Reports

Cooperation Dynamics in a Multiethnic Society

A Case Study from Tamil Nadu

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The importance of ethnic diversity in determining social outcomes and reducing generalized cooperation is increasingly well documented. Theory suggests that cooperation in human groups may depend on reciprocal altruism and frequency of contact, yet these factors have not been linked with ethnic diversity. This study explores how fine-scale components of cooperation—social exclusivity and reciprocity—relate to broad-scale social conditions—ethnic diversity and ethnic stratification—in villages in Tamil Nadu's Palani hills. Both ethnic diversity and ethnic stratification are associated with declines in indirect reciprocity, although stratification has a larger effect. In addition, stratification is linked to increased social exclusivity. Moreover, measures of direct reciprocity in the form of agricultural labor exchanges are uncorrelated with both diversity and stratification. These results imply (1) that ethnic stratification is more detrimental to cooperation than is ethnic diversity, (2) that social exclusivity and ethnic stratification are mutually reinforcing, and (3) that direct reciprocity is more robust to cooperative failure across ethnic boundaries than is indirect reciprocity. These results confirm and extend current theory of human cooperative regimes and may be of value for community development in multiethnic settings.

Research on human cooperation suggests that human cultural abilities coevolved with our cooperative tendencies (Bell, Richerson, and McElreath 2009; Boyd and Richerson 1985), that human groups develop distinguishing ethnic markers that help solve coordination and collective-action problems (Boyd and Richerson 1987; Efferson, Lalive, and Fehr 2008; McElreath, Boyd, and Richerson 2003), and that ethnic groups supply a cultural boundary that helps promote cooperation (Boyd and Richerson 2009). These findings lead to the prediction that generalized cooperation suffers as the number of ethnic groups increases because individuals limit cooperation to those within their group. This prediction has been largely borne out by research on the effect of ethnic diversity on economic development. This literature shows that ethnic diversity reduces the ability of human communities to cooperate and produce public goods (Banerjee, Iyer, and Somanathan 2005), including public schools (Miguel and Gugerty 2005), water and waste services (Alesina, Baqir, and Easterly 1999), and environmental management (Baland, Bardhan, and Bowles 2007; Ruttan 2006). One important dimension of social reality largely absent from this research, however, is that of social hierarchy and ethnic stratification. This study addresses the linked effects of ethnic diversity and ethnic stratification through a case study in South India.

The two most notable features of Indian caste society are ethnic diversity and ethnic stratification. India is one of the most diverse nations in world, containing thousands of ethnic groups, which vary widely by region and likely originated as local tribes (Gadgil and Malhotra 1983). India is also famous for the hierarchical ethnic stratification of "caste." Although these two aspects of Indian caste society have long been recognized by anthropologists (Bayly 1999; Dirks 2001; Marriott 1976; Srinivas 1957; Weber 1958), their interaction with each other and their influences on cooperation are not well understood.

Ethnic stratification in India has long been controversial (Appadurai 1986, 1988; Dumont 1970; Vincentnathan 1996), and it remains a foundational feature on or against which succeeding descriptions of Indian society have stood. Indian caste has been influenced by both historical factors (Bayly 1999) and internal and external social forces (Dirks 2001). But caste stratification[1] is not ubiquitous. Nonhierarchical communities exist in villages (Deliège 1995) and tribal populations (Gardner 2000). Moreover, economic forces may have some erosive effect on ethnic stratification in Indian cities. These complicating issues highlight the need for a dynamic theory of caste (Bayly 1999) to integrate the factors of social identity and ethnic diversification, on the one hand, with economic inequality, social hierarchy, and ethnic stratification, on the other. This need is severe, since as Luce (2007) observes, ethnic relationships of caste society perpetuate economic stagnation and social injustice. Yet it remains unclear how ethnic diversity and ethnic stratification interact to restrict cooperation and which is more detrimental. This study explores how the intermediate cooperative factors of reciprocity and exclusivity covary with ethnic diversity and ethnic stratification.

Ethnic Stratification

The key features of ethnic stratification in the context of Indian caste can be highlighted by combining the criteria of Velassery (2005) and Quigley (1994): (1) division of society

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1. Although the terms "hierarchy," "stratification," and "dominance" are all used to describe ethnic power differentials, I use the term "stratification" this report.

into cultural groups, (2) economic differentiation of groups, (3) social separation between groups, and (4) power hierarchies between groups. This list captures the basic features of caste society as described by scholars of caste. These same features form part of Henrich and Boyd's (2008) model of the evolution of ethnic stratification. Henrich and Boyd's model serves the need for a dynamic theory of the social construction of caste. The model uniquely suggests conditions under which ethnic stratification, ethnogenesis, and economic specialization positively reinforce each other as society changes through time.

The Henrich and Boyd model is built on a few key premises: (1) economic specialization generates a surplus, (2) individuals preferentially imitate those with the greatest economic success, and (3) subpopulations exist. These assumptions are each simple and individually justifiable. The model predicts that ethnic stratification is favored by (1) greater cultural isolation between groups, (2) a greater surplus, (3) greater importance of economic success in guiding cultural learning, and (4) more equitable divisions between specialized economic roles. Most of these results come as no surprise to students of Indian caste.

Each of the four most important model parameters can be interpreted in terms of Indian caste society. The first parameter is m, the migration between subpopulations (or caste switching). Low migration increases the likelihood of stratification and inequality. The analogue in India, switching caste identity, is nearly impossible, although rare cases do exist. The second parameter, G, is the size of the economic surplus. Borgerhoff Mulder et al. (2009) show that agrarian societies are more economically unequal than both hunter-gather and industrialized societies, and they argue that agrarian surpluses are directly responsible for this extreme wealth inequality. Increases in G cause greater stratification and inequality. The third parameter, β, is the added weight that individuals give to economic success in choosing individuals to imitate. Ethnographic experience suggests that people in agricultural village conditions are typically highly sensitive to difference in economic success. As this weight increases, so do both stratification and inequality. The reason is that, ceteris paribus, as individuals become more discerning of the success of economic strategies, they will adopt the most effective strategies of their peers within their subpopulation, not the strategies of other castes, from which they are isolated at 1 minus the mixing rate, m. The fourth parameter, γ, represents the proportion of the surplus allocated to the high stratum. As γ approaches 50% (an even share of the surplus between high and low strata), stratification becomes increasingly likely. This counterintuitive result occurs because as sharing becomes increasingly unequal (γ approaches 1), high-caste individuals will gain at the expense of low-caste people, who will nonetheless be able to observe (at rate m) and imitate (with bias β) those high castes. Therefore, all else being equal, as inequality grows, the chances that low castes will imitate the high castes also grow, reducing the likelihood of social stratification.

This model has one limitation and three important benefits as a theory of caste. The primary limitation of the Henrich-Boyd stratification model is that it concerns only the interactions between two groups. The dynamics of a multigroup society are likely to be more complex. However, unlike prior theories of caste, the model is not a static description of a dynamic process but a dynamic process itself and a parsimonious description of the way a set of forces leads to the evolution of stratification. Both egalitarian and stratified societies are possible within the Henrich-Boyd model, but the combination of parameter values uniquely determines which type of society will arise. This feature addresses much of the discomfort that anthropologists have with social theory. Second, social inequality and stratification can both result even when individuals are imitating the payoff-maximizing strategies. Low-caste individuals do not choose their strategies poorly or irrationally, but they find themselves in a situation where only certain strategies are available, and yet those strategies ultimately perpetuate their status. This aspect of the model is a feature often sought by scholars of caste, since it allows both individual and group autonomy and yet explains power differentials. Finally, this model is robust because of what it does not assume. It does not assume coercion of one group by another or the existence of exogenous group differences, both of which would tend make the evolution of stratification even more likely.

Hypotheses

Cooperation is difficult to measure directly, but cooperative social regimes often share common features that serve as useful diagnostic instruments. This report examines two hypotheses that arise from the mathematical literature on cooperation, regarding the relationships between the broad social states of ethnic diversity and ethnic stratification and the fundamental social processes of group mixing and reciprocity.

Ethnic Stratification

Stratification and group mixing. In the Henrich-Boyd model, the lower the mixing rate between groups, m, the greater the chances of ethnic stratification, all else being equal. Therefore, in more stratified situations, we expect to find less mixing or more exclusivity.

Stratification and reciprocity. The Henrich-Boyd model does not include cooperation and provides no hypotheses on how reciprocity and stratification might interact. However, basic social psychology would predict that reciprocity would decrease with increasing ethnic stratification.

Ethnic Diversity

Diversity and group mixing. In a model on the evolution of ethnic marking, McElreath, Boyd, and Richerson (2003) suggest that low levels of intergroup mixing are initially necessary

to generate ethnically marked groups but that once ethnic marking has set in, mixing actually reinforces ethnic differentiation, although it is not necessary. Because the ethnic groups in this study have been historically differentiated, the McElreath, Boyd, and Richerson (2003) model predicts no strong relationship between mixing and the number of ethnic groups.

Diversity and reciprocity. Both direct reciprocity (Nowak and Sigmund 1998) and indirect reciprocity (Panchanathan and Boyd 2004) have been shown to stabilize cooperation within groups. If cooperation is concentrated in ethnic groups, then increasing the number of groups should be associated with a decrease in reciprocal exchanges between groups.

Below, I test how caste stratification and caste diversity correlate with reciprocity and group mixing, using survey data from rural agricultural villages in Tamil Nadu.

Study Sites

The Palani Hills of Tamil Nadu, an eastern escarpment of the Western Ghats, are home to many agricultural villages retaining traditional governance institutions (see fig. 1). For additional demographic information, see CA+ online supplement A.

Five months of ethnographic investigation on social identity, oral history, and village organization across the Upper Palani villages form the basis on which caste (or *jati)* relationships were classified. Caste hierarchy in the Palani Hills region is centered on two focal caste groups, at opposite ends of the power spectrum, that share a long history. The most powerful group, the Manadiar, was the first to settle the Palani mountain villages. The Manadiar typically hold some or all of the hereditary leadership positions, giving them great influence within the village justice system. By contrast, the Sakkliyar, a Dalit group, has almost no formal power. The Sakkliyar are denied representation in the village justice system and are excluded from the semisacred commons where village meetings are held. Dalit discrimination is ubiquitous in these study villages and is a broad and well-documented phenomenon in India (Human Rights Watch 2007; Michael 2007).

Srinivas (1962) observed that actual caste rankings are often limited to the few most powerful and most oppressed groups, while the majority of groups are not clearly or consensually ranked. This observation holds true in the study region as well. In the Palani Hills villages, "caste people" (non-Dalits) occupy headmen positions. Typically, the first headman is called "the Manadiar" and the position is occupied eponymously, while further headmen come from other non-Dalit castes. The Sakkliyar hold village servant positions, including the village crier, the water controller, and the festival celebrant. These formal roles betray a caste-driven power asymmetry and a historical stratification centered on the relationship between the village leader and village servant castes (table 1).

The tests I evaluate in this report draw on the results from a larger project that included qualitative ethnography, surveys, and experimental games. The statistical tests are all evaluated against the survey, while the institutional details and caste classification come from the preliminary qualitative ethnography.

Sampling

Seventeen villages in the upper Palani Hills have the traditional system of village management, with active headmen. Nine of these have a cooperative irrigation system, with appointed irrigators. These nine villages may be distinguished along three important dimensions: the number of resident

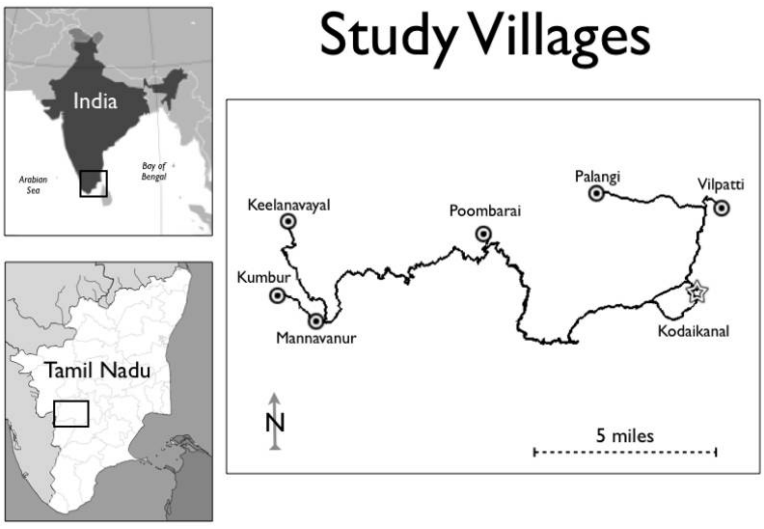

Figure 1. Study villages in the Palani Hills of Tamil Nadu and their distances and routes to the nearest city, Kodaikanal (population 32,931), which provides important social and economic opportunities (Government of India 2001).

Table 1. Castewise distribution of traditional village leadership and servant positions across the six study villages

Caste *(jati)*	Headman positions (hereditary)	Servant positions (appointed by headmen)	Regional status
Manadi	10	0	Traditional leaders
Asari	8	0	Caste
Mudali	3	0	Caste
Pillai	3	0	Caste
Chetti	2	0	Caste
Reddi	2	0	Caste
Thevar	1	0	Caste
Sakkli (Dalit)	0	98	Dalit

Note. Sakkliyar is the predominant Dalit caste in the Palani hills region. Servant positions include water controller (*neer-nikam*), celebrant (*vettiyan*), and village crier (*thandalkarar*). Headman (*thalaivar)* positions are individually named, with multiple headmen per village. Common headman titles include the primary *Manadiar* as well as *Manthiriar* (sacred) and *Periyathanam* (wealthy).

castes, the village population, and the distance to Kodaikanal, the local market town. I selected six representative villages, in a quasi-factorial fashion across these three variables (table 2), in which to conduct a semistructured, caste-stratified survey of farming households. In each village, all castes with 10 or more households were subsampled, and at least nine households were surveyed for each caste group. Efficient randomized sampling was aided by the commonality of caste-segregated neighborhoods. Excluding 11 out-of-sample surveys, 254 heads of household were interviewed between January and June 2008.

The survey instrument provides multiple measures for each of our test factors (table 3). For group mixing, I use six separate questions that solicit nominations from the respondent as to whom they are most likely to interact with in the realms of borrowing and lending cash and agricultural equipment; in seeking social, political, and economic contacts; and in agricultural labor exchange. I summarize these network data to provide a simple measure of own-caste exclusivity for each respondent.

I use different responses to address direct and indirect reciprocity. Indirect reciprocity is measured with the local tradition of social donations, in which families will make gifts in cash or kind to other families during major life events. I summed estimates of the value of average donations that each family makes per year given to other families. Direct reciprocity is measured in the context of a reciprocal agricultural labor exchange tradition called *kamal velai*. In *kamal velai*, individuals will volunteer to work for no pay, assuming that the favor will be returned. I include two measures of the respondents' participation in *kamal velai*, the number of partners they trade with and the frequency of labor exchanges each month. It is important to note that the different domains of reciprocity (family social relations vs. agriculture) are both economic in nature. Farmers' productivity literally depends on reciprocal aid during intensive work periods, such as harvest and field preparation, and families often give significant fractions of their yearly income in gifts. The essential difference is that *kamal velai* is a one-to-one practice, while social donations are many-to-one and therefore are reasonably considered a domain of "indirect reciprocity."

Analysis

To accommodate both individual- and village-level predictor variables, the survey data were analyzed with hierarchical multiple regressions, and probability distributions were chosen as appropriate for each response variable. Regression models controlled for both individual-level variables (age, household size, education, and wealth) and village-level variables (populations, distance, wealth [Gini coefficient]). Since it is not possible to measure an important factor that varies by village, I included a random effect for village, accounting for those unmeasured village effects. This allowed for a determination of the proportion of variance explained by village-level versus individual-level variation. Analyses were computed in the R

Table 2. Village-level predictor variables and samples

	Distance (km)	Population (households)	No. of castes	Wealth (Gini coefficient)	*n* (mean caste sample)
Mannavanur	36 (far)	762 (large)	9 (many)	.45	43 (14%)
Kumbur	39 (far)	208 (small)	6 (few)	.46	31 (21%)
Keelanavayal	44 (far)	104 (small)	8 (many)	.39	30 (64%)
Poombarai	18 (close)	1,262 (large)	10 (many)	.49	69 (18%)
Pallangi	10 (close)	133 (small)	3 (few)	.66	27 (33%)
Vilpatti	5 (close)	508 (small)	10 (many)	.43	54 (17%)

Note. Gini index calculation per Milanovic (1997). Mean caste sample is the village-wise average of each per-caste-and-village survey sample.

Table 3. Response variable descriptions for each hypothetical test variable

	Unit	Description	Survey question(s)	Reliability[a]
Mixing:				
Exclusivity	Index 0–22	A negative measure of mixing: the sum of 22 opportunities to nominate individuals of one's own caste in the realms of borrowing and lending cash; agricultural equipment; social, political, and economic contacts; and reciprocal agricultural labor exchange	11, 12, 13, 14, 15c, 20	.65
Indirect reciprocity:				
Donations	Rupees	Sum of donations over the course of the year to other households from major family events (birth, death, marriage, house warming, ear piercing, girl's first menses, and religious pilgrimage); log transformed	10	.74
Direct reciprocity:				
Days	Days/month	Days of reciprocal labor (*kamal velai*) conducted per month	15a	NA
Partners	Partners	Number of reciprocal labor (*kamal velai*) partners	15b*i*	NA

Note. For survey instrument details, see CA+ online supplement B. NA = not applicable.
[a] Cronbach's α.

open-source statistical language. Predictor variables are detailed in table 4.

I conducted a separate mixed-effects regression, with a random effect for village, for each of four dependent variables. For index variables such as exclusivity, I fitted binomial models, because they accurately represent the sum of multiple binary choices. For the count variables days and partners, I used negative binomial and Poisson regressions, respectively. For donations, a continuous variable, I used standard linear models. Of all models, only exclusivity had nonnegligible village-level variance, for which I report the more accurate mixed-model estimates.

In addition, model selection was performed to compare regression models with alternative combinations of the control and predictor variables, using the Akaike Information Criterion. Further analysis details are provided in CA+ supplement A.

Results

Regression analysis reveals that the social correlates of cooperation vary strongly with ethnic diversity and ethnic stratification (fig. 2) but only weakly with control variables. Caste-based exclusivity increased markedly with both high and low caste status, in comparison to "middle" castes, as well as with "caste fraction," the fraction of the village population represented by the respondent's own caste. An increase of 50% in caste fraction was associated with a 2.4-fold increase in the probability of nominating a coethnic, while being Dalit was linked with a 2.3-fold increase. Meanwhile, moving from Dalit to high-caste status was connected to a 1.8-fold increase in the probability of caste exclusivity. Thus, populous castes, Dalits, and high castes are much more exclusive than middle castes and demographically small castes.

Indirectly reciprocal household donations show the reverse

Table 4. Description of individual and village level predictor variables

Predictors	Type	Unit/range	Description
Individual-level variables:			
Age	Control	Years	Age of head of household
Household size	Control	No. people	People living in household
Education	Control	Years	Years of education of head of household
Wealth	Control	log(1,000 Rs)	Natural log of total value of owned items, in 1,000-R increments
Caste fraction	Test	0–1	Proportion of village population made up by respondent's caste
Dalit	Test	0,1	Dalit (1), others (0)
Stratum	Test	1, 2, 3	Constructed from responses regional caste status (table 1) and self-nomination as "powerful caste"; see table 5 for details
Village-level variables:			
Population	Control	No. people	Village population as reported by the 2001 census (Government of India 2001) or estimated by the Panchayat clerk for that village, 2008
Distance	Control	Kilometers	Distance to closest city, Kodaikanal
Wealth (Gini coefficient)	Control	0–1	Estimated inequality index, per Milanovic (1997)
Castes	Test	No. castes	Number of castes with 10 or more households

Note. Wealth was calculated in 1,000-R increments as .01 + (livestock × 10) + (pumps × 5) + (house × 300) + (two-wheeled vehicle × 50) + (four-wheeled vehicle × 750) + (acres owned × 7,000).

Table 5. Caste stratification index, stratum, a rank measure of power for each caste in each village

Caste (*jati*)	Keelanavayal	Kumbur	Mannavanur	Pallangi	Poombarai	Vilpatti
Mudhaliar	2	2	2	2	3*	3*
Thevar	2	NA	2	NA	3*	NA
Reddiar	3*	NA	NA	NA	3*	3*

Note. Social power differences vary significantly by village and caste. Stratum was constructed using the following procedure: Manadiar always ranked 3 (top), Sakkliyar always ranked 1 (bottom), and all other castes ranked 2 (middle), unless a respondent of that caste self-nominated the group as a "powerful caste," in which case it was ranked 3 (top). Self-nominations were coded from survey question 22 and survey comments, and are marked by asterisks. This procedure changed the stratum of only three castes in three villages. NA = not available.

pattern from caste exclusivity, decreasing with Dalit status and increasing with high-caste status. Social donations declined with greater numbers of castes and rose dramatically when higher-power caste groups were in positions of greater demographic majority (the stratum × caste fraction interaction). Adding two family members to a household was associated with a 46% increase in social donations, while adding six more castes to a village correlated with a 55% reduction in social donations. Meanwhile, being Dalit was linked with a 53% reduction in donations, and moving from Dalit to a high caste was linked with an additional 25% reduction.

In stark contrast to indirectly reciprocal donations, direct reciprocity in the form of agricultural labor exchanges showed no strong effects of ethnic predictors in the regression analysis. The greatest effect on time devoted to *kamal velai* exchanges was that of additional farmer wealth. Farmers with 1 million rupees (Rs) more than average participated in 28% fewer days of labor exchange, likely because additional wealth allowed farmers to hire more labor.

The caste stratum variable plays a major role. Models estimated that the shift from Dalit to high caste increased the odds of being caste exclusive 1.8-fold and resulted in a 75% drop in donations. The interaction of stratum and caste fraction denotes the difference between the high caste effects of minority and demographically dominant castes. The interaction is associated with a sixfold increase in donations. High castes donate more in social situations when they constitute larger fractions of the village population.

Discussion

The results match predictions of the Henrich-Boyd model and corroborate prior findings of the negative cooperative effects of ethnic diversity. As expected, the results suggest that people find it harder to cooperate with individuals of other ethnic identities but that the cooperative challenge is heightened when power differences also map onto ethnic boundaries. Table 6 summarizes the ethnic effects by domain. With all of these regressions, we have little reason to assume causation in either direction, but readers ought to view corre-

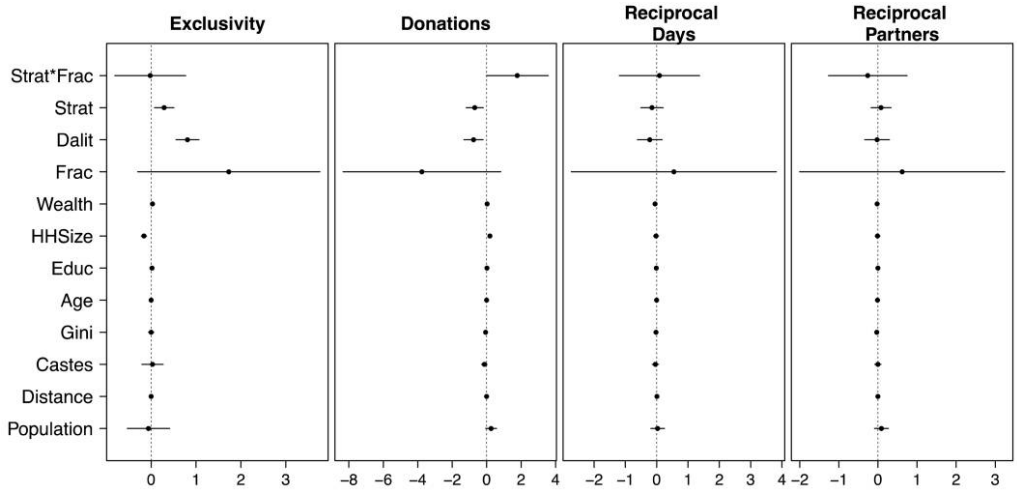

Figure 2. Hierarchical regression effect-size estimates (β) and 95% confidence intervals for the four response variables. Mixed-effects model results are reported for the exclusivity regression. See table A2, in CA+ online supplement A, for transformed effect sizes. Model selection supported these results in two ways: (1) in the exclusivity and donations competitions, the full model presented in the text dominated, with an Akaike weight greater than 0.99, and (2) in the reciprocal-days and reciprocal-partners competitions, the selected model contained only the control variables, signaling that theoretical variables were indeed not important predictors. Strat = stratum; Frac = caste fraction.

Table 6. Summary of large effects with significant ($P < .05$) estimates

	Group mixing (exclusivity)	Indirect reciprocity (donations)	Direct reciprocity (days, partners)
Ethnic stratification:			
Dalit	−	−	NLSE
Stratum	−	−	NLSE
Ethnic diversity:			
Castes	NLSE	−	NLSE
Caste fraction	−	NLSE	NLSE

Note. Sign indicates the direction of any large and significant effect. Caste fraction is considered a "negative" diversity variable, because it measures relative homogeneity. NLSE = no large and significant effect.

lations as evidence of the sorts of social interactions that coevolve with the ethnic forces of diversification and stratification. Nonetheless, the colinearity of exclusivity, indirect reciprocity, and cast stratification is a very strong endorsement of the dynamics of the Henrich-Boyd model, suggesting that social stratification coevolves with reduced social mixing.

Most strikingly, caste exclusivity was positively associated with both measures of social stratification (revealing that both high and Dalit castes are more exclusive than average) yet showed no relationship with caste diversity. While exclusivity was also positively linked with relative caste size, this is likely a result of the necessary mathematical relationship (as castes get proportionally larger within a village, they must become more caste exclusive because there are fewer other castes to interact with).

That social exclusivity is linked more to ethnic stratification than to ethnic diversity supports Henrich and Boyd's (2008) model but is also readily supported from the ethnography of India. In the Palani Hills, as in much of India, Dalit status is defined by exclusion in the form of manifold restrictions on Dalit clothing, location, education, food, and housing. Dalits are segregated in nearly every aspect of village life, presenting them with no choice but to assort with their coethnics. Anecdotes support the claim that segregation is a near-ubiquitous practice on the part of non-Dalits. A Manadiar man from Manavanur states that his caste status causes him "no problems, but scheduled tribes and scheduled castes [SCs, i.e., Dalits] should be separated," while a Dalit man from Vilpatti offers, "We allow all inside our house, but high-caste people don't come." The exclusivity we detect for both high and low castes is, in practice, an exclusionary tradition maintained by the more powerful castes. This implies that social groups become isolated much more in conditions of ethnic inequality than in conditions of mere ethnic differentiation.

In contrast, indirectly reciprocal family donations do decline with increasing ethnic differentiation, suggesting that a growing diversity of social identities within a community does decrease generalized cooperation. This result confirms studies in development economics documenting a decline in public goods with increasing ethnolinguistic fractionalization. Nevertheless, the diversity effect on family donations is small in comparison to the effects of both stratification variables. That this pattern so neatly mirrors caste exclusivity points to the likely explanation that exclusivity is maintained as a way of restricting the benefits of altruism and cooperation to caste groups. Indeed, survey responses evince a regional norm that Dalits should be treated differently. A non-Dalit Kukkal man said, "villagers don't restrict the SC from taking from their fields because they are treated as children." A similar pattern is the idea that Dalits are to be excluded or excused from generalized reciprocal donations, as suggested by a retired school headmaster in Poombari, "if a death occurs every house gives 10 Rs to that family. Collection occurs from all, even Muslims, except the SC. They receive the same death benefits that others do, but it is not asked of them." Dalits are to be treated systematically as inferior.

Surprisingly, direct reciprocity seemed buffered from both diversity and stratification variables, as neither correlated with either the amount (days/month) or the scope (number of partners) of agricultural labor exchanges. This hints that direct reciprocal relationships may be more robust to interethnic stratification and ethnic boundaries in general. If that is so, then it must be a relative effect, since surveys suggest clearly that *kamal velai* is sometimes withheld from Dalits. A Dalit man from Vilpatty reflects, "We go to work with everyone, but only SC people come for our work," while another from Keelanavayal admits "only other SC will do *kamal velai* with us."

If *kamal velai* is indeed restricted by the Dalit divide, then we can be certain that social donations and caste exclusivity are restricted even further. One potential explanation for the lack of effects from either diversity or stratification variables could be that the *kamal velai* tradition is an economic necessity in this agricultural society. Thus, it seems that traditions of direct reciprocity are more robust to the challenges of cross-ethnic cooperation than traditions built on indirect reciprocity.

Conclusion

The motivating question has been how reciprocity and social exclusivity covary with caste diversity and hierarchical caste stratification. While the results presented here substantiate the general evolutionary theory of human group-based coop-

eration, they also demonstrate that ethnic stratification is likely a much larger barrier to cooperation than nonstratified ethnic diversity.

With regard to theory, the Henrich-Boyd model explores only the interactions of two groups, leaving open questions about the dynamics of social stratification among three or more groups. A multiethnic stratification model could yield novel predictions that the Henrich-Boyd model does not. For instance, in this study, middle-caste groups were less exclusive than both Dalit and high-caste groups, a fact that cannot be addressed in a two-group model. Results of the sort presented here call for a new dynamical multigroup theory of ethnic diversification and stratification.

This analysis makes two novel contributions to the theory of human cooperation. First, all evidence in this report, as well as the larger data set it is derived from, indicates that hierarchical ethnic stratification is much more detrimental to cooperation than is ethnic diversity, which has itself already been identified as a major cooperative hurdle. Increased exclusivity and reduced indirect reciprocity may underlie the negative cooperative effects so often observed in multiethnic societies. Second, direct reciprocity may be relatively insulated from these same anticooperative ethnic effects. The contrast between domains of direct and indirect reciprocity is stark, and it hints that institutions built on direct reciprocity may be more resilient in multiethnic contexts and perhaps in general.

Finally, the ethnic stratification explored here has the worst effect on those of the Sakkliyar Dalit caste. As the ethnographic evidence supports, Dalits receive terrible treatment and are the subjects of systematic discrimination. The results of this study help anthropological theory approach a mechanistic understanding of the causes and cures of exactly this kind of ethic stratification.

Acknowledgments

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