, many land-poor households sharecrop on the land of neighboring Mapuches though land is never rented. Sharecroppers receive access to one or two hectares of land for a year in exchange for 50% of the yield. If chemical fertilizers or other inputs are employed, the costs are split 50/50.

The Huinca. The Mapuche commonly use the term "Huinca" to refer to the non-Mapuche Chileans who inhabit the lands and towns that surround them. We have adopted this term to distinguish the Mapuche from the non-Mapuche inhabitants of the small, rural town of Chol-Chol. We used the Huinca as a control group with regard to influences of the regional economy and the local environment. All the Huinca in the study group grew up in Chol-Chol. Most work in low-or minimum-wage jobs, often in construction, on road crews, or as well-diggers and painters. A few were older high-school students or "preuniversity" students, although no one was younger than 17 years. Although the Huinca and the Mapuche have intermixed, interacted, intermarried, and interbred for hundreds of years, the Huinca/Mapuche distinction remains quite salient throughout the region. Everyone knows and agrees on who is a Huinca and who is a Mapuche.

The Sangu. The Sangu are agro-pastoralists in southwestern Tanzania. They originated from Bantu peoples that intermixed in the region during the late 1800s and early 1900s, when they united under a hereditary chief and began raiding their neighbors for wealth and livestock (Shorter 1972, Wright 1971). Most now live in sedentary agricultural communities, where farmers produce corn (and some rice) and raise cattle on an average parcel of one acre for an average family of six people. Cattle are the greatest measure of wealth, though some farmers do sell rice (which they then use to buy corn). Wage work is very scarce and desirable. Until recently, the Sangu have had little market contact, but now they use the market to sell grain and buy most living and farming supplies.

There is great diversity in lifestyle among the Sangu. Since 1997, McElreath has been working with two Sangu communities: Utengule and Ukwaheri. Utengule residents live in very closely spaced settlements, with homes often less than 10 m apart, and the vast majority of households farm corn and rice and own no livestock. A small number make a living off transport between Utengule and the road (about 10 miles) or by selling imported goods in the market. Most people under 25 years of age in Utengule have had some primary schooling, and many of them can read and write at a basic level. Ukwaheri ("place of blessings") is less a town or village than a region of interrelated communities. Ukwaheri lies about 35 km north and east of Utengule, in the dry region of the plains. Household compounds are very scattered: distances of 1–2 km are the norm. Most residents own some livestock, and those with larger herds (typically > 20 cattle) practice transhumance. Access to markets is much more restricted in this area, and family sizes can be considerably larger than in Utengule, as wealthy herders marry as many as five or six wives, each mothering an average of four or five surviving children. Very few people of any age in Ukwaheri region can read or write anything beyond their own names.

METHODS AND RESULTS

We conducted two binary-choice lottery experiments: the titration experiment, with Mapuche, Huinca, and Sangu, and the variance experiment, with Mapuche, Sangu, and University of California, Los Angeles, undergraduates.

The titration experiment. The titration experiment is designed to compute the *certainty equivalent* or indifference point for a risky option. By asking participants to choose among a series of binary choices involving some sure amount of money (option A) and a fixed risky bet (option B), one can home in on the approximate point at which participants become indifferent between a fixed amount of money and a risky bet and thereby assign a value to the risky option (the fixed amount value = the "certainty equivalent"). Risk-neutral expected-value theory predicts that this certainty equivalent will be the expected value of the risky option. The point above 1,000 pesos at which respondents switch to preferring the sure thing determines their indifference point and provides a measure of their risk preference. If, for example the risky bet is a 50% chance at 2,000 pesos (and 50% at 0 pesos), then risk-neutral individuals should be indifferent between 1,000 pesos with certainty and this 2,000-peso gamble. Risk-averse individuals will prefer the 1,000-peso option over the 2,000-peso gamble. In contrast, risk-seeking people will prefer the risky bet and not become indifferent until the sure bet rises above 1,000 pesos (higher than the expected value of the risky bet). Economists and psychologists have performed many such experiments with university undergraduates and generally found them to be moderately risk-averse (e.g., Holt and Laury 2000).

Here we discuss the procedure using the peso amounts for the Mapuche. The money amounts used in the Mapuche/Huinca and Sangu experiments were equivalent to one-third of a day's wage (the expected value of the risky gamble) in the local economy. Our experimental procedure used a sequence of three binary choices (A or B) to estimate an individual's indifference point. First, Mapuche and Huinca participants faced a choice between 1,000 pesos (40% of a day's wage) for sure (option A) and a 50% chance at 2,000 pesos (and a 50% chance at 0). (The corresponding choices for Sangu participants were 400 shillings and a 50% chance at 800 shillings.) If the participant picked the risky bet (option B) in the first round, we would "sweeten" option A in the next round by increasing it from the 1,000 pesos to 1,500 (with option B remaining the same). If the participant picked the safe bet (option A) in round 1, we would "sour" option A, reducing it to 500 pesos—the idea being to "sweeten" or "sour" the safe bet until the participant switched from the risky to the safe bet or vice versa. Round 2 was administered much like round 1. If the participant picked the risky bet on round 2, we would increase the value of the safe bet by 300 pesos in round 3 (to either 1,800 or 800, depending on the participant's previous choices). If the participant picked the safe bet on round 2, we would decrease the value of option A to either 1,300 or

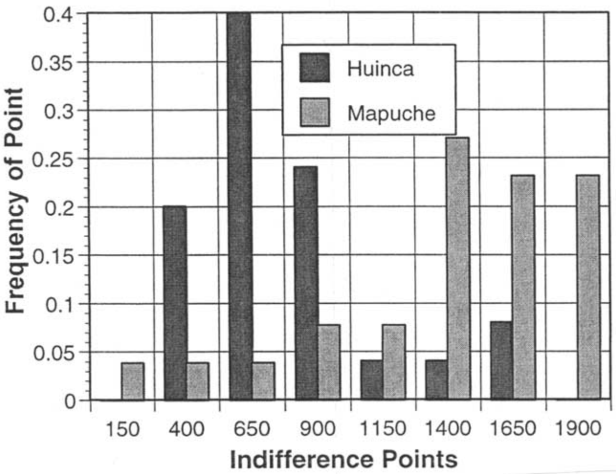

FIG. 1. *Results of the titration experiment for Huinca* (n = *25*) *and Mapuche* (n = *26*).

300 pesos—again depending on the previous choices. Indifference points were recorded as the amount halfway between the sure bet in round 3 and the nearest known decision point. For example, if a participant picked A in round 1, round 2 became a choice between 500 pesos for sure and a 50% chance of 2,000 pesos. If the participant then picked B, round 3 became a choice between 800 pesos for sure and the 2,000-peso gamble. If the participant then picked B again, the indifference point was recorded as 900 pesos (he picked A when it was 1,000 pesos and B when it was 800 pesos). After round 3 was completed, participant flipped the coin for any risky bets and Henrich paid them the total amount owed. (McElreath, working with Sangu), played the bets as participants made their choices and paid after each round.) When all rounds were complete, we interviewed participants about why they had made particular choices.

Figure 1 shows the results of the titration experiment for the Mapuche and Huinca. The horizontal axis gives the eight possible indifference points between zero and 2,000 pesos. The vertical axis is the frequency of individuals who arrived at each indifference point. Risk neutrality would lead to an average of 1,000 (the expected value of the 2,000-peso gamble is 1,000 pesos). Comparing Mapuche farmers with their Huinca neighbors shows that Mapuche are *risk-prone* relative to both risk neutrality and the relatively risk-averse Huinca. Most Mapuche indifference points are well above 1,000, although a few Mapuche are quite risk-averse. The mean indifference point for the Mapuche is 1,400 pesos (with standard deviation of 474). This means that, on average, Mapuche farmers are indifferent between 1,400 pesos and a 50% chance of 2,000 pesos. In contrast, over 80% of Huinca indifference points are below 1,000 pesos and therefore *risk-averse*. The mean indifference point for the Huinca is 790 pesos (with standard deviation of 354). The Mapuche and Huinca data are very unlikely to arise from the same underlying distribution (Mann–Whitney test, $p < 0.0001$). Regression analyses yield a similar finding. Table 1 shows the results of a multivariate regression analysis on the Mapuche and Huinca titration dataset. This linear model includes age, sex, head of household (as a dummy variable), and cultural group (Mapuche = 1, Huinca = 0). It shows that, controlling for these other variables, cultural group is the only large and well-estimated predictor of risk preferences. However, it remains unclear exactly which of the many differences between the Huinca and Mapuche our Cultural-Group variable represents. These data indicate that the difference does not arise from differences in the controlled variables, wealth or income (see below), but the cultural-group variable may be picking up differences related to occupation (farming versus wage labor), settlement pattern (town versus scattered households), or primary school education. Research is currently under way to explore these possibilities.

The above findings are consistent with previous experimental work using a large sample ($n = 175$) of U.S. undergraduates, business-school students, and university faculty using a similar methodology. Holt and Laury (2000) found that age, sex, income, and wealth failed to predict any significant proportion of the variation in risk preferences across their high-stakes sample. The only individual-level variable that did predict high-stakes risk preferences, controlling for age, sex, wealth and income, was "being Hispanic" (mostly Cubans from Miami), which predicted substantially less risk aversion. This result is similar to our findings regarding the Cultural Group variable, although all these subjects were very risk-averse compared with the Mapuche.

The Sangu titration data reveal similar patterns. Sangu are risk-prone in an absolute sense and compared with Huinca, although slightly less risk-prone than Mapuche. Standardizing to the expected value of the risky game, the mean indifference point for the Sangu is 1.37 (standard deviation 0.56), compared with 1.4 (1,400/1,000) for Mapuche and 0.79 for the Huinca. As for U.S. students, Huinca, and Mapuche, neither sex nor age predicts risk preference (see table 2). (Wealth and income effects below.)

Kuznar (2001) employs a method somewhat similar to our titration experiment and shows Andean Aymara pas-

TABLE 1
Regression of Economic Variables on Indifference Points for Mapuche and Huinca Datasets Combined

Economic Variable	Std.β	Significance
Household head[a]	0.15	0.39
Age	0.13	0.48
Sex[a]	−0.035	0.79
Cultural group[a]	0.63	< 0.0001

[a]Dichotomous variables. For sex, male = 1; for cultural group, Mapuche = 1, Huinca = 0.

TABLE 2
Regression of Economic Variables on Indifference Points for Mapuche, Huinca, and Sangu Datasets Separately

Economic Variable	Mapuche (n = 24) Std. β (p Value)	Huinca (n = 24) Std. β (p Value)	Sangu (n = 42) Std. β (p Value)
Total land owned	−0.065(0.83)	–	–
Age	−0.26(0.32)	−0.075(0.78)	−0.23(0.17)
Sex[a]	−0.22(0.32)	0.20 (0.47)	−0.23(0.17)
Animal wealth/ household size	0.47 (0.12)	–	0.32(0.86)
Income	–	−0.12(0.69)	–
Acres of corn cultivated	–	–	0.36(0.07)
Acres of rice cultivated	–	–	−0.14(0.39)

[a]Dichotomous variable.

toralists to be risk-averse. His method has two important differences, however. First, instead of real money he uses hypothetical stakes that may fail to focus informants' attention on the economic issues of the experiment. Instead, when actual economic stakes are 0 (hypothetical), all kinds of other concerns come to predominate in the decision process. Informants may be concerned with what the ethnographer will think of them or what other people will infer about them from their decisions. We put large stakes on the line to focus the informants attention on the game payoffs rather than on exogenous social concerns. This does not by any means eliminate such exogenous factors, but it should reduce their impact on decision making and give us a better chance at measuring risk aversion (as apposed to, for example, what the informant thinks the ethnographer wants him to say. Further, Holt and Laury (2000) have demonstrated that hypothetical risk-measuring methods yield quite different results from those found in identical paid experiments. For this reason, the use of hypothetical stakes is considered unacceptable in experimental economics (Hertwig and Ortmann 2001). Second, Kuznar uses livestock amounts instead of money gambles, and it is possible that different currencies tap into different sets of decision rules.

The variance experiment. The basic structure of the variance experiment is similar to that of the titration experiment. The goal of the experiment is to explore how variation in outcomes influences economic decisions when the expected value of the options is the same. The expected value (average return) of both options in all four rounds is the same (1,000 pesos for Mapuche, 400 shillings for Sangu, and $15 for the undergraduates). What varies across rounds is the variance in outcomes.

In round 1, participants faced a choice between (in the case of the Mapuche) 1,000 pesos for sure and a 50% chance of 2,000 pesos. (The corresponding choices for Sangu participants were 400 shillings and a 50% chance at 800 shillings, for the university undergraduates $15 and a 50% chance of $30.) A coin was used to illustrate and generate a 50/50 chance. In round 2, participants chose between 1,000 pesos for sure and a 20% chance of 5,000 pesos (and an 80% chance of 0). In round 3, participants selected either 1,000 pesos for sure or an 80% chance of 1,250 pesos. In rounds 2 and 3, probabilities were illustrated using five cards (four with X's and one with a Z; the Sangu received red and blue cards in the same proportions instead). To play, participants selected one card. Round 4 had two possibilities: (1) 1,000 pesos for sure or a 5% chance of 20,000 pesos (and a 95% chance of nothing) and (2) 1,000 pesos or an "unknown chance" of 5,000 pesos. To illustrate the "unknown chance," a new stack of cards was brought out, and participants were instructed that "some cards in the stack have X's (winners) and some are blank, but you don't know how many of each are in the stack"—this is an *ambiguous* bet, as opposed to a *risky* bet. The Sangu and the undergraduates received only risky bets in this round.

Figure 2 shows the frequency of risky bets (option B) for each of the five possible gambles in our three different groups: the Mapuche, the undergraduates, and the Sangu. The graph reveals substantial behavioral differences for the highest-variance gambles, 20% and 5%. Given a choice between 1,000 pesos for sure and a 20% chance of 5,000 pesos, 78% of Mapuche preferred the risky option, while only 20% of the undergraduates took the risky gamble (p = 0.00044). For the highest-variance gamble, 67% of Mapuche only 20% of the undergraduates preferred the risky bet (p = 0.05). For the lowest-variance bet, with an 80% chance of winning, Mapuche were still significantly more risk-seeking than the undergraduates who were approximately risk-neutral. Over 80% of Mapuche and only 55% of the undergraduates preferred the risky bet (p = 0.078).[2] Sangu risk preferences generally paralleled the Mapuche.[3]

2. These p values are cumulative binomial probabilities that give the chances of picking the undergraduate sample (or one with fewer risky picks) via a random draw from a distribution matching the combined Mapuche and undergraduate samples. If the undergraduate samples are compared with the distribution matching the Map-

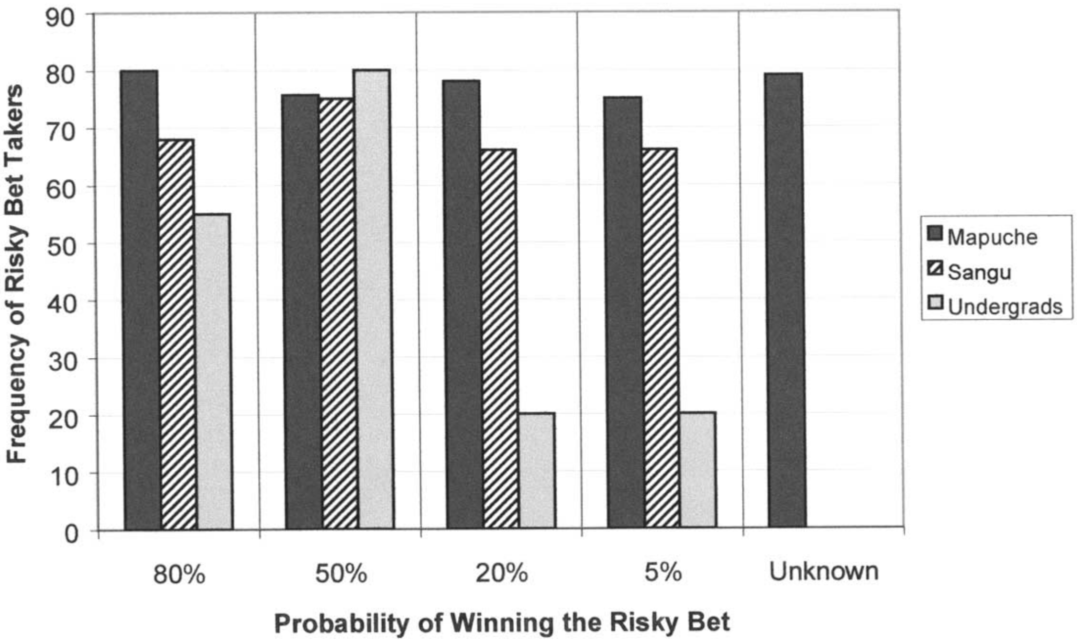

FIG. 2. *Frequency of risky gambles with different amounts of outcome variance. Sample sizes are* n = *41 for all Mapuche at 80%, 50%, and 20%,* n = *12 for 5%, and* n = *29 for unknown bet. For Sangu,* n = *76 for 50% and* n = *38 for other bets. For students,* n = *20 for 80%, 50%, 20%, and 5%.*

The students' strong preference for the risky bet when the chances were 50/50 may at first seem puzzling, deviating as it does from their preferences on both sides of the 50/50 gamble and matching the preferences shown by the otherwise risk-prone Mapuche and Sangu. This strong preference of the students for 50–50 gambles replicates previous findings in similar laboratory research (Edwards 1953, Coombs and Pruitt 1960). Coombs and Pruitt (p. 273) suggest that their subjects may have preferred the 50/50 bets because "they are regarded as 'fair bets,' and perhaps because they are simpler bets, more easily comprehended than some of the others." In part, our postgame interviews and observations concur with their suggestion. When Henrich asked participants why they picked the risky bet on the 50/50 gamble, students often respond with something like "50/50 is a good chance" or "It's fair." However, in general, our evidence runs counter to the proposal by Coombs and Pruitt that participants understood the 50/50 gamble better than the other gambles. In round 1 of the titration experiments which involved the same 50/50 gamble, only 16% of the risk-averse Huinca picked the risky bet. This risk-averse behavior is quite consistent with the Huinca's generally risk-averse behavior in the titration experiment and with the pattern of risk aversion shown by the students in the variance experiment for the 20% and 5% gambles but quite different from the strong preference shown by the students in 50/50 gambles.

The bar at the far right of figure 2 shows the frequency of Mapuche farmers' taking the risky bet when they faced a choice between a guaranteed 1,000 pesos and an unknown chance at 5,000 pesos. Instead of displaying the ambiguity aversion found among typical student subjects (Camerer and Weber 1992), the Mapuche preferred this uncertain option over the certain option with about the same frequency as they preferred the other risky gambles. This finding calls into question the idea that ambiguity aversion is standard component of our species-typical cognitive architecture (Rode et al. 1999). Perhaps undergraduates learn, as a consequence of growing up in a particular place, to fear uncertainty (and risk) in dealing with money.

DISCUSSION

In the following discussion we explore the relationship between economic/demographic variables and experimentally derived risk preferences, examine our results in light of the two risk models discussed earlier, and present alternative interpretations of our results, and address some common concerns about methods and field measurement.

Economic/demographic variables. Although expected

uche only, then the p values for the 80%, 20%, and 5% bets are 0.0084, 5.78×10^{8}, and 6.22×10^{-5} respectively.

3. The Sangu results also provide a number of interesting puzzles, but for our purposes what they confirm is that another group of small-scale, partially market-integrated, culturally distinct people (living on another continent) behave quite similarly to the Mapuche and quite differently from the students.

utility maximization does not make any predictions about the effect of wealth on risk preferences without some further specification of the shape of the utility curve, many economists and economic anthropologists have the intuition that wealthier individuals should be more risk-prone. If wealth were an important variable, then one might endeavor to explain the risk-preference differences between these groups as a consequence of their average differences in wealth. Without any further analysis, it is clear that the intuition that wealthier groups should be more risk-prone is not supported. To the contrary, if we compare the Mapuche and the Sangu with the undergraduates, the poorer groups are substantially more risk-prone than the richer undergraduates. Additionally, the students and the Huinca are both risk-averse, but the Huinca are much poorer. Comparing the wealth of the Huinca and the Mapuche is difficult because the Mapuche have lower social status and less cash on hand than the Huinca but more wealth in land and animals. If land and animals can be converted into cash (which they can but not easily or quickly), the Mapuche are wealthier than the Huinca, However, both Mapuche and Huinca consider the Mapuche poorer and lower in social status.

Using the titration experiment data, table 2 shows the standardized regression coefficients and p values for a series of economic variables regressed on indifference points. For the Mapuche, age, sex, animal wealth per household member, and total land (owned by the household) are used to predict indifference points. Animal wealth per household member captures most of the stored wealth possessed by households except for their land (and land is difficult to sell because Mapuche can only sell to other Mapuche). None of these variables explain any significant proportion of the variation in indifference points, although animal wealth per household member is marginally significant (using just animal wealth makes the fit worse). For the Huinca, sex, age, and income fail to predict indifference points. Including a dummy variable for head of household in these regression models does not change the qualitative results. Further, regression analyses on the Mapuche that included numbers of cows, oxen, horses, and pigs as individual covariates yielded only negative results. In the Sangu data, total acres of corn per household has a sizable positive and marginally significant effect, so a small proportion of the variance in Sangu indifference points may be due to differences in the availability of subsistence (crop). However, many of the poorest members of the sample remain more risk-prone than Western subjects once wealth is accounted for, and if acres of corn are divided by household size the effect disappears.

Similarly, in analyzing the variance experiment data, we find that economic and demographic variables do not predict an individual's likelihood of taking the risky gamble (see table 3, later rounds are no different).

Our negative finding on the effect of wealth is consistent with previous experimental work using peasants, undergraduates, MBA students, and university faculty. Binswanger and Sillers (1983:9), summarizing risk experiments done among peasants in India (Binswanger 1980), the Philippines (Sillers 1980), El Salvador (Walker 1980), and Thailand (Grisley 1980), conclude that "neither wealth nor income had a significant effect on observed choices [which varied in their riskiness], despite large differences in the household wealth of respondents" Binswanger (1980) also found that tenant farmers were more risk-prone than landowners, not, as might be supposed, vice versa. Similarly, in both high-and low-stakes risk experiments among undergraduates, MBA students, and university faculty, Holt and Laury (2000) found no effect of income or wealth (controlling for age and sex) on risk preferences.

TABLE 3
Logistic Regressions Using Economic Demographic Variables to Predict an Individual's Likelihood of Taking the Risky Bet in the Variables Experiment, Round 1

Group and Variable	β	Standard Error	Significance
Mapuche			
Sex	−0.18	1.27	0.89
Age	−0.004	0.028	0.89
Animal health per household member	0.0017	0.0027	0.53
Land	−0.014	0.066	0.83
Sangu			
Sex	0.32	0.6405	0.84
Age	−0.014	0.0196	0.29
Cattle	0.0172	0.0184	0.11
Acres of corn	0.267	0.2138	0.20

Additionally, among the Mapuche and the Sangu neither round number (1, 2, 3, or 4) nor gamble variance has any measurable effect when examined in a fixed-effects regression. In contrast, the undergraduates were substantially less likely to take the risky bet as the variance in outcomes increased and as round number increased.

Risk models. According to the standard economic conception of risk aversion—as decreasing marginal utility—neither the Mapuche nor the Sangu are risk-averse. In fact, they are both quite risk-prone, relative to both expected-value theory and control populations. Taken at face value, these experiments provide a direct challenge to the standard approach to risk aversion. We address a variety of mitigating interpretations below.

Unfortunately, our experiments do not confront the safety-first or satisficing model as directly. Nevertheless, the predictions from some interpretations of the satisficing model are clearly not supported. This model predicts that individuals above some minimum threshold should behave risk-aversely. If this threshold is some physiologically defined minimum level of subsistence, then all four groups described in this paper as well above it. No one was starving or seemed concerned about not being able to obtain sufficient food in the coming year. If this is the case, then the Mapuche and the Sangu violate the risk-averse prediction of the safety-first model, while the Huinca and the students remain consistent with it. Contrary to the prediction, if any group runs the risk of falling beneath a minimum subsistence threshold it is the risk-averse Huinca. If instead this threshold represents some local, culturally evolved standard of wealth and success, then risk preferences *within* groups should be predicted by some measure of individual wealth. However, as we have seen, wealth does not predict experimentally measured risk behavior. Given these findings, the safety-first approach does not shed much light on our results. However, if Mapuche and Sangu are including other groups in their assessment of who is high-status, then very few individuals within these groups may feel they are above the relevant threshold.

Alternative interpretations. How are we to interpret these findings in the light of the substantial evidence (including our own) that a great deal of economic behavior is adaptive and does manage risk (Johnson 1971, Norman 1974, Wolgin 1975, Ellis 1988, Ortiz 1979, Roumasset 1976, Netting 1993)? We see two possibilities: (1) Small-scale farmers are risk-averse, cost-benefit decision makers in most economic/agricultural domains but—perhaps because of fun-seeking behavior or lack of experience with games—risk-prone in these particular gambles—gambles that involve substantial sums of money that could be used for food, fertilizer, and seed. (2) Small-scale farmers, among others, rely on cultural transmission mechanisms (e.g., social learning rules) to acquire economic practices and contextually specific decision-making heuristics that produce well-adapted risk-averse behavior without any risk-averse decision making on the individual level.

In defending the first possibility, some readers have suggested that the Mapuche may lack sufficient experience in situations suitable similar to these games to apply their cost-benefit, risk-averse decision making. Perhaps experience with similar situations is a factor in calibrating decision making. Unfortunately, we no comparative, quantitative data on different rates of exposure to similar situations, but many Mapuche and Sangu have experience in bingo, betting on board games (*bao*, among the Sangu), charitable lotteries ("door prizes" at bingo), and betting on horse races (Mapuche run their own), and therefore it is not at all clear that Huinca and undergraduates have more experience than they do with games of chance. And, although the Huinca have more experience in wage labor than the Mapuche and Sangu, the dichotomous variable "having done wage labor" is not a predictor of risk preferences in regression models for either experiment. Finally, without a theory of how "experience" affects decision making it remains unclear to us how such experience would lead to risk-averse, as opposed to risk-neutral or risk-prone, decision making. Risk aversion is not the "correct" (income-maximizing) answer in these games; it is simply a matter of taste.

Others have suggested that risk-averse decision makers may prefer the risky gambles because they get some "utility" or "fun" from playing them. Such individuals would avoid the "sure thing" because they like flipping coins or picking cards. There are two problems with this explanation, one empirical and the other theoretical. Henrich has performed many three-choice lotteries with both Mapuche and Huinca in which individuals had to choose among three gambles that varied in their mean returns and their variances. As in the experiments discussed above, Mapuche preferred the higher-variance (risky) options significantly more than the Huinca, which suggests that fun in "playing" versus "not playing" is not the answer—although it is possible to construct a theory in which the amount of "fun" increases with the size of the variance. Theoretically, such a "fun" proposal is still saddled with explaining why human groups vary in their preferences for "fun." Why does "fun" affect Mapuche and Sangu choices but not Huinca and student ones? It would be interesting to repeat the games with play money and see if anyone's behavior changed.

Another concern about the games focuses on differences in the way people may perceive "losses" versus gains." Participants may receive more money than they had at the start, but they cannot finish with less money than they had at the start. We have several comments on this point. First, perceiving the money as a "gain" is merely a "framing effect." In the variance experiment, for example, we could have given Mapuche participants 4,000 pesos on one day and returned the next week to administer the game. In this case, participants would have had to put down 1,000 pesos (or choose not to) for a chance at winning the various gambles. The payoff structure of this version of the game would have been identical to the one we actually used; it just "looks" different. This is not, of course, to belittle framing effects; in fact, we think that framing effects are often the most important variable. Second, from the point of view of the standard model of risk aversion in economics, framing effects should be irrelevant, so our criticism of that model stands. Third, we think that the decisions in our model bear some resemblance—in terms of the framing of gains and losses—to the actual cropping decisions that farmers make. In our games, farmers face a choice between a sure gain and a high-variance gain. Similarly, in selecting a particular wheat seed for sowing the following year, farmers often face a choice between their traditional seed (which approximates a "sure thing") and high-tech seed that may produce a higher yield (bigger gain) but, if not dealt with properly, may yield substantially less. Sowing either seed will provide a "gain" relative to *not planting* (even in a bad year, fields usually yield something). Consequently, in terms of gains and losses, we think that these frames are somewhat similar for the participants. Finally, even if something about the gains versus losses framing did affect the results, the question remains why this framing affected different populations in different ways. If framing-as-gains made the Mapuche and Sangu risk-prone, why didn't it also make the Huinca and the students risk-prone.

The second possibility, that small-scale farmers rely on cultural transmission mechanisms to acquire economic practices and contextually specific decision-making heuristics and not on a generalized, risk-averse cost-benefit decision-making process (as is often assumed in economically oriented anthropology), is consistent with a substantial amount of research from across the social sciences indicating that people solve problems by culturally acquiring the strategies, practices, mental models, beliefs, and preferences of others (Henrich n.d.). If, for example, people rely on prestige-biased cultural transmission (Boyd and Richerson 1985, Henrich and Gil-White 2001), in which they preferentially copy the behaviors, decision-making heuristics, ideas, and beliefs of prestigious or "successful" people, then quite sensible and adaptive behaviors that would effectively manage risk in the economically precarious context of peasants would spread without anyone's applying generalized risk-averse decision analysis. Such a process would equip farmers with context-specific heuristics or rules of thumb (Henrich n.d.), which may embody some notion of risk aversion or satisficing and thus generate risk-averse decisions in certain situations but actually bear little resemblance to classical approaches to risk aversion. In many economic contexts, small-scale farmers who persistently deployed risky practices would eventually experience catastrophic losses that would create a severe drop in their prestige (or their apparent degree of "success") if they managed to survive. Such results would stifle the spread of these risk-prone practices and any other transmissible traits of these unsuccessful farmers. In contrast, farmers whose practices or context-specific heuristics effectively managed risk and consistently avoided disastrous or catastrophic consequences would gradually accumulate wealth, wives, and children. This success would lead to prestige, which would cause their practices and cultural traits to spread more vigorously than those of others. In cultural evolutionary time and in response to historical circumstances, this process would diffuse risk-managing practices throughout the population without anyone's doing risk-averse decision making in the usual sense.

From this perspective, given that in many traditional economies cash transactions, banking, credit, and money management either are relatively new or have never been crucial to economic success (this is certainly true for the Mapuche and the Sangu), we should not expect cultural selection processes such as prestige-biased transmission (Henrich et al. 2001) to have evolved adaptive rules or preferences for dealing with such matters. For example, there is little doubt that historical factors such as the Huinca's persistent exploitation of the Mapuche's past ignorance of land values (which pervades Mapuche stories) have been inculcated into Mapuche practices, beliefs, and heuristics (such as "Don't buy on credit from Huinca") and consequently slowed the cultural evolution of rules for dealing with money. In contrast, Huinca townspeople and the undergraduates come from societies in which cash transactions, banking, credit, and money management have long been the key to economic prosperity and prestige. Consequently, we should expect them to have acquired culturally evolved rules and preferences about how to deal with money in risky situations, while we should expect the Mapuche and Sangu to have developed similar rules for agriculture and herding instead. Kuznar (2001) in fact finds risk-averse behavior in a somewhat comparable group of Aymara pastoralists, although the hypothetical nature of the gambles makes his results difficult to compare directly with our own.

But why should Mapuche and Sangu be risk-prone in these money gambles? Given that gambling games are prevalent and popular in many foraging groups throughout the world, that big-money lotteries have rapidly spread to most nations, that revolving-credit associations have spread throughout the "underdeveloped" world, and that people can become addicted to gambling just as they can to food, drugs, and sex, it could very well be that humans have some predisposition toward taking risky monetary gambles. Consequently, Westerners or any cultural group that has long and intensely participated in a monetary economy are risk-averse in monetary gambles because they have acquired, via social learning, rules and preferences for dealing with risky monetary situations. The students, for example, seemed clearly tempted by the higher-pay off risky bets but believed that the "smart thing" was to take the sure money. Neither Mapuche nor Sangu possess such a belief. It would be profitable to see how such groups behave with similar gambles for other currencies, such as livestock (Kuznar 2001) or land.

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