

# Land Rights and Community Cooperation Public Goods Experiments from Peru

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**Summary.** — Joint land rights in peasant communities are often held to preserve cooperation norms better than individual land rights. This study uses contributions in public goods experiments as a measure of cooperation norms in 15 jointly- or individually-owned peasant communities in the Peruvian Andes. Cooperation norms are significantly stronger in joint-ownership communities, when controlling for relevant exogenous variables. This effect is found only among men, who are considered the main landholders in a household and are thus more likely to respond to the incentives provided by the land right system.

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## 1. INTRODUCTION

Management of common resources requires collective action. Many scholars have argued that common property rights may preserve cooperation norms, whereas privatization may erode them (Baland & Platteau, 1996; Deininger & Feder, 2009; McCulloch, Meinzen-Dick, & Hazell, 1998; Ostrom, 1990). This question is particularly relevant for small-scale peasant communities in the developing world, where land privatization reforms are increasingly being implemented. Individual land rights are thought to improve tenure security and thereby encourage investments, loosen credit constraints, and promote efficient land markets (De Soto, 2000). However, such a one-sidedly optimistic view of privatization may be overly simple, as it disregards the institutional role that land property rights play in sustaining local norms of cooperation. Such norms are vital for efficient community organization and management of common infrastructure, like water-sharing systems. Joint property rights may facilitate the enforcement of such cooperation norms, by providing communities with the important sanction possibility of confiscating land from non-cooperating members. In general, cooperation norms are vulnerable to even small institutional changes, because cooperative behavior usually requires a critical number of participants. Even a small increase in the share of free-riders may shift a whole group into a non-cooperative equilibrium (Bowles, 1998; Ostrom, 1990).

This study reports from a one-shot standard public goods experiments conducted in 15 peasant communities in the Peruvian highlands that hold joint or individual formalized land property rights. Participants were randomly divided into anonymous groups of four within each community. Each group member chose how much of a given endowment to contribute to his or her group, at the expense of individual earnings. Total group contributions were doubled and then distributed equally to all group members. This incentive structure resembles naturally-occurring cooperation dilemmas in these communities, in which the individual peasant must make some personal effort or monetary contribution in order to facilitate joint projects from which all community members draw equal benefits. An individual's norm of cooperation toward the community is assumed to drive both general cooperative behavior in such dilemmas and cooperative

behavior in the specific public goods experiment. The contribution decision in the experiment therefore provides a proxy for the participant's cooperation norm at the community level. The aim of the study is to compare these cooperation norms between property-rights regimes.

Historical circumstances in the Peruvian highlands resemble a quasi-experiment for studying the effects of formal property rights to land. Peasant communities of differing legal status existed side by side, initially with the same *de facto* land use and land rights. Status as “recognized” peasant communities was apparently granted at random, as there were no evident structural differences between communities of different status. However, in the early 1990s, new land laws introduced formalization of individual land rights *only* in non-recognized communities, whereas recognized communities continued with joint land rights. This setting provides a rare possibility to study the effects of property rights by cross-sectional analysis.

Why should joint-ownership rights promote cooperation norms in the Peruvian highlands? Irrespective of property-rights regime, peasants access, manage, and harvest their individual plots. However, formal individual property rights protect the individual from community interference in land issues and are ultimately enforced by the government. With joint formal property rights, peasants rely on the community to protect their individual landholdings. When conflicts arise, the community has the possibility to confiscate individual land—a severe sanction mechanism against non-cooperative community members. And indeed, there are some examples from the Peruvian highlands where communities have

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confiscated individual land as a sanctions mechanism (Wiig, 2005). The mere threat makes the individual dependent on the goodwill of the community and increases the incentives for cooperating. An additional practical difference between regimes is the right of alienation. It is only in communities with individual ownership that peasants are freely allowed to sell their land. Restrictions on land sales limit the scope for migration and strengthen group stability over generations, which may facilitate shared norms of trust and reciprocity and provide members with a long-term, sustainable perspective on collective resources (Ostrom, 2003). By intervening in land sales, the community may also ensure that members do not sell off land for short-term or risky profits, later becoming dependent on community support or entailing other negative social externalities (Deininger & Feder, 2009). Finally, the sale of individual *versus* joint ownership rights might in itself induce general values of individualization. Reduced collective values may diminish one's perceived dependence on and commitment toward the community, and restrict one's willingness to sacrifice individual benefits for the sake of the wider community (Bowles, 1998).

Although the theoretical literature is abundant, there is scant empirical evidence of joint property rights enforcing cooperation norms. Ostrom (1990) reports from several case studies that support this claim, but to my knowledge there is no evidence from larger-scale studies. One reason may be the difficulty of measuring cooperation norms in a manner that allows for comparison across communities and land-rights regimes. The public goods experiment offers such a method. Unlike survey questions on past behavior in specific cooperation dilemmas, the experiment isolates the cooperation decision and provides a simple and identifiable outcome variable. By using the same payoff structure and context for all participants, the experiment allows for meaningful comparison between communities. In contrast, observed behavior in naturally occurring cooperation dilemmas is problematic to compare between communities because the situations are never identical across communities.

Laboratory experiments are increasingly used to identify and compare social norms in the field (Andersen, Bulte, Gneezy, & List, 2008; Bouma, Bulte, & van Soest, 2008; Cardenas & Carpenter, 2005; Cardenas, Stranlund, & Willis, 2000; Carpenter & Seki, 2011; Fehr & Leibbrandt, 2011; Henrich, Boyd, Bowles, Camerer, Fehr, & Gintis, 2004; Henrich *et al.*, 2001; Lesorogol, 2005; Rustagi, Engel, & Kosfeld, 2010). In their comprehensive study of 15 small-scale community cultures from around the world, Henrich *et al.* (2004) find substantial differences in ultimatum, dictator and public goods game behavior across cultures, which they explain by structural differences in daily life and organization. People play more cooperatively in communities with higher market integration and/or higher returns to cooperation in their daily lives. Contribution levels are to a very limited extent explained by individual characteristics, which are traditionally assumed to determine preferences in economics, but are primarily seen as related to group characteristics. Other studies confirm the importance of group characteristics and social organization as determinants for public goods game contributions. For instance, Fehr and Leibbrandt (2011) find Brazilian fishermen who contribute more in the public goods game also forgo short-term personal income by employing more sustainable fishing practices that benefit the whole group of fishermen. Similarly, Rustagi *et al.* (2010) report that forest management groups in Ethiopia with higher shares of conditional cooperators in a public goods game are more successful in forest management, and they spend more time monitoring

their forests. Closest to the focus of this study is Lesorogol (2005), who has conducted public goods games and ethnographic studies in two Kenyan villages with different degrees of land privatization. She finds lower game contributions in the community with more formalized individual land rights, a result she ascribes to a crowding-out of cooperation norms.

This study is based on a substantially larger sample, consisting of 570 participants from 15 communities. It finds that contributions to the public good are significantly higher in joint-ownership communities than in individual-ownership communities, when controlling for relevant exogenous variables. This relationship is found only among men, who traditionally are *de facto* landholders, while women's contributions are independent of property-rights regime. These gender differences relate to traditional gender roles and support the interpretation of cooperation norms as enforced by joint land ownership.

## 2. LAND RIGHTS AND LAND USE IN HIGHLAND PERU

### (a) *Historical determination of land rights*

Peruvian highland agriculture was long dominated by large landholdings (haciendas), owned and managed by the elite. Indigenous peasants worked the land and were in practice exploited as slave labor. "Land to those who work it" was long a rallying call for agricultural workers in the country's class struggle. As Peru developed into a democratic state, the power of the hacienda owners was gradually reduced. Large-scale hacienda farming did not yield enough to feed the growing highland population. In the 1950s, with low productivity and leftist political forces on the rise, a few hacienda owners foresaw the diminishing future prospects and started to sell off land to their workers. The Peruvian urban elite saw land distribution as a means of avoiding a leftist revolution; also the government initiated some early experiments of redistributing land to the workers at the same time (Wiig, 2013). In 1968, a military leftist regime came to power by a coup, and immediately started large-scale redistribution reforms. When civilian rule was re-established ten years later, nearly all haciendas had been confiscated and the land redistributed according to the principle "land belongs to those who work it" (del Castillo, 1997).

After these major land redistributions, peasants were organized in small groups, in line with highland tradition. The intention was for these peasant groups to function as agrarian collectives, with joint production and joint output, based on a misperception that this was traditional highland practice and a belief that collective farming would make possible investments in modern machinery and technology (Plant & Hvalkof, 2001; Wiig, 2013). However, very few peasant groups practiced collective farming. The few groups that did were dysfunctional and soon closed down. Peasants worked individually on their separate land plots, while the groups had social functions together as communities. That is the community structure remaining today.

Under the military regime, the government started an administrative process of registering peasant communities. Registered peasant communities (*comunidades campesinas reconocidas*) were issued with formalized joint ownership of the land. The intention was for all communities to be recognized, but the process took time. When the military regime fell, the administrative support ended and the process halted—so some communities ended up as formally recognized, while others

were not. The communities themselves do not seem to have pressed for recognition, because legal status in itself had no practical implications at the time. Land rights were apparently perceived as joint in all communities. Then, a shift in the political regime in the early 1990s brought new land laws, which liberalized and individualized land property rights. Recognized communities were exempted from the individualization regime since they already held joint formal property rights. Hence, the new laws introduced an important difference in formal property rights between recognized and non-recognized communities (here referred to as joint-ownership and individual-ownership communities).

(b) *The titling process*

The Special Land Titling and Cadaster Project (PETT) started the process of prescribing formal land titles to individuals and households in 1996, with the principle of universal coverage in all individual-ownership communities (for details about the process of land registration and titling, see Fort (2008)). All individual plots of importance were eligible for titling, but land at very high elevations (assumed to be pastureland) and marginal plots with low production were exempted. The titling process is still ongoing. By 2011, the governmental titling agency had issued around 1.5 million titles (Glavin, Stokke, & Wiig, 2013), amounting to approximately 40% of eligible plots (Fuentes & Wiig, 2009). No land in joint-ownership communities is eligible for individual titling.

(c) *Land rights and land use today*

In this context, landholdings and land ownership are different concepts. In both property-right regimes, nearly all agricultural land is *held* by individual households. If land is held by individual households, it implies that the household in practice has access to, manages, and harvests the production from the land. In contrast, *ownership* rights refer to the formal right to the land. Joint-ownership communities have the right of joint formal ownership to all community land, also land held by individual households. By contrast, in individual-ownership communities, the individual peasants (or households) have formal ownership rights to the landholdings.

In addition to individually-held land, most communities have some land areas which are held in common. This applies mainly to less-fertile areas at higher elevations, used for pasture. Very little agricultural land is *de facto* held and managed in common.

(d) *Community organization*

Each community is organized by a community assembly, constituted of one representative from each land-possessing household. The assembly elects a community chief, who runs the community on a day-to-day basis. The right and duty to meet in the community assembly are attached to the man through his traditional role as the household head and perceived land possessor. Among the assembly's most important tasks is management of common resources, hereunder water management. Water rights are collective, and efficient sharing depends on well-functioning collective action both within and between communities. Individuals and communities often rotate water-right days, and set fees normally apply per day or hour. Complex canal systems which distribute water between plots are frequent, often built and managed

by the community assembly (for examples of water-sharing institutions and community land use in the Peruvian highlands see Goethebuer and Platteau (2005, 2010)).

For the physical work related to management of common resources, the community assembly organizes *faenas*, a traditional highland institution of mandatory public work. For example, *faenas* are used for the construction and maintenance of irrigation schemes, roads, and public buildings. The assembly normally specifies how many days each household is obliged to participate in a particular *faena*. In most cases, non-participating households must pay a given fee. *Faenas* typically involve physical labor and are therefore regarded a male responsibility.

Another cooperative highland tradition is *ayni*, a reciprocal agricultural work exchange between households ("you help me today and I help you tomorrow"), also performed mainly by men. I am not aware of comparable community-level cooperative institutions dominated by women. Community-level spheres of cooperation seem reserved for men, although female participation is increasing along with external pressure for female empowerment.<sup>1</sup>

Some communities consist of two or more independently organized sub-sectors, hence labeled sectorized communities. These sub-sectors are often geographically dispersed from another and might have separate organizational institutions, in addition to its members participating in the community level assembly. One might suspect that sectorized communities reveal weaker cooperation norms at the community level. These communities tend to be larger in terms of inhabitants and more geographically dispersed, which might imply more interaction within ones subgroup and less interaction with the community at large, providing a weaker basis for development of cooperation norms.

(e) *A quasi-experiment*

The historic determination of formal land rights in the Peruvian highlands offers the background for a quasi-experiment for studying the effects of property rights. This is based on the following two conditions: there were no structural differences between recognized and non-recognized communities before the land individualization reforms of the 1990s; and the individualization reforms were implemented for non-recognized communities only, for the first time implying a practical difference between communities of different legal status.<sup>2</sup>

For causal interpretation of the results reported in this article, a core question is whether the *initial* level of cooperation in a community might have affected its likelihood of becoming a recognized peasant community in the first place. According to Wiig (2013), however, there is no reason to suspect that there were any structural differences between recognized and non-recognized communities before the implementation of formal individual land titles. On the basis of fieldwork in the highland in 2002, he argues that recognition in itself had no practical implications, and that people were generally not aware of whether their community was recognized or not, as all communities simply were labeled "communities." However, on returning to the field five years later, he found that a linguistic change had taken place as a response to the implementation of formal individual titling. Individual-ownership communities were now labeled "private communities," whereas joint-ownership communities were called "recognized communities." Today people are highly aware of the legal status of their community. Land rights are considered very important, partly because having a formal individual title facilitates bank credits and partly due to strong fears of land-grabbing.

In the aftermath, it is difficult to determine why some communities were recognized while others were not. Recognition status seems to have been driven by both external and internal factors. In some cases, it was driven by idiosyncratic decisions of local land-reform directors, independent of community characteristics (Wiig, 2013). However, there also seems to have been some political pressure for recognition during the military regime. Some communities might have expected recognition to yield economic benefits to the community, although in reality transfers were never differentiated between the two regimes.

At the time when recognition status was issued, it is unlikely that communities could have foreseen the individualization reforms of the 1990s. I therefore exclude the possibility that community preferences for individual land titling affected the likelihood of obtaining recognition status. Could the more cooperative communities have been more able to seek recognition status in the first place, with the aim of obtaining some benefits, than the less cooperative communities? There are no indications that this was the case. However, joint-ownership communities tend to be more remote or lie at higher elevations than individual-ownership communities. This research project specifically sampled districts in which the two types of communities existed at similar elevations, in order to avoid major initial differences between community types. I am not aware of any other initial structural differences between the two types of communities. Considering the length of time elapsed since the determination of recognition status and the dynamic feature of community cooperation norms, any potential initial differences are unlikely to be related to cooperation norms in these communities today.

### 3. DESIGN

#### (a) *Experimental design*

The experiment was a standard one-shot public goods game, with groups of four participants randomly allocated within each community. Each group member was provided with seven Peruvian soles,<sup>3</sup> and had to decide how much of this sum to contribute to the group account. After all members had decided their contributions, the group account was doubled and shared equally among the members of the group. Groups were randomly matched within each community in the aftermath, with the sole condition that no spouses would be grouped together.<sup>4</sup>

The experimental session was run individually and orally in the homes of the participants, in the language preferred by the participant (Spanish, or the native language Quechua for the many non-Spanish speakers). All eight instructors were female in order to neutralize potential gender effects. The whole session consisted of six experiments, all paid independently. First, three experiments were run with the individual in private, and then three experiments run jointly with the two spouses. The three individual games were the public goods game, a trade game, and a risk game. During the individual part, the one spouse was requested to leave the room in order to ensure independent decisions. When the first spouse had completed the individual part, the other spouse was called and the procedure was repeated. The individual experimental part started with a two-minute survey before the three games were conducted, in random order. The order of the games did not significantly influence contributions in the public goods game. In the joint part the couple played the same three games they had already played in the individual part; however, this time

they had to agree on one joint decision in each game. For the public goods game this implied that the spouses again were allocated to separate groups (not the same group as in the individual part) and they were to agree on the same contribution level to their separate groups. These joint decisions were executed in order to answer other research questions and are not analyzed in this article. Participants were not told about the joint part before they played the individual games, so the individual games are considered as independent of the joint games. In this article, I analyze individual decisions and not the couples' joint decisions, in order to study gender differences in contributions.

Running economic experiments always entails a trade-off between complete comprehension by all participants and exposing all participants to identical framing. Complete comprehension is difficult to ensure with all types of participants, though more so in this case, with participants being less-educated peasants inexperienced in abstract games, than with university students. The standard procedure followed in conducting public goods experiments is to have all participants play simultaneously in the same room with joint instructions. In this experiment, separate games for the individual participants and oral instructions were chosen, in order to promote comprehension, if at the expense of identical framing. However, instructors were trained to follow the same routines and conduct the experiment as identically as possible each time. Instructions were framed neutrally, without reference to any real-life examples (see Instructions in the [Appendix B](#)). There were no training rounds in terms of rounds that included response from other players. However, the instructor carefully explained several specific hypothetical examples of contribution levels and the resultant outcomes for the various group members. These examples were visualized with actual coins. After the instructions had been given, seven one-sole coins were placed in front of the participant, who was then asked how much he or she wanted to give to the group. The instructor continued explaining the rules of the game until she made sure that the participant understood. If, after repeated instructions, a participant did not clearly express that he or she understood the rules of the game, the instructor used real-life examples. That proved necessary for only 36 men and 30 women, out of 570 individuals; moreover, there were no significant differences between the contributions of these participants and those of others. The impression of the instructors was that the game was relatively easily comprehended by participants, as they seemed to have experience of similar cooperation dilemmas. After the experiment, several participants independently and without explicit questioning from the instructors confirmed that they felt the game resembled community cooperation projects and that the decision thus seemed a familiar situation.

Since the games were conducted separately for each participant at different points in time, participants could not receive information about the decisions of the other group members during the experimental session, so one-shot games were chosen. Separate conduct of the games also meant that the contribution decision was made in isolation from other potential group members. That may have reduced contribution levels compared to a setting where potential group members are gathered in the same room, even though both cases would involve anonymous decisions and the precise identity of one's co-players would be unknown.

Before the start of the experiments, it was explained to participants that some of their earnings would depend on the actions of other participants in the community, and that they therefore could not receive their payments before all



experiments had been conducted within the community. Although coins were used to illustrate the rules of the game, it was made clear that the participant would not obtain any payment on the day of the experiment. Payments were made only after all experiments had been completed in the community, which varied from one up to seven days after the individual sessions. Each person's earned money was placed in a sealed envelope and given to him or her privately, with an oral explanation of the outcomes in the games. Participants were reminded about their own contribution level and also informed about the total contribution of the group, which determined their personal earnings from the game.

Most of the local people were generally occupied with agricultural work and other tasks during much of the day, and had little time available for participation. The experimental team therefore spent up to seven days conducting the experiments in each community. This time-lag entailed a risk of participants spreading information about the experiments to others in the community who had not yet participated. Avoiding this potential problem was difficult. On the other hand, the problem was probably reduced because everyday interrelations between households in these communities are limited. Houses are often scattered and peasants normally spend the whole day from early morning to late evening working in their fields. Still, some participants are likely to have heard of the games before they received the formal instructions. I have no reason to believe that this affected their game-decisions in any specific direction, and there is nothing in the data to indicate that early participants behaved differently from later participants within each community.

The public goods game was chosen instead of other cooperation dilemmas, mainly because of its wide use in the literature and its relevance to these communities. This game resembles a different class of cooperation dilemmas than, for example, the common-pool resource game, in which group members choose how much to *withdraw from* a common resource instead of choosing how much to *contribute to* common resource. The focus in this paper is on community cooperation projects where individual contributions precede the mutual benefits, for example, construction of infrastructure like water-sharing systems and roads. Such projects may also involve contributions in terms of money, like the experimental setting which had purely monetary outcomes. Contribution projects stand in contrast to typical natural resource dilemmas, for example individual use of common grazing lands or extraction from common forests or water systems, which may be subject to a different set of norms and bear less resemblance to monetary transactions. It is sometimes argued that the public goods game does not involve a purely public good, because the group outcome is distributed to group members as individual earnings, whereas a distinct feature of a purely public good is being non-rivalrous. In the communities in question, the most important common resource, water, is divided among members of the community, which makes the public goods game particularly relevant.

#### (b) Participant recruitment and survey design

Participants were all established couples who had been recruited to participate in an in-depth survey prior to the experiment. A survey research team first entered each community, following approval from the community leader. The team randomly selected 10–30 couples who met the criteria for participation, and invited them to take part in an in-depth survey.<sup>5</sup> The criteria were as follows: (1) The couple was either married or cohabitating for at least one year; (2) they were the

head couple in the household; and (3) at least one of the spouses held land, whether jointly or individually. Only head couples were selected, as they are the main decision makers in the household and their decisions are therefore most relevant for actual outcomes. The conditioning on landholdings was necessary to ensure relevance for the research question. Established couples were required because of other research questions in the project (see Wiig (2013), on intra-household decision power).

The in-depth survey consisted of three parts. It started with a joint part that included both spouses, with general questions considering household members, income, and landholdings. Then it continued with separate parts for each spouse, including questions on household decision making. (See Wiig (2012) for a more detailed description of the sampling procedure and survey.) The focus on intra-household decision-making in the survey was not expected to affect the outcomes of the experiments, since it was relatively unrelated to the individual's cooperation decisions at community level.

When the survey had been completed, the experiment research team arrived, while the survey team moved on to the next community. In the one region visited (Cusco), the experiment team entered the community some two to five days after the survey team had left. In the other region (Aurimac), the experiment team came several weeks after the survey team had left. All households who had participated in the survey were then invited to participate in the experiments. A few households declined to participate in the experiments or were not available for participation, and they were not replaced.

#### (c) Location and sample description

The study was conducted in two regions in the southern highlands of Peru: a macro-district consisting of two small and neighboring districts in the Cusco region, and a larger district in the Aurimac region. Districts were purposely selected to find geographically comparable communities of both property-rights regimes. The Aurimac district is ranked in the poorest quintile in the country: 26% illiteracy, 46% of households without tap water and 80% of households without electricity (national means are 12% illiteracy, 23% without tap water and 24% without electricity). It is isolated from regional infrastructure, and communities are also dispersed within the district, some reachable only on foot during the rainy seasons. The Cusco districts perform much better on national poverty rankings, and were therefore chosen to increase the variability in economic development in the sample.<sup>6</sup> The Cusco districts are small and relatively centralized around a highway that links all communities with several market centers in the region. However, economic possibilities vary substantially within the districts, and the more geographically isolated households are generally on similar poverty levels as in the Aurimac sample. In the Cusco districts, 10% have no access to tap water, around 30% are without electricity and individual illiteracy rates are 18%.

The intention was to select four communities of each type of property-rights regime within each region, preferably so that the two types of communities should be as comparable as possible as regards geographical location. In the Cusco districts, only three joint-ownership communities were found. The communities are mainly inhabited by small-scale peasants who grow potatoes, maize and other vegetables at elevations ranging from 2,600 to 3,900 m above sea level. Table 2 in the Appendix A presents descriptive variables from the survey by community type. We see there are no statistically significant

differences between individual and joint-ownership communities in terms of elevation, market distance, household land possessions, household income or literacy ( $p > 0.10$  with  $t$ -tests/proportional tests for the dummy variables). However, joint-ownership communities are significantly less likely to be characterized as small in terms of inhabitants ( $p = 0.07$  with a proportional test) and participants are generally somewhat younger than in individual-ownership communities ( $p < 0.001$  with a  $t$ -test).

Participants vary substantially in economic possibilities, formal education and incomes, depending mainly on the amount and quality of land assets and off-farm employment. Average household income for the past year (value of agricultural production and labor income), as estimated by the participating couples, is 14,000 soles (USD 5,100). This estimate, however, should be interpreted with caution, since determining the exact value of their agricultural production in the aftermath is problematic for households that normally consume most of their agricultural production. I therefore prefer to use reported perceptions of household poverty as a proxy for income: 6% of the couples describe themselves as very poor, 48% as poor and 45% as somewhat poor.

Formal individual land titling had been implemented a few years prior to data collection. In Apurimac, 91% of households in individual-ownership communities received their first formal land title during 2005–08, with 55% receiving their first title in 2005. For Cusco, we have less data on titling history, as only 76 of 150 households in individual-ownership communities reported the year they received their first formal land title. The titling process seems to have started earlier but has been slower there. Of the households that reported the year of first formal title, 24% received a title before 2000. The process seems to have continued until the year of data collection: 2005 was the peak year, with 18% of formal titles issued, according to reports.

## 4. RESULTS

### (a) *Main results*

All data were collected between October and December 2010. The sample consists of 570 individuals from 15 communities, of which seven are jointly owned and eight individually owned.<sup>7</sup>

**Result 4.1.:** Contributions are significantly lower in individually-owned communities, when controlling for relevant exogenous variables

Table 1 shows the results from OLS regressions with individual contributions as the dependent variable. Since contributions are correlated within couples, standard errors are clustered on household levels in all presented models.<sup>8</sup> Models 1 and 2 are based on the total sample. In model 1 the following assumedly exogenous control variables are included: gender, geographical aspects (elevation, market distance, and region), community size, community sectorization (whether the community consists of two or more independently organized sub-sectors), and number of game participants in the community.<sup>9</sup> Even though communities were deliberately selected to be comparable in terms of geography, those with joint ownership tended to be more isolated, located at higher elevations, smaller in population, and more often sectorized (see average values of all control variables for joint and individual-ownership communities respectively in the appendix, Table 2).

All these variables are potentially related to cooperativeness, so controlling for them reveals the relationship between land-rights regime and cooperation that we would observe without these differences. Isolation (market distance and elevation) was expected to have a negative impact on cooperation norms, whereas smaller communities were expected to have stronger cooperation norms. Sectorized communities were expected to show weaker norms of cooperation on the community level, because of their larger population size and because group identity might be linked more to the sector and less to the community. The number of game participants in the community is included as a control variable because having a large number of potential co-players might reduce the willingness to contribute in the game. In fact, the opposite effect is found: the number of game participants has a positive (albeit weakly significant) effect on contributions. Gender and region do not vary systematically between property-rights regimes, but are included in order to show how they affect norms of cooperation.

Assuming exogeneity of the variables included in model 1, I propose that these variables are not affected by the output variable, contributions in the public goods game, or the latent cooperation norms it aims to be an indicator of. Hence they do not bias the coefficients. Whether community size and community sectorization are truly exogenous to property rights may be debated. However, considering the relative stability of these agricultural communities, in which children inherit their parents' land generation after generation, I assume that any potential effect of contribution norms on community size is so small that it can be disregarded. Similarly, sectorization mainly seems to be a result of geographical conditions, as it is mainly the case in larger and geographically spread communities.

The results reveal a significantly negative effect of individual ownership regime. Average contributions are 0.5 soles lower in individual-ownership communities than in joint-ownership communities, when the control variables are held constant. That amounts to 7 percentage points compared to maximum contribution of 7 soles: a considerable difference.

In model 2, Table 1, I introduce the following additional controls which are potentially endogenous: demographic characteristics of the respondent (literacy, age, and whether the individual respondent is an immigrant in the community) and social, economic, and demographic characteristics of the household (share of land with formal title, total land area, income from trade, agricultural income, perceived poverty, and whether both spouses in a couple are immigrants to the community). Theory predicts that individual land rights provide investment incentives and access to credit, in turn assumed to promote better incomes and general development. Including variables that can be seen as a result of individual land rights, and are also potential drivers of cooperation in themselves, might thus reduce a potential negative effect of land rights on cooperation. However, the inclusion of social and economic control variables in model 2 does not substantially alter the relationship observed between community property rights and cooperation, indicating that the endogeneity is limited. The negative coefficient of individual ownership regimes remains relatively unaltered and significant compared to model 1. Hence, to the extent that this analysis can be controlled for, it does not seem that the relationship we observe is due to indirect effects through increased migration to the community or economic development in individual-ownership communities, but is instead a direct relationship between joint ownership rights and cooperativeness. I discuss these other variables in section 4b below. Note that a model with random

Table 1. *OLS regressions on individual contributions for total sample and gender subsamples*

	(1) All	(2) All	(3) Men only	(4) Men only	(5) Women only	(6) Women only
Ind-ownership community <sup>C</sup>	−0.502** (0.234)	−0.600** (0.298)	−0.915*** (0.325)	−0.835** (0.418)	−0.0880 (0.302)	−0.357 (0.378)
Female <sup>I</sup>	−0.428*** (0.144)	−0.380** (0.161)				
Apurimac region	0.549** (0.275)	0.649** (0.313)	0.362 (0.365)	0.590 (0.427)	0.736** (0.318)	0.760** (0.377)
Elevation, km <sup>H</sup>	−0.687** (0.341)	−0.627* (0.348)	−1.152* (0.451)	−1.134* (0.474)	−0.222 (0.374)	−0.131 (0.371)
Market distance <sup>C</sup>	−5.078 (3.728)	−5.889 (3.779)	−6.130 (4.902)	−6.791 (4.992)	−4.025 (4.142)	−4.585 (4.307)
Sectorized community <sup>C</sup>	−0.261 (0.256)	−0.290 (0.264)	−0.615* (0.343)	−0.68* (0.364)	0.0933 (0.298)	0.0187 (0.322)
Small community <sup>C</sup>	0.442 (0.439)	0.541 (0.441)	0.755 (0.568)	0.931 (0.580)	0.129 (0.498)	0.118 (0.522)
Game participants <sup>C</sup>	0.0188* (0.0103)	0.0208* (0.0107)	0.0226 (0.0156)	0.0242 (0.0165)	0.0150 (0.0121)	0.0152 (0.0129)
Literacy, dummy <sup>I</sup>		0.293 (0.219)		0.693* (0.373)		0.137 (0.270)
Age <sup>I</sup>		−0.00801 (0.00703)		−0.00507 (0.00947)		−0.0111 (0.00947)
Immigrant <sup>I</sup>		−0.0198 (0.232)		0.519 (0.402)		−0.203 (0.289)
PETT-titled land share <sup>H</sup>		0.0789 (0.347)		−0.240 (0.480)		0.351 (0.466)
Land area <sup>H</sup>		−2.942* (1.703)		−2.179 (2.899)		−4.151** (1.765)
Trade income <sup>H</sup>		5.100** (2.501)		6.108* (3.357)		3.467 (3.054)
Agricultural income <sup>H</sup>		−2.736 (1.695)		−2.606 (2.196)		−2.127 (2.231)
Perceived poverty <sup>H</sup>		−0.180 (0.162)		−0.123 (0.231)		−0.218 (0.197)
Both spouses immigrants <sup>H</sup>		0.482 (0.440)		−0.501 (0.684)		1.177* (0.600)
Constant	4.798*** (1.194)	5.211*** (1.256)	6.523*** (1.592)	6.343*** (1.778)	2.645* (1.347)	3.490** (1.444)
Observations	570	570	285	285	285	285
R <sup>2</sup>	0.056	0.081	0.072	0.106	0.037	0.080

Outcome variable is individual contribution in the public goods game. Superscripts of variables denote level of specification.

Income variables given in 100,000 soles, market distance in driving minutes to district center divided by 100, and land area given in hectares divided by 100. Standard errors in parentheses, clustered on households.

<sup>I</sup> Individual level.

<sup>H</sup> Household level.

<sup>C</sup> Community level.

\*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ .

effects on the household level gives the same qualitative effects of ownership regime and gender as those reported in the first two columns of Table 1.

The overall mean contribution is 3.05 soles (44% of the sum provided to each participant). In a plain comparative analysis, not taking control variables into account, mean contributions are higher in joint-ownership communities (3.13) than in communities with individual ownership (2.97). However, this difference is not statistically significant ( $p = 0.325$  with  $t$ -test<sup>10</sup>). Further, the variance in contributions does not differ significantly between community types ( $p = 0.883$ ).

Figure 1 presents pure and cumulative distributions of contributions by type of community. We see that the difference in

contributions by property-rights regime is driven mainly by a higher frequency of very low contributions in individual-ownership communities and a higher frequency of maximum contributions in communities with joint ownership. The cumulative distribution is greater in individual-ownership communities for each contribution level, indicating stochastic dominance in contributions. Comparing the overall contribution levels with results from samples of Western university students (Henrich *et al.*, 2001), the mean contribution is at comparable levels, while the distribution of contributions differs. The Peruvian distributions are bell-shaped with a mode at 2 and relatively small fractions at 0 or 100% of endowments.<sup>11</sup> However, experiments with students typically reveal

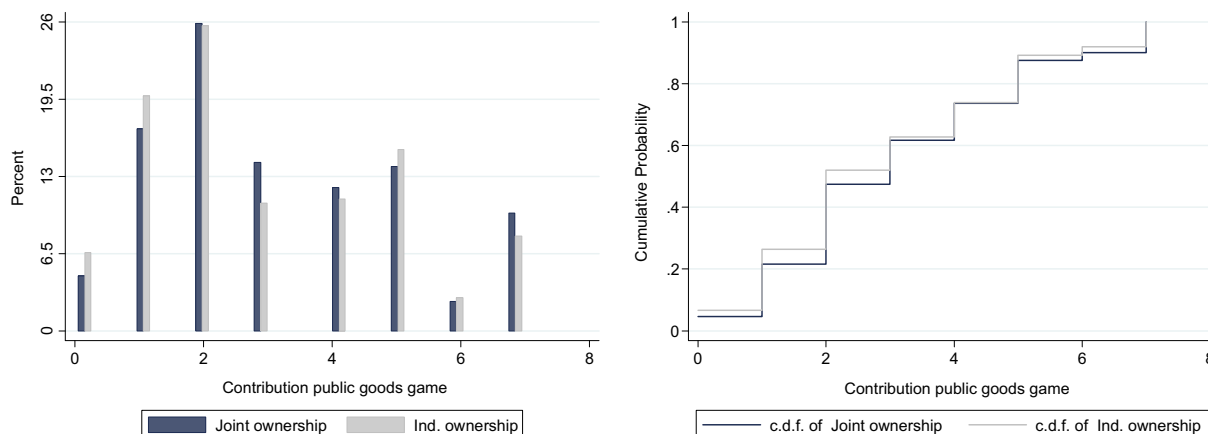


Figure 1. Individual contributions in the public goods game by community type, histograms and cumulative distributions. Optional contribution levels to the public good are integers between 0 and 7 soles.

bimodal or uniform distributions, with higher fractions at the boundary contribution levels. Distributions from other small societies in developing countries are more varied and some communities resemble the results of this study with a unimodal bell-shaped distribution of contributions.

**Result 4.2.:** *The significant effect of property-rights regime is found only among men*

Breaking down the results by gender, we see that the difference between community types comes from the male sample only. Women's contributions are independent of community type, while men's contributions are higher in joint-ownership communities than in those with individual ownership, controlling for the exogenous variables. These regressions on gender-specific subsamples are presented in models 3 and 5 in Table 1. Among men, there is a substantial difference between property rights regimes: men in individual-ownership communities contribute 0.9 soles less than men in joint-ownership communities, given constant control variables. Controlling for the potentially endogenous variables in model 4 reduces the negative impact of the individual ownership coefficient to  $-0.8$ , which is still significant at conventional levels. Women's contributions appear unaffected by the property-rights regime of the community, and controlling for individual-specific variables does not alter this picture. However, for the female subsample in model 6, the negative coefficient on individual-ownership communities is rather large, although still insignificant. That suggests that there might also be a smaller effect among women, but that the sample is too small to capture it.

Men contribute significantly more in the experiment than do women in total ( $p = 0.009$ ). This gender difference is found within both types of communities, but is significant only in joint-ownership communities ( $p = 0.008$ ). Women's contributions remain significantly lower than men's contributions when individual-specific characteristics in model 2 (literacy, age, and immigration) are controlled for. In addition to the difference in means, the variance in contributions is significantly higher among men than women ( $p = 0.007$ ). This reflects the variation between community types which is only found among men. However, men's contributions are more varied than those of women also within community types, although significantly so only within joint-ownership communities. Figure 2 plots the distribution of contributions by gender. We see that women to a greater extent than men

contribute amounts in the lower and medium range, especially around the mode of 2, whereas men contribute far more often at the maximum level.

The reported gender differentiated effect of property right regime matches well with gender-specific responsibilities in the cultural context. Social gender roles give women the main responsibility for the household and children, while men work in the fields and are regarded as the main land holders in the household. Men also dominate the official arenas for cooperation on the community level, including meetings in the community assembly and public work (*faena*). In the survey, men report significantly more *faena* work (7 days more per year) and *ayni* work (30 days more) than women. Likewise, men report significantly higher levels of trust in others than women. These gender differences are summarized in Table 3 in the Appendix A. Controlling for *faena* work in an OLS regression on individual contributions in the public goods game makes the gender variable insignificant. Higher contributions among men thus relate to more frequent interaction and cooperative experiences with other community members. Women's low contributions in the public goods game should be seen in light of women's main responsibility for securing the needs of the household rather than the community. These gender roles may explain why the difference between land-rights regimes is found only among men. Since women have less land rights in practice, they also to a lower degree respond to the incentives provided by the land rights regime. Additionally, since they do not participate in community organization to the same extent as men, it is likely that they do not pick up the governing cooperation norms in their community to the same extent as men do.<sup>12</sup>

Gender-specific domains may also explain the higher variance in male contributions. Male contributions are more likely to vary if they are based on contribution habits in other community cooperation situations, and these are likely to vary substantially with personal and community characteristics. However, lower variation in women's contributions is in line with the finding that women generally show more conforming behavior in experiments (Eagly, 1983).<sup>13</sup>

#### (b) Robustness to confounders

In the following I briefly discuss the effects of specific variables of interest on contributions.



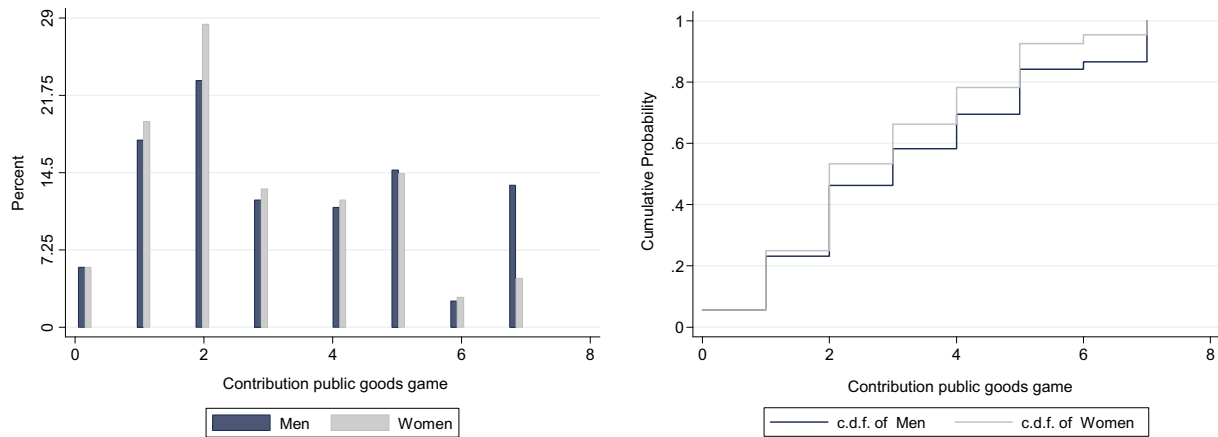


Figure 2. Individual contributions to the public goods game by gender, histograms and cumulative distributions. Optional contribution levels to the public good are integers between 0 and 7 soles.

#### (i) Community size

There is somewhat more cooperation in small communities (defined as fewer than 40 households) and less cooperation in sectorized communities, although the difference is insignificant in the general model. However, for the male subsample only, there is a slightly significant negative coefficient of sectorization. Similarly, the positive coefficient of the small-community dummy is stronger for the male than for the female sample. Again, these patterns seem to be linked to gender roles according to which mainly men engage in community organization and public work: this leads to higher variance in men's contributions depending on community-specific factors which may affect community cooperation norms.

#### (ii) Market exposure

Distance to market has a negative effect on cooperation in all models, although not significant. Elevation, however, has significantly negative effect, which may be interpreted as a variable that captures variation in resident isolation between households within a community (the community center is normally located down in the valley, so living at higher elevations often implies further distance from the center). Household income from trade is also associated with significantly higher contributions, supporting the hypothesis that market experience is related to cooperativeness.<sup>14</sup> This is in line with the previous finding of higher contribution in the public goods game in more market-exposed communities (Henrich *et al.*, 2004).

#### (iii) Land assets

Agricultural income<sup>15</sup> is used as a proxy for the income possibilities facilitated by the household's land assets, independent of property-rights regime, in addition to land area (measured in hectares). They are both negatively correlated with contributions, although only land area is partially significant, indicating that cooperation may be hampered if better land assets make it less important for the individuals. However, the effects of land-rights regime do not change when these controls are included, which strengthens the impression that the negative coefficient observed on individual-ownership communities is directly related to land rights, and not to possible differences in land quality across community types.

#### (iv) Immigration

Immigration is more frequent in communities with individual ownership rights,<sup>16</sup> presumably because such

communities to a greater extent allow land sales to persons from outside. The regression results in Table 1, however, indicate that newcomers/immigrants are no less cooperative than community natives. On the contrary, women in immigrant couples are somewhat more cooperative, as shown by the weakly significant positive coefficient in model 6, Table 1. Neither does the inclusion of immigration variables alter the effect of the community-level property-rights dummy. Further controlling for the community-specific share of immigrants gives a positive (weakly significant) coefficient and additionally decreases the negative coefficient of the individual-ownership community dummy (regression results available on request). Hence, more frequent immigration in individual-ownership communities does not seem to have led to less cooperation—quite the contrary, in fact.

#### (c) Household-specific property rights: Land titling

We now turn to the effects of formal land titling on cooperation. Land titling is a household-specific variable, in contrast to the community-specific property rights variable discussed above. In the Apurimac region, nearly all agricultural plots in the sampled individual-ownership communities are formally titled, whereas the proportion of titled plots in the Cusco sample varies between 20% and 40%. The limited degree of titling in Cusco is explained by marginal productivity and more plots at higher elevations, which are not eligible for titling, and perhaps also by different approaches from the titling agency in the two regions. Further, in the Cusco sample there are a few plots in joint-ownership communities with formal titles, even though they were not eligible according to the land law.<sup>17</sup> Households may also hold land outside the community, so that peasants in joint-ownership communities may hold formal land titles in neighboring individual-ownership communities.<sup>18</sup> Since the degree of land titling is differentiated between households within communities, it is possible to analyze the effect of formalized land rights on the individual level, in addition to land rights at the community level. Most non-titled land is, as noted, generally less-productive land, so a low share of titled land indicates a low share of productive land. The regression controls for total productivity of a household's land through the variable *agricultural income*, and the household's PETT-titled land share therefore reflect only the degree of titling.

**Result 4.3:** *The cooperation effect stems from community-specific rather than household-specific property rights*

There are no effects of PETT-titled land share on contributions in the model specifications shown in Table 1, either for the total sample or in the gender-specific subsamples. Since land is normally perceived as a household asset independently of whether it is formally registered in the name of one individual or both spouses together, all household land is pooled together in this analysis. The lack of effect of household land titling share does not mean that there is no effect of formal titling on cooperation norms, because the effect is captured in the community-level property-rights dummy. An effect on the community level rather than the individual level suggests that cooperation norms work mainly at the group level. However, there is limited variation within communities as to the extent of formal titling, and that could explain the lack of effect of household titling differences.

(d) *Gender-specific land possessions*

Although land is in some aspects perceived as belonging to the household, internally within the household, plots are often regarded as the specific possession of one of the spouses, generally the man.<sup>19</sup> This raises the question of whether it is individual land-owners, and not members of a specific gender as such, who contribute more to community-level public goods. That might be an explanation for the gender differences in contributions. Indeed, landless women do contribute significantly less to the public good than do women with at least some landholdings, but this explains only a small part of the general tendency to lower contributions from women.

**Result 4.4:** *Gender differences in land possession do not explain gender differences in contributions*

There are no effects of individual land inheritance on game contributions, and controlling for individual inheritance does not reduce the gender differences in contributions (results shown in Table 4, Appendix A). Neither does controlling for community-specific levels of male or female inheritance or land possession reduce the gender difference. Hence, there is no evidence that the gender differences in contributions depend directly on skewed land possession. This indicates that the gender differences are based on stable norms about gender-specific behavior and responsibility, which are not easily overturned by the fact that a few women own land or have inherited land themselves.

(e) *Implications for community cooperation projects*

Cooperation norms as proxied by contributions in the public goods experiments are expected to facilitate cooperation projects in the community, like the construction and management of joint infrastructure projects, including water-sharing systems. The community assembly organizes mandatory public work (*faenas*) for the execution of such projects.

**Result 4.5:** *Experimental contributions are positively related to reported participation in community cooperation projects and reciprocal work exchange*

There is a positive correlation (of 14%) between individual contributions in the public goods game and the number of days the individual reported having participated in *faenas*

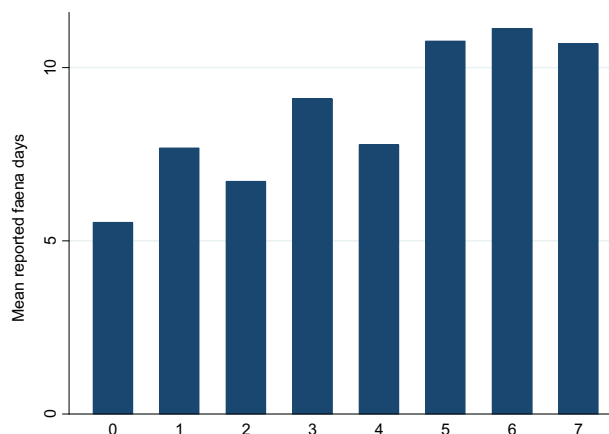


Figure 3. Mean reported days of *faena* participation in the past 12 months, by contribution level in the public goods experiment.

the past 12 months. Figure 3 shows the mean days of *faena* participation per contribution level in the public goods experiment. Those who contributed no soles in the experiment contributed an average of 5.5 days to *faenas*, while those who contributed six or seven soles (the total sum provided) in the experiment were found to contribute an average of 11.1 and 10.7 days, respectively, to *faenas*. These differences indicate that stronger cooperation norms have important implications for cooperation projects in practice in these communities. Participants from joint-ownership communities also report significantly more participation in *faenas* (on average 12 days in the course of the past year) than participants from individual-ownership communities (on average 5 days the past year).

There is also a positive correlation (of 9%) between contributions in the experiment and the number of days of reported reciprocal work exchange (*ayni*). Figure 4 shows the mean days of reported *ayni* work per contribution level in the experiment. Zero contributors in the experiment on average worked 17.9 days in *ayni* during the past year, whereas those who contributed the total sum of seven soles in the experiment worked as much as 39.0 days in *ayni* on average. Thus it seems that cooperation norms on the community level also relate to cooperation within community subgroups. This relationship

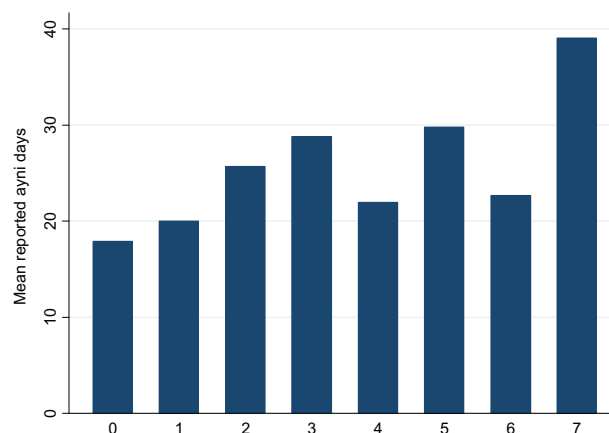


Figure 4. Mean reported days of *ayni* work in the past 12 months, by contribution level in the public goods experiment.

between cooperation norms and *ayni* work is further reflected in the large differences in *ayni* work between communities of different formal property-rights regimes: we find substantially more reciprocal work exchange in joint-ownership communities (33 days on average) than in individual-ownership communities (19 days on average). The variables on participation in *faenas* and *ayni* are summarized by property-rights regime in Table 2 in the Appendix A.

The positive correlation between collective works and cooperation norms supports the relevance of cooperation norms, as measured by the experiment, for cooperation in practice within the community. However, it introduces the question of whether the causality might go the other way, if it is instead the importance of collective works which drives inter-community differences in cooperation norms, rather than land ownership. This argument would rely on there being structural differences between community types affecting the importance of collective works which are not controlled for in the analysis. Such differences might include geographical aspects, like soil quality, plot location within the eco-system, or the amount and characteristics of water inflow in the community which determines the need for work-intensive collective irrigation systems. In order to avoid such potentially systematic differences, the sampling of communities for this research project was specifically done to select locations of both land rights regimes with similar geographical conditions within districts. Each of the two research teams stayed and observed community life in the sampled communities for several days, and no such systematic differences were observed. Therefore, it does not seem likely that initial inter-community differences in importance of collective work should drive the observed relationship between cooperation norms and land rights.

## 5. CONCLUSIONS

Privatization of land property rights has been high on the agenda in the developing world for decades, and it still is. Economic development and increased outmigration from rural communities to urban areas have pushed a demand for land markets and formalization of individual land rights, at the expense of collective rights. Critics have held that joint property rights are important for preserving norms of cooperation in peasant communities. This article provides some unique support for this claim from the Peruvian Andes. Cooperation norms are measured by an economic

experiment, the public goods game. The experiment provides a measure of individuals' willingness to cooperate with their fellow villagers which is comparable across 15 peasant communities. The results reveal that cooperation norms are indeed significantly stronger among those who share property rights to the land, compared to those who own their land individually.

Due to historical circumstances in Peru, some communities came to hold joint formal property rights to land, whereas in others such formal rights were individual. The situation resembles a natural experiment, indicating that the observed relationship can be interpreted as a causal mechanism. It suggests that the relatively recent formalization of individual land rights has indeed weakened the traditional norms of cooperation.

The effect is statistically significant only among men, who are often seen as *de facto* land-holders and traditionally represent the household in arenas for community cooperation. Because men traditionally are responsible for issues regarding the land in the household, they are more likely to adjust their cooperative behavior at the community level to the incentives provided by the land property rights system in the community, compared to women. More experience with community cooperation projects also makes men more aware of the current cooperation norms in the community, and thus they to a higher extent than women respond accordingly when placed in a similar situation.

Under joint property rights, the community can sanction non-cooperators by confiscating their land, a threat which provides an important incentive for cooperation at the community level. Interdependent land rights therefore seem important for sustaining cooperation norms. Such cooperation norms remain important, even when economic development provides increased opportunities for a rural population in many regards. Cooperation norms generally facilitate community life, for example by supporting public work on water-sharing systems and other joint infrastructure. Due to climate change and population growth, water scarcity is a growing problem in various parts of the world, and smoothly-functioning cooperation is vital for sustainable and fair management of both water and other natural resources. When land rights are shifted from the community to the individual peasant, communities should be aware that individual norms of cooperation may be vulnerable, and should look into alternative means of supporting such norms as necessary.

## NOTES

1. The right and duty to participate in the community assembly and at *faenas* are related to possession of land, which is traditionally reserved for men. However, these gender roles are in transition, and women increasingly hold land and meet in the assembly. See Deere and Leon (1998, 2003) and Fuentes and Wiig (2009) for more on gender roles in the Peruvian highlands.

2. For a more detailed description of these issues see Wiig (2013); this work originates in the same research project and the dataset overlaps with the data used in the present article.

3. 7 soles = USD 2.52. A normal daily wage for unskilled labor amounts to approx. 15 soles in the districts sampled.

4. In some communities, the final number of participants was not evenly divisible by four. Some participants were then grouped with "shadow members," as did Carpenter and Seki (2011). The contribution of these randomly drawn shadow members counted in another group, in addition to the group they played in themselves.

5. In some communities the research team was not able to find or recruit as many as 20 land-possessing couples, so they decreased the sample and accordingly increased it in other communities of the same property-rights type, to yield a total of 80 households from each community type in each district.

6. Poverty indicators are taken from the governmental poverty indicators that classify Peruvian districts according to educational standards and living conditions (Foncodes, 2007). On the poverty index ranging from 0 to 1, the Apurimac district is classified as 0.88, while the two Cusco districts are classified as 0.41 and 0.47, respectively.
7. The original sample consisted of 287 couples, but two couples were dropped due to deviating implementation of the public goods experiment.
8. An alternative clustering on community level yields similar significance levels on the ownership-rights dummy and the gender dummy, but has not been used due to potential problems with limited amount of clusters.
9. The size of the participant pool in each community (the variable *Game participants*) varied in a range from 20 to 60, for practical reasons. Some communities were found to be too small, so that the research team was not able to select as many as 20 couples according to plan. The smallest communities had only 20 households; from these, only 10 households were used, in order to avoid universal coverage. To compensate for this, as many as 30 households were selected from some larger communities with the same property-rights regime. Even if we did not inform participants about the size of the participant pool in the community, and villagers do not necessarily meet on a daily basis, they might still have gained some impressions about the participant pool.
10. Non-parametric tests (Mann-Whitney and Kolmogorov-Smirnov tests) yield the same qualitative conclusions as *t*-tests in all hypothesis testing reported in this section.
11. Shapiro-Wilk tests for non-normality of distributions were rejected.
12. This result adds to the findings of Andersen *et al.* (2008) from India, who also report that only men's contributions in a public goods game depend on institutions (matrilineal *versus* patrilineal societies), whereas women's contributions are unaffected.
13. Several studies have found that contributions in public goods games differ between genders, but there is no consistency regarding the direction of this gender difference (see Croson & Gneezy, 2009 for an overview).
14. The effect of trade income cannot be ascribed to an effect of income as such. Replacing income from trade and agriculture with total income in the regressions yields no significant effects. Neither is there any significant effect of rest income when this variable is included in addition to income from trade and agriculture, and including rest income does not alter the effect of trade income.
15. Participants were asked to put a monetary value on the total household agricultural production the last 12 months, denoted as the variable *agricultural income*.
16. Some 20% of participants are immigrants to the community, slightly more in individual-ownership communities (23%) than in joint-ownership communities (19%). The majority of them are married or cohabiting with a community native. Only 30 couples, of the 285 in the sample, are non-marriage immigrants (neither spouse originally comes from the community). Of these, 24 are found in individual ownership communities, indicating that there is more immigration into these communities than in joint-ownership communities.
17. Five sampled households in communities with joint ownerships possess a plot with formal individual title (all in Cusco). Four of these plots are located within the same community and one is located in another joint-ownership community in the district. These examples of titled plots within joint-ownership communities show that titling practice is sometimes in violation of the land law.
18. Only two sampled households in joint-ownership communities hold a formally titled plot outside the community. One of these plots is located in a neighboring individual-ownership community and another in a neighboring joint-ownership community (both in Cusco); the latter is also mentioned in endnote 17.
19. This is partly because men inherit more land than women (45% of the men sampled have inherited, as against 29% of the women). This gender difference in inheritance is significant in both types of communities.

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## APPENDIX A. ADDITIONAL TABLES

Table 2. Descriptive variables by community type

Variable description		Total sample (standard dev.)	Joint ownership communities (standard dev.)  N = 282	Individual ownership communities (standard dev.)  N = 288	Difference between community types  (p-values)*
<i>Individual-specific variables</i>					
Contribution	Public goods game contribution	3.05 (1.97)	3.13 (1.96)	2.97 (1.98)	0.16 (0.325)
Literacy	Dummy for literacy	0.72 (0.45)	0.70 (0.46)	0.74 (0.44)	–0.04 (0.275) <sup>χ²</sup>
Age		45.6 (14.0)	41.8 (12.8)	49.3 (14.2)	–7.55 (<0.001)
Immigrant	Dummy for community immigrant	0.21 (0.41)	0.19 (0.39)	0.23 (0.42)	–0.04 (0.230) <sup>χ²</sup>
Trust <sup>a</sup>	Scale variable, 1–6	3.39 (1.58)	3.43 (1.57)	3.36 (1.59)	0.07 (0.572)
Faena days	Days worked last 12 months	8.3 (10.2)	11.7 (12.3)	5.0 (5.9)	6.7 (<0.001)
Ayni days	Days worked last 12 months	25.9 (2.1)	32.7 (57.8)	19.2 (41.6)	13.5 (0.001)
<i>Household-specific variables</i>					
Elevation (km)	Household residence km above sea level	3.169 (0.385)	3.204 (0.432)	3.135 (0.330)	0.069 (0.129)
Trade income	Household income from trade, in soles	674 (4283)	537 (1874)	808 (5740)	–271 (0.594)
Agricultural income	Household income from agriculture, in soles	3692 (6542)	3767 (5241)	3618 (7623)	149 (0.848)
Rest income	Household income from other sources than trade and agriculture, in soles	9936 (10656)	9941 (9635)	9931 (11603)	9 (0.994)
Perceived poverty	Scale variable: 1 not poor, 2 rather poor, 3 poor, 4 very poor	2.57 (0.62)	2.55 (0.63)	2.60 (0.62)	–0.06 (0.431)
Both spouses immigrants	Dummy for both spouses community immigrants	0.05 (0.22)	0.02 (0.14)	0.08 (0.28)	–0.06 (0.001) <sup>χ²</sup>
Land area	Possessed by household, ha	1.78 (3.18)	2.03 (3.64)	1.55 (2.63)	0.48 (0.205)
Titled land share	Share of household's possessed land area with PETT title	0.33 (0.45)	0.004 (0.03)	0.65 (0.44)	–0.64 (<0.001)
<i>Community-specific variables</i>					
Market distance	Minutes by car to district center	27 (34)	41 (46)	15 (10)	27 (0.132)
Sectorized community	Dummy for communities of more than one independently organized sector	0.27 (0.46)	0.43 (0.53)	0.13 (0.35)	0.30 (0.185) <sup>χ²</sup>
Small community	Dummy for less than 40 households in the community	0.2 (0.41)	0 (0)	0.38 (0.52)	–0.38 (0.07) <sup>χ²</sup>
Game participants	Number of game participants in the community	38 (14)	40 (10)	36 (17)	4 (0.561)

<sup>a</sup> Question posed: 'On a scale from 1 to 6, where 1 is "disagree totally" and 6 is "agree totally", indicate how much you agree with the statement: "One can trust the majority of people".'

\* p-Values are from t-tests when nothing is indicated and from proportional tests when indicated by  $\chi^2$  (for all dummies, since they cannot be said to be normally distributed). Bold emphasis implies difference significantly different from zero at the 10% level.

Table 3. *Social capital variables by gender*

Variable description		Total sample (st.dev.)	Men (st.dev.) N = 285	Women (st.dev.) N = 285	Gender difference ( <i>p</i> -values)
Trust <sup>a</sup>	Scale variable, 1–6	3.39 (1.58)	3.6 0 (1.52)	3.19 (1.62)	<b>0.417 (0.001)</b>
Faena days	Days worked last 12 months	8.3 (10.2)	12.1 (11.8)	4.6 (6.3)	<b>7.5 (&lt;0.001)</b>
Ayni days	Days worked last 12 months	25.9 (2.1)	41.0 (63.7)	10.7 (25.2)	<b>30.3 (&lt;0.001)</b>

Bold emphasis implies difference significantly different from zero at a 10% level.

<sup>a</sup> Question posed: ‘On a scale from 1 to 6, where 1 is “disagree totally” and 6 is “agree totally”, indicate how much you agree with the statement: “One can trust the majority of people”’.

Table 4. *OLS regressions: individual contributions, further effects of gender specific land transactions*

	(1) All	(2) All	(3) Men only	(4) Men only	(5) Women only	(6) Women only
Ind. ownership Community <sup>C</sup>	–0.615** (0.311)	–0.633** (0.299)	–0.851** (0.427)	–0.865** (0.418)	–0.382 (0.390)	–0.385 (0.381)
Female <sup>I</sup>	–0.376** (0.162)	–0.391** (0.161)				
Apurimac	0.643** (0.325)	0.567* (0.316)	0.591 (0.436)	0.518 (0.435)	0.738* (0.390)	0.678* (0.381)
Altitude, km <sup>H</sup>	–0.603* (0.350)	–0.694* (0.353)	–1.106** (0.485)	–1.182** (0.481)	–0.103 (0.373)	–0.211 (0.378)
Market distance <sup>C</sup>	–5.553 (3.778)	–6.285* (3.799)	–6.268 (5.055)	–7.105 (5.025)	–4.486 (4.328)	–5.046 (4.313)
Sectorized community <sup>C</sup>	–0.342 (0.273)	–0.306 (0.262)	–0.705* (0.367)	–0.649* (0.364)	–0.0216 (0.334)	0.00723 (0.321)
Small community <sup>C</sup>	0.549 (0.449)	0.572 (0.440)	0.950 (0.587)	0.959 (0.582)	0.131 (0.525)	0.152 (0.519)
Game participants <sup>C</sup>	0.0230** (0.0112)	0.0218** (0.0107)	0.0270 (0.0171)	0.0251 (0.0167)	0.0172 (0.0135)	0.0161 (0.0128)
Literacy, dummy <sup>I</sup>	0.321 (0.221)	0.275 (0.218)	0.759** (0.377)	0.666* (0.380)	0.148 (0.270)	0.108 (0.267)
Age <sup>I</sup>	–0.00854 (0.00716)	–0.00891 (0.00704)	–0.00540 (0.00984)	–0.00562 (0.00962)	–0.0121 (0.00967)	–0.0125 (0.00935)
Trade income <sup>H</sup>	4.648* (2.514)	5.567** (2.495)	5.431 (3.368)	6.469* (3.382)	3.257 (3.134)	4.062 (3.076)
Agricultural income <sup>H</sup>	–2.369 (1.686)	–3.023* (1.690)	–2.095 (2.197)	–2.853 (2.219)	–1.870 (2.266)	–2.488 (2.235)
Perceived poverty <sup>H</sup>	–0.161 (0.162)	–0.191 (0.163)	–0.0974 (0.235)	–0.135 (0.232)	–0.204 (0.197)	–0.231 (0.200)
Immigrant <sup>I</sup>	–0.00712 (0.234)	0.00233 (0.229)	0.488 (0.407)	0.504 (0.404)	–0.197 (0.301)	–0.143 (0.288)
Both spouses immigrants <sup>H</sup>	0.457 (0.431)	0.383 (0.440)	–0.484 (0.688)	–0.549 (0.681)	1.143* (0.597)	1.039* (0.610)
Land area <sup>H</sup>	–3.351* (1.790)	–3.022* (1.699)	–2.610 (2.984)	–2.274 (2.909)	–4.464** (1.909)	–4.151** (1.747)
PETT titled land share <sup>H</sup>	0.0640 (0.347)	0.139 (0.350)	–0.260 (0.485)	–0.181 (0.486)	0.340 (0.464)	0.412 (0.467)
Woman inherited land <sup>H</sup>	0.137 (0.224)		0.204 (0.312)		0.0266 (0.280)	
Man inherited land <sup>H</sup>	–0.197 (0.220)		–0.248 (0.305)		–0.168 (0.270)	
Only woman has land <sup>H</sup>		–0.254 (0.266)		–0.363 (0.682)		–0.212 (0.781)
Only man has land <sup>H</sup>		–0.751** (0.284)		–0.610 (0.461)		–0.836** (0.328)
Constant	5.061*** (1.240)	5.593*** (1.276)	6.102*** (1.801)	6.644*** (1.820)	3.425** (1.432)	3.935*** (1.459)
Observations	570	570	285	285	285	285
R <sup>2</sup>	0.084	0.091	0.110	0.112	0.082	0.095

Outcome variable is individual contribution in the public goods game. Standard errors in parentheses, clustered on households in models 1 and 2.

Superscripts of variables denote level of specification.

<sup>I</sup> Individual level.

<sup>H</sup> Household level.

<sup>C</sup> Community level.

\*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ .

## APPENDIX B. INSTRUCTIONS

(Translated from Spanish)

*Text in italics is for the instructor only and should not be read aloud.*

All the participants in this study in this community will take part in this exercise, both men and women. You have been divided into groups of 4 participants. However, you do not know who the other people in your group are. Husband and wife are never in the same group. Each group member will be given 7 soles. (*Illustrate with giving participant 7 coins of 1 sol*) You can choose how much of these 7 soles you would like to give to the group and how much you would like to keep for yourself. For each sol you give to the group, the group earns 2 soles. (*Illustrate with taking 1 sol of the participant's money and putting it in another pile, the "group earnings", and add 1 sol to this pile. Then show the collective earnings if*

*the participant gives 3, 5 or 7 soles in the same manner*) We call the money earned by the group "group earnings."

Now, your decision is to decide how much of the 7 soles you would like to keep for yourself and how much to give to the group. All other group members will make the same decision. All of you will make the decision anonymously and we will not reveal to anyone your decision. After all group members have decided how much they want to give to the group, we will divide the collective earnings equally out to all group members. Everybody gets the same amount of the collective earnings, no matter how much they gave to the group.

Do you have any questions?

Here are 7 soles. You should now tell me how much you want to give to the group.

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