The Benefits of Titling Indigenous Communities in the Peruvian Amazon: A Stated Preference Approach

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Abstract. We conduct a discrete choice experiment with leaders of 164 Peruvian indigenous communities (ICs) to elicit their preferences about and valuation of land titles—to our knowledge, the first use of rigorous stated preference methods to analyze land titling. We find that: (i) on average, IC leaders are willing to pay US$35,000–45,000 for a title, roughly twice the per community administrative cost of titling; (ii) WTP is positively correlated with the value of IC land and the risk of land grabbing; and (iii) leaders prefer titling processes that involve indigenous representatives and titles that encompass land with cultural value.

Keywords: discrete choice experiment, indigenous community, land rights, mixed logit

JEL codes: O13, Q15, C93

1. Introduction

Although indigenous communities (ICs) effectively manage more than 38 million square kilometers in 87 countries—an area representing more than one-quarter of the world's land surface—they have formal rights to only a fraction of that land (RRI 2015; Garnett et al. 2018). Over the past four decades, advocates have built an international movement aimed at strengthening IC land rights (Alden Wily 2018; UN 2021). With hundreds of millions of dollars of support from multilateral development banks, bilateral cooperation agencies, and nongovernmental organizations, dozens of countries, mostly in the Global South, have funded campaigns to provide formal legal land titles to ICs (RRI 2018; DGM 2020). A growing body of evidence suggests that at least in some situations, such titling can have a range of private benefits, including boosting agricultural investment and improving livelihoods (Besley 1995; Higgins et al. 2018; Tseng et al. 2020).[1]

But important gaps remain in our understanding of the private benefits that arise from providing formal land titles to ICs. First, we have little information on the features of land titles and the titling process about which IC leaders are most concerned. The amount of land titled? Whether titled land encompasses areas with high cultural value? The cost of the titling process? The duration of this process? Answers to these questions could help stakeholders design and manage titling campaigns so as to enhance the net benefits to ICs. Second, we know little about how the private benefits of land titling vary across subgroups of ICs—that is, about the characteristics of ICs that obtain higher and lower benefits. And third, we lack reliable estimates of the dollar value of the private benefits of IC titles, assessments that policymakers need to determine whether and by how much the benefits of titling campaigns exceed the costs. Monetary values of these benefits are difficult to measure for several reasons (Farr et al. 2016). Neither land titles themselves nor many of the benefits they confer—including cultural services and bequest values—are traded in markets. As a result, market prices cannot be used as measures of the value of titles. In addition, the various benefits of titles are often interdependent and potentially overlapping. For example, titles to forested land can generate both intangible cultural benefits and tangible benefits like food, medicines, and building materials. Parsing and aggregating the benefits of land titles is therefore challenging. And finally, many of these benefits accrue to the community as a whole as opposed to its individual members. Hence, surveys of individual community members may provide an incomplete accounting.

Discrete choice experiments (DCEs) offer a novel and to our knowledge, as yet unexplored means of helping to close these knowledge gaps and address these challenges. DCEs are survey experiments in which respondents are asked to repeatedly select a preferred option from among structured sets of options (Adamowicz et al. 1998; Bennet and Blamey 2001; Hensher 2007; Johnston et al. 2017). All options have a common set of attributes, at least one of which entails some form of payment, but each option features different levels of the attributes. For example, in a DCE designed to assess IC preferences for land titles, the attributes might include the extent of land titled and the cash payment the IC is required to make to obtain the title. Each option would feature different levels of these attributes. Respondents' marginal willingness to pay (MWTP) for each attribute and their total WTP for various combinations of them could be derived econometrically from respondents' choices. Such a DCE would shed light on ICs' preferences for land title attributes, provide insights into how the private benefits of land titling vary across subgroups, and generate estimates of the monetary value of IC land titles.

We conducted such a DCE with leaders of a sample of 164 ICs in the Peruvian Amazon that have yet to receive official land titles. We reach three main conclusions. First, IC leaders tend to prefer titling processes that include indigenous representatives and titles that encompass the areas they perceive as having high cultural value, but not those that award them more land than they expected to be titled ex ante. Not surprisingly, they also tend to prefer titling processes that are shorter and require them to incur lower costs. Second, individual IC leaders' WTPs for a titling contract are positively correlated with the value of IC land and negatively correlated with the risk of land grabbing. And finally, on average, IC leaders' WTP for a titling contract ranges from US$35,203 to US$44,749 (US$15 to US$20 per hectare), depending on the contract's specific attributes. To put these estimates in context, back-of-the-envelope calculations indicate that they equal 10 to 13 percent of median IC annual net agricultural revenue and exceed per community administrative costs of titling by a factor of 2. These findings suggest that the private benefits of initiatives aimed at titling ICs could be enhanced by including indigenous representatives in titling teams and awarding titles to geographic areas with high cultural significance. They confirm the conventional wisdom among advocates that the net private benefits of strengthening IC land rights are both positive and significant. And finally, they provide guidance for targeting titling to ICs for which benefits will be highest.

Our study makes three main contributions to the literature. Most important, to our knowledge, it is the first use of a DCE to analyze IC titling and, more generally, the first to use a rigorous stated preference approach (i.e., a DCE or contingent valuation survey) to analyze any type of land titling. Hence, it represents a proof-of-concept for this approach. The study most closely related to ours is Qin, Carlsson and Xu (2010), which uses a DCE to assess individual Chinese farmers' preferences for concession contracts that confer rights to harvest timber from forests. However, unlike our study, Qin, Carlsson and Xu (2010) do not examine land titling per se and they focus on individual land holders, not communities.

Second, our paper adds to the thin literature on the private benefits of providing land title to communities in the Global South. A recent systematic literature review identified 117 quantitative studies of the benefits of land tenure security (Tseng et al. 2020). Of these, eight examine the private (versus environmental) benefits of land titling. All find evidence of some type of private benefit. Xu et al. (2018), Gao, Sun, and Huang (2017), and Ito, Bao, and Ni (2016) examine the effect of post-2000 changes in China's rural land policies that strengthened land tenure security on collective land. Xu et al. (2018) and Gao, Sun, and Huang (2017) find that these changes boosted the use of organic fertilizer, an indicator of long-term agricultural investment, and Ito, Bao, and Ni (2016) find that they encouraged land rental, which they contend enhances the efficiency of land use. Mendola and Simtowe (2015), Mueller et al. (2014), and Gayatri, Del Carpio, and Hoffman (2009) all analyze the Community Based Rural Land Development Project, a resettlement initiative in southern Malawi that formalized property rights for groups of households. All three studies conclude it increased productive efficiency. Finally, Pender, Suyanto, and Kato (2008) find that an Indonesian program, Hutan Kamasyarakatan, that gives groups of farmers secure tenure on state-owned land contributed to the planting of timber and multipurpose trees.

Third, ours is among a handful of studies that apply DCEs in ICs. As noted above, these studies do not examine preferences for land tenure security. Rather, most analyze preferences of individual respondents for different conservation outcomes and/or estimate the value of environmental and cultural goods used by ICs (Rolfe and Windle 2003; Venn and Quiggin 2007; Hoyos, Mariel, and Fernández-Macho 2009; Zander and Garnett 2011; Oleson et al. 2015).

The remainder of the paper is structured as follows. The next section provides background on IC titling in Peru. The third section discusses our DCE and econometric models. The fourth section describes out data. The fifth section presents our results. And the last section sums up and concludes.

2. Background

In Peru, ICs (*comunidades nativas*) are defined as collections of families linked by indigenous language or culture and by common use of a single territory (COFOPRI 2008; IBC 2013). To date, the Peruvian government has awarded formal land titles to 1,943 ICs (Chirif 2021). Since the first IC title was awarded in 1974, the pace of titling has varied markedly: 44 percent of IC titles were awarded during the Fujimori administration (1991–2000) and 32 percent in the eight years between the start of the Humala administration (2012–2016) and the end of the Sagasti administration (2020–2021). The Peruvian government counts 810 ICs that still lack formal title (Chirif 2021).

Peru's 1,943 titled ICs comprise more than 16 million hectares and host a population of about 421,000 (Chirif 2021; Calderón 2021). Hence, the average IC covers 8,261 ha and supports a population of 210 people. The large majority of titled ICs are in rural areas of Peru's Amazon region. Infrastructure is limited and socioeconomic levels are relatively low. Only 23 percent of households in Amazonian ICs have access to electricity, only 15 percent have piped potable water, and only two percent have telephone service (Thiede and Gray 2020).

Titling of Peruvian ICs was made possible by the passage of two foundational laws (Dandler 1998).[2] The 1974 Law of the Agricultural Development of Native Communities of the Rainforest and Rainforest Border (D.L. 20653) established the legal basis for granting ICs rights to land. It recognized a broad range of criteria that could be used to delimit IC territory, including use of land for hunting, gathering, and fishing. The 1978 Law of Native Communities (D.L. 22175) set out detailed procedures for granting ICs legal title organized into two broad stages: recognizing the IC as a legal entity and awarding it title. Each stage involves numerous legal, bureaucratic, and technical steps, and each is complex, costly, and lengthy. For example, the titling stage involves (i) a desk phase that entails compiling technical and legal documents, forming a working group of representatives of the responsible entities and agencies, and formally notifying local stakeholders of the process; (ii) a fieldwork phase that entails face-to-face meetings with the IC and local stakeholders, demarcating the IC's territory and installing stone markers, and classifying parcels of land within the territory as suitable for agriculture, forestry, and forest protection; and (iii) a processing phase that involves preparing maps and field reports, obtaining approval of these documents by a general assembly of the IC, and issuance of formal reports by the Regional Agrarian Agency (*Dirección Regional Agraria*) of the Agriculture Ministry and other agencies. The cost and complexity of these interactions with state authorities put them out of reach for most ICs acting on their own. As a result, external organizations have provided technical and financial assistance.[3]

For the past three decades, the Peruvian government's main rural land titling initiative has been the Land Titling and Registration Program (*Programa de Titulación y Registro de Tierras*, PTRT), which has had three phases, all focused primarily but not exclusively on private properties (IADB 2015). From 1993 to 2001, PRTR1 titled about 900,000 properties on Peru's Pacific coast. From 2001 to 2007, PTRT2 titled more than 1 million properties in the Sierra (Andean highlands) region. Launched in 2015 (but mothballed in 2022 because of implementation challenges), PTRT3 was intended to title more than 230,000 properties in the Sierra and Amazon regions of eastern

Peru, including 331 ICs. Of these 331 ICs, 250 were in Loreto department and 81 in six other departments: Amazonas, Cusco, Huanuco, Junin, San Martin, and Ucayuali.

As discussed in the next section, responses to our DCE were provided by IC leaders. As a result, it is helpful to describe their role in IC governance, particularly as it relates to titling.[4] Peruvian law requires that IC leaders, as legal representatives of their communities, be elected by an IC general assembly for two-year terms. Leaders rarely retain their positions for extended periods. Rather, leadership tends to rotate among IC members from election to election. Although leaders must be able to speak and read Spanish to interact with governmental and other external agents, they are not as a rule far better educated or wealthier than other adult members of the IC (because wealthier, better educated individuals tend to leave ICs).[5] Leaders participate in all three phases of the titling process described above. Nevertheless, they do not have final say on whether to approve a titling proposal. As noted above, in the third and final (processing) phase, a general assembly of all IC members must vote upon and approve maps of the proposed IC polygon.

Although the Peruvian government does not charge formal fees to ICs for providing land titles, in practice communities often incur thousands of dollars of out-of-pocket and in-kind costs related to for example, travel to meetings with government and other external agents (which can entail multi-day trips from remote ICs), demarcating boundaries, and conducting the soil analysis required for titling (Sarmiento 2023; Monterroso et al. 2019a; Notess et al. 2018; Killick 2007).[6] No general rule dictates who within ICs bears these costs: they are allocated on an ad hoc basis (Cronkleton 2023; Sarmiento 2023).[7] Presumably, however, they are disproportionately borne by the IC leaders who manage the titling process.

3. Methods

This section describes our DCE's experimental design, its implementation, and the specification of our econometric model.

Experimental Design

Stated preference nonmarket valuation methods are survey-based methods used by social scientists to explore preferences for goods and services, typically those that are not traded in markets and for which market prices therefore are not available to serve as measures of value. Based on Lancaster's pioneering work on consumer theory (Lancaster 1966) along with random utility theory (McFadden 1974; Manski 1977), the DCE is a stated preference method that generates estimates for both values of a nonmarket a good or service and consumers' preferences for attributes of the good or service (Adamowicz et al. 1998; Bennet and Blamey 2001; Hensher 2007; Johnston et al. 2017).

For our DCE, an initial set of attributes and levels was selected on the basis of a review of the literature on IC titling in the Peruvian Amazon and consultations with stakeholders working on IC titling in the Peruvian Amazon. The literature reviewed included: Dandler (1998), Monterroso et al. (2019b and 2017), Montes and Barthel (2017), and Notess et al. (2018). The stakeholders consulted included representatives of: (i) three nongovernmental organizations representing IC interests in Peru (*Instituto de Bien Comun*, *Centro Peruano de Estudios Socials*, and *Sociedad Peruana de Derecho Ambiental*); (ii) the unit within the Peruvian Ministry of Agriculture responsible of IC titling; (iii) the IADB unit that supports IC titling in Peru; and (iv) the Peru office of the Center for International Forestry Research, which studies IC titling. The authors piloted a preliminary version of the DCE in four ICs in San Martín and Loreto departments in May 2019. The pilot data along with enumerators' feedback informed subsequent revisions.

The final version of the DCE features five attributes, each with two to seven levels (Table 1). The first attribute, *cost*, is the out-of-pocket payment the IC must make each year for five years to receive a title. As discussed in the Background Section, ICs typically pay some portion of the titling cost, the remainder being absorbed by government agencies. Our DCE did not specify who within the IC would pay titling costs and how. The seven levels of this attribute range from zero to 3000 soles (US$900).[8]

[Insert Table 1 here]

The second attribute, *quantity land*, is the amount of IC land titled, typically the outcome of a negotiation among the government titling agency, the IC, other local stakeholders with land claims and nongovernmental organizations. The three levels of this attribute are the reference level, the reference level plus 20 percent, and the reference level plus 40 percent. The reference level is the number of hectares the respondents indicated they believed would be titled in answer to a survey question that preceded the DCE (enumerators reminded respondents of their answers to this question while explaining this DCE attribute).[9]

The third attribute, *traditional uses*, is whether the IC's titled land encompasses burial grounds and other places with religious or customary significance. In our sample of 164 ICs, just over half of respondents reported that these lands were "close to" the ICs, and the remainder either said they were "far from" the community or "somewhere between near and far." The levels of this attribute are simply yes and no.

The fourth attribute, *duration*, is the number of years between the start and end of the titling process. Historically, in Loreto and San Martin, the two departments where our data were collected, the average lags between the formal recognition of an IC and the award of title were 1.9 years and 5.5 years, respectively (IBC 2013).

The final attribute, *indigenous representative*, is whether the titling team includes a representative of the local regional federation of ICs. Historically, some titling teams have included such personnel and others have not. The levels of this attribute are yes and no.

Using those five attributes and associated levels, we generated choice cards with an orthogonal fractional factorial D-efficient experimental design (Kuhfeld 2010). The design resulted in 18 unique choice cards, each with three options that we identified as A, B and C. Options A and B were framed as hypothetical titling contracts between the government and the IC, each featuring combinations of levels of the five attributes. Option C represented the status quo (no payment, zero hectares titled, etc.). The 18 choice cards were randomly divided into six blocks, each with three choice cards. Each survey respondent was randomly assigned to one of the six blocks. Following best practice, to control for respondent learning, we included a "practice" choice card as the first choice card of each block (Carlsson et al. 2012). This practice choice card was identical to the last choice card in the block and was therefore randomly assigned (to control for potential anchoring effects). Responses to practice choice cards were not used in the analysis. Figure 1 is the English translation of an example choice card.

[Insert Figure 1 here]

Implementation

The DCE was incorporated into the baseline (pre-intervention) survey for PTRT3, the Peruvian government project initiated in 2015 that aimed to title 331 ICs in eastern Peru, mostly in Loreto department (Section 2). The survey, including the DCE, was designed by the authors of the present article and administered by the Peruvian Cadastral Institute (*Instituto Peruano de Cadastro*, IPDC), a consulting firm specializing in land titling and survey administration. The DCE was administered in person and on site in ICs by IPDC enumerators who were trained and supervised by the authors. Respondents were either current or former IC leaders.

To economize on the costs of traveling to remote ICs, IPDC restricted the baseline survey to 169 ICs in four of the seven departments targeted for IC titling: Amazonas, Cusco, Loreto, and San Martin.[10] These 169 communities were selected from a list compiled by the Peruvian Ministry of Agrarian Development and Irrigation (*Ministerio de Desarrollo Agrario y Regio*, MIDAGRI) of 651 untitled ICs in these four departments.

Of the 169 ICs in the baseline survey sample, 165 (98 percent) were located in two departments: Loreto and San Martin. To control for unobserved confounding factors correlated with geography, we restrict our regression sample to the sample ICs in these two departments. One of these sample ICs declined to participate in the DCE. Hence, our regression sample comprises 164 ICs: 137 in Loreto and 27 in San Martin. According the MIDAGRI registry of ICs used as a sampling frame, 44 percent of the eligible ICs in the original 10 PRTR3 departments were in Loreto and 4 percent were in San Martin.

Econometric specification

Our econometric analysis has two stages. In the first stage, we estimate respondents' average MWTP for individual titling contract attributes and their average total WTP for a contract comprised of a specific combination of these attributes. In the second stage, we explore the determinants of total WTP for this contract.

First stage: Respondents' preferences and marginal willingness to pay

To analyze responses to our DCE, we use a mixed logit (ML) model which, unlike other polychotomous choice models, does not require assumptions of homogeneous preferences or the independence of irrelevant alternatives (Hensher and Greene 2003; Carlsson and Martinsson 2003; Campbell 2007).[11] The conceptual framework for this model is well known, so we provide only a brief sketch here.

Assuming a linear random utility model, the utility gained by person q from option i in choice situation t is given by

$$U_{qit} = \alpha_{qi} + \beta_q X_{it} + \varepsilon_{qit} \qquad [1]$$

where X is a vector of the option's observable attributes, α and β are individual-specific preference parameters, and ε is a stochastic error term. Hence, utility comprises a nonrandom observable component (the first two terms on the right-hand side) and a stochastic unobservable component (the last term). The parameter α_{qi}, the alternative specific constant (ASC), can be interpreted as person q's intrinsic preference for option i irrespective of the specific levels of the attributes. In the context of the present study, U_{qit} is the utility that IC leader q obtains from titling contract i

represented in choice card t and the vector X is comprised of the five attributes described above: *cost, quantity land, traditional uses, duration,* and *indigenous representative*.

Conditional on her choice parameter β_q, the probability that IC leader q chooses option i in choice situation t is the probability that utility from i is greater than that from all other options in the choice set. That is,

$$P_{qit} = Pr\left(U_{qit} - U_{qjt} \geq 0\right) \quad \text{for } i \neq j,\ j = (1, 2 \ldots n) \qquad [2]$$

where P_{qit} is the probability of choosing i and n is the number of options. If we substitute Equation (1) into Equation (2) and assume that error terms in Equation (1) are independent and have type I extreme value distribution, the unconditional probability can be written

$$P_{qit} = \int \frac{exp(\alpha_{qi}+\beta_q X_{qit})}{\sum_j exp(\alpha_{qj}+\beta_q X_{qjt})} f\left(\beta_q|\theta\right) d\beta_q \qquad [3]$$

where $f\left(\beta_q|\theta\right)$ is the density function of β_q. The coefficients for this model cannot be estimated directly and must be derived through simulation (Train 2009; Holmes, Adamowicz, and Carlsson 2017). To that end, we used the *mixlogit* command in Stata (Hole 2007).

Although coefficient estimates from the ML model do not have an intuitive interpretation, the ratio of the estimated coefficient for the cost attribute to the estimated coefficient for any other attribute reflects the marginal rate of substitution between the cost attribute and the other attribute and therefore can be interpreted as the average MWTP for the other attribute. That is,

$$\text{MWTP}_\text{i} = \frac{-\hat{\beta}_i}{\hat{\beta}_{cost}}. \qquad [4]$$

Second stage: Determinants of individual respondents' willingness to pay

Our analysis of individual respondents' WTPs entails four steps. First, following Revelt and Train (2000), Hensher and Greene (2003), Hole (2007), and Vincent et al. (2017), we use our ML model results to generate respondent-level parameter estimates. Specifically, we derive these parameters as the conditional means of the coefficient distributions for all respondents who made identical choices when faced with the same choice set. Second, we use these respondent-level parameters to calculate each respondent's MWTP for each attribute (Equation 4). Third, we obtain each respondent's total WTP for a specified titling contract by summing MWTPs for the attribute levels in that contract. Finally, following Campbell (2007), we use ordinary least squares (OLS) to identify correlations between respondents' total WTP for a specific titling contract and their observable characteristics. [12]

Here, too, the analytical framework is well known, so we provide only a brief sketch. The expected value of β_q conditional on a given response pattern *p* and a set of options *a* is given by

$$E\left(\beta \middle| p_q, a_q\right) = \frac{\int \beta \prod_{t=1}^{T} \prod_{i=1}^{I} \left[\frac{exp\left(a_{qi}+\beta_q X_{qit\,q}\right)}{\sum_{j\in J} exp\left(a_{qj}+\beta_q X_{qjt}\right)}\right]^{Pqit} f(\beta|\Omega) d\beta}{\int \prod_{t=1}^{T} \prod_{i=1}^{I} \left[\frac{exp\left(a_{qi}+\beta_q X_{qit\,q}\right)}{\sum_{j\in J} exp\left(a_{qj}+\beta_q X_{qjt}\right)}\right]^{Pqit} f(\beta|\Omega) d\beta} \qquad [5]$$

We approximate the value of $E\left(\beta \middle| p_q, a_q\right)$ via simulation using Stata's *mixlbeta* command (Hole 2007), assuming preferences for attributes are random and normally distributed. Next, as noted above, we calculate each respondent's MWTP for each attribute and then obtain each respondent's total WTP for a specified titling contract by summing MWTPs for the attribute levels in that contract. Finally, we identify the determinants of individual total WTP by using OLS to estimate

$$w_q = \delta + \gamma Z_q + \upsilon_q \qquad [6]$$

where w is individual total WTP, Z is a vector of respondent and community characteristics, υ is a stochastic error term, δ is a parameter, and γ is a vector or parameters.

4. Data

Table 2 defines and provides descriptive statistics for the covariates used in the analysis of respondents' total WTP. Our rationale for selecting these covariates is explained below. Here, we focus on the characteristics of our survey sample, respondents' general views about land titling, and their responses to DCE follow-up questions.

[Insert Table 2 here]

Respondent and community characteristics

The average survey respondent was 46 years old. Seventy-two percent of respondents had six or more years of formal education.

Of the ICs in our sample, 84 percent were in Loreto and 16 percent were in San Martin. Only 36 percent were within a half-hour travel time to the nearest main road. The average level of economic development was low: only two percent of sample communities had households with indoor sewage, and only four percent had households with piped potable water.

On average, 64 percent of community land was considered not steeply sloped, and just over one-fifth was used for agriculture. The average community had 43 household parcels, each comprising 143 hectares. The mean net revenue per hectare used for agriculture was S/ 4,207 (US$1,262).

Just over three-quarters of the sample communities obtained their land via "ancestral possession" versus purchasing it or other means. Two-thirds of the communities had formal rules governing land use, and 62 percent had rules penalizing unauthorized logging. Thirteen percent reported that some of their land was claimed by noncommunity members, and just over one-quarter stated that such claims had led to conflict in the past five years.

Community leaders' views on land titling

The survey of IC leaders that included our DCE also featured several general questions about land titling. Asked to identify the single most important reason to title IC land, 43 percent of respondents selected "tenure security" and 40 percent selected "to prevent others from invading the IC" (Appendix Table A1). Eighty-six percent of respondents thought the titling process takes too long and 72 percent thought it is too costly. Finally, 99 percent agreed that tenure security is important for their ICs economic development.

Follow-up questions about DCE and attributes

After the DCE was administered, follow-up Likert-scale questions asked both enumerators and respondents to indicate whether respondents understood the DCE and were confident in their answers. For 92 percent of the 164 DCEs administered, enumerators reported that they were either "very confident" or "confident" that the respondents understood the DCE and had thought through their answers (Appendix Table A2). As for the respondents themselves, 88 percent reported that they were either “very confident” or “confident” of the choices they made. Follow-up Likert-scale questions about the importance of individual attributes suggest that respondents viewed all five attributes as important, particularly *traditional uses*: at least 88 percent of respondents reported that each attribute was either “very important” or “important” and 96 percent reported that *traditional uses* was.

5. Results

First Stage: Respondents’ preferences and average marginal willingness to pay

Estimated coefficients for *traditional uses* and *indigenous representative* are statistically significant at the one percent-level, indicating that both attributes are positively associated with the probability of choosing a titling option (Table 3). Coefficients for *cost* and *duration* are negative and statistically significant at the five or 10 percent levels, suggesting that these attributes are negatively associated with the probability of choosing a titling option. Only the coefficient on *quantity of land* is not statistically significant. ASC is positive and statistically significant at the one percent level. These results suggest that IC leaders value titling overall, irrespective of the specific levels of the attribute, that they tend to prefer titles that encompass the areas they perceive as having high cultural value, but not those that award them more land than they expected to be titled ex ante. And not surprisingly, they also tend to prefer titling processes that are shorter, involve indigenous representatives, and require lower payments.

[Insert Table 3 here]

Our estimates of standard deviations are statistically significant for ASC and for *indigenous representative* (Table 3). The implication is that respondents varied considerably in their preferences for a land title irrespective of its attributes, and in their preferences for including an indigenous representative in the titling team.

We use estimated parameters from the first-stage models to calculate the average MWTP for all respondents in our sample (Table 4). Standard errors are calculated using the delta method. Note that because our cost attribute is an annual payment over five years, our MWTPs are annual payments over five years. On average, respondents are willing to pay S/ 28,207 (US$8,462) per year for five years for a communal land title, irrespective of its specific attributes. On average, they are willing to pay an additional S/ 3,217 (US$965) for a titling team that includes an indigenous representative, and an additional S/ 1,760 (US$528) for a title that includes land used for traditional purposes.

[Insert Table 4 here]

Next we calculate our respondents' average total WTP for titling options with selected attributes (Table 5). Option 1 is meant to be the least preferred, Option 3 the most preferred, and Option 2 is intermediate. Recall that the cost attribute is an annual payment over a five-year payment period. We report both average annual total WTP and the average total WTP, which is calculated as the present value of five annual payments assuming a 10 percent discount rate. Average total WTP for Option 1 is S/ 117,342 (US$35,203), for Option 2 is S/ 147,548 (US$44,265), and for Option 3 is S/ 149,314 (US$44,794). For the average IC in our sample, which comprises 2283 ha, average total WTPs are S/ 51 (US$15), S/ 65 (US$19), and S/ 65 (US$20) per hectare.

[Insert Table 5 here]

How do these estimates compare with measures of IC financial resources? The PTRT3 baseline survey for IC members (versus leaders) included questions on annual revenue and expenses per household plot. From these data we are able to calculate median annual net agricultural income per community: S/ 1.18 million (US$0.35 million). Hence, average total WTP for Option 1 (least preferred) equals 10 percent of median annual net agricultural income, and that for Option 3 (most preferred) is 13 percent of the average.

How do these estimates compare with measures of the administrative cost of providing title to Peruvian ICs? As noted above, our DCE was incorporated into a PTRT3 baseline survey that aimed to title 331 ICs in the Peruvian Amazon. The estimated per unit cost of titling these 331 ICs was 2019 US$ 21,079 (IADB 2014). Hence, estimated average total WTP for Option 1 (US$35,203)—which can be interpreted as the private benefit of a title—exceeds the administrative cost of providing title by a factor of 1.7, and the average total WTP for Option 3 (US$44,794) exceeds it by a factor of 2.1. Note that if our estimate of benefits included both private and public benefits, such as the effect of titling on reducing forest loss and degradation (Blackman et al. 2017), these ratios would be even higher.

Second stage: Determinants of individual respondents' willingness to pay

Here we explore the determinants of individual respondents' total WTP for a land title. We use the methods summarized in Section 3.3.2 along with the ML estimates reported in Table 3 to retrieve respondent-specific MWTPs for each of our titling contract attributes and then total WTP for a specified titling contract. Appendix Figure A1 displays histograms for the distributions the MWTPs, both for a communal land title irrespective of its specific attributes, and for each of our four specific attributes other than cost. Appendix Figure A2 displays a histogram for the distribution of total WTP for titling Option 2.

Next, we estimate OLS regressions (Equation 6) to explore correlations between total WTP for titling Option 2, as described above (quantity land = reference level + 20%; traditional uses = yes; duration = 1 year; indigenous rep = yes), and the characteristics of our respondents and the ICs they represent (Table 6). To control for outlier effects, we trim the regression sample by dropping five percent of observations at the extremes of the distribution of total WTP, leaving a sample of 148 observations.[13]

Conceptual framework

A simple conceptual framework guides our selection of the covariates included in Equation (6). Ideally, this model would be based on previous research on the determinants of WTP for IC land titles. However, to our knowledge, no such research exists: because estimates of the monetary value of IC titles are quite rare, so too is research on the drivers of heterogeneity in these values. Therefore, our model is based on a review of the broader literature on the IC characteristics that stem and spur IC titling. We assume these same characteristics also explain variation across ICs in WTP for land titles.

The literature suggests that four IC characteristics, which we refer to as ‘metavariables’, explain why some ICs are titled others are not. The first, *C*, is the level of human and technical capacity in the IC, and in particular, in its leadership. Because titling requires navigating complex bureaucratic procedures, ICs with higher levels of capacity have a significant advantage (Notess et al. 2018; Monterroso et al. 2017 and 2019a). The second, *L*, is level of liquid assets that the IC has available. As discussed above, titling generally requires ICs to pay some costs. As a result, communities with more liquid assets are more easily able to shoulder these costs (Monterroso et al. 2017 and 2019a; Notess et al. 2018). The third metavariable, *R*, is the risk of land grabbing absent a title. Generally, the IC’s faced with greater risks have stronger incentives to obtain titles (Gilbert 2016; Monterroso and Larson 2018). The fourth metavariable, *V*, is the value of land as perceived by the IC leaders. By definition, the benefits of obtaining land tiles are greater for ICs with more valuable land. Hence, we hypothesize that w_q, the WTP of IC leader q for a given contract, (Equation 6), can be re-written in more detailed form as

$$w_q = \delta + \gamma_1 C_q + \gamma_2 L_q + \gamma_3 R_q + \gamma_4 V_q + \upsilon_q \qquad [6a]$$

where w is an increasing function of *C*, *L*, *R* and *V*.[14]

We do not directly observe the four metavariables in Equation (6a). Therefore, we proxy for them using variables included in the baseline survey in which our DCE was embedded. The last column in Table 2 indicates the correspondence between each of these covariates and the four metavariables. Some covariates may proxy for more than a single metavariable. For example, *near* may proxy for both *V* (since land closer to population centers is typically more valuable) and *R* (since competition for land close to population centers is likely to be more intense). For the sake of simplicity, the last column of Table 2 lists the metavariable for which the link to the covariate is, in our view, likely to be strongest.

We hypothesize that our two respondent characteristics, *age* and *education*, proxy for and are positively correlated with *C*, the capacity of the IC to successfully negotiate the titling process. We posit that our two community infrastructure variables, *indoor sewage* and *drinking water*, proxy for and are positively correlated with *L*, the liquidity required to finance the cost of the titling process.

We conjecture that four covariates proxy for *R*, the risk of land grabbing absent title: *land use rules, logging rules, competing claims,* and *land rights conflict*. We hypothesize that all four covariates are positively correlated with *R;* the first two because those ICs facing a significant risk of land grabbing tend to promulgate land use and logging rules, and the last two because historical land-use conflict is correlated with future conflict.

Finally, we hypothesize that six community land characteristic variables (*near, flat, percentage agriculture, crop net revenue per hectare, parcels,* and *land per family*) as well as one community institutional characteristic (*ancestral ownership*) proxy for *V*, the perceived value of the IC land. We conjecture that *near*, *flat,* and *percentage agriculture* are positively correlated with *V* because land that is close to population centers, that is flatter, and that tends to be used for agriculture is likely to be more valuable for that purpose; that *parcels* and *land per family* are negatively correlated with *V* because in communities with more parcels and with larger parcels, land is presumably less scarce and therefore less valuable; that *crop net revenue per hectare* is positively correlated with *V* because it is a measure of the average current return on agricultural land uses; and that *ancestral ownership* is positively correlated with *V* because a longstanding historical link to community land increases its perceived value.

Results

In Table 6, which presents our results, Models 1–4 each include the subsets of covariates that proxy for each metavariable (*C,L,R,V*) and Model 5 includes all covariates together. Only the proxies for *V*, the perceived value of the IC land, and *R*, the risk of land grabbing, explain variation in total WTP. Specifically, for Model 5, two proxies for *V* (*parcels* and *land per family*) are negatively correlated with total WTP, and one proxy for V (*ancestral ownership*) and one proxy for R (*land use rules*) are positively correlated with total WTP. The hypothesized reasons for these correlations are discussed above. Estimated coefficients indicate that on average, each additional parcel in a community reduces total (five-year) WTP by S/ 200 (US $60), each additional hectare of land per family reduces total WTP by S/ 204 (US $61), ancestral ownership increases total WTP by S/ 61,659 (US $18,498), and land-use rules increase total WTP by S/ 45,747 (US $13,724). Finally, on average, total WTP is S/ 76,766 (US $23,030) lower in San Martin department than in Loreto, a spatial fixed effect that may control for a variety of unobserved factors.

[Insert Table 6 here]

In principle, a lack of statistical power could explain why the majority of the 17 covariates in our second stage regressions are statistically insignificant. To explore that hypothesis, in Table 6, we report minimum detectable effects (MDEs) expressed as a percentage of mean annual total WTP.[15] We focus our discussion here on Model 5, which includes all 17 covariates, and specifically on the 11 covariates that are not statistically significant. Of these 11 covariates, five (*age, indoor sewage, drinking water, percentage ag., and crop net revenue per ha*) have MDEs less than one percent of the average annual total WTP, implying that 80 percent of the time, Model 5 has the power to identify changes in total WTP less than one percent above or below average total WTP. Hence, for these five covariates, lack of statistical power is unlikely to explain why the coefficient is not statistically significant. However, for the remaining six covariates with insignificant coefficients (*education, near, flat, land use rules, logging rules, competing claims and land rights conflict*), MDEs are at least 26 percent of the average annual total WTP. For these six covariates, lack of statistical power may help explain null results.

6. Discussion

To analyze the private benefits of awarding formal legal title to ICs, we conducted a DCE with leaders of 164 untitled ICs in the Peruvian Amazon. To our knowledge, it represents the first attempt to use rigorous stated preference methods (DCE or contingent valuation) to examine land titling.

Our findings shed light on IC leaders' preferences regarding land titling, the magnitude of the private benefits that titling generates, and how net benefits vary across IC types. As for preferences, IC leaders place a high value on receiving a title irrespective of its attributes. That said, among the five titling contract attributes we examined, IC leaders were most concerned about whether the IC titling team includes an indigenous representative. They were at least as concerned about the location of the land titled as the quantity of it. And not surprisingly, they prefer titling processes that are shorter and less expensive. A caveat is that our DCE tested whether IC leaders valued obtaining more land than they expected to, not less. As for the magnitude of private benefits, our results suggest that they are significant—10 to 13 percent of median IC net agricultural revenue and two times the administrative costs of providing titles. Finally, we find that the net benefits of titling depend on IC characteristics. They are most strongly correlated with proxies for the perceived value of land: an indicator of ancestral ownership, the number of parcels of land in the IC, and the amount of land per household.

Two general caveats to these findings are in order. First, they should not be framed as reflecting aggregate or average preferences of our sample ICs. Rather, they reflect the preferences of the single respondent in each IC to whom the DCE was administered: the IC's elected leader. Moreover, as discussed in the Background Section, even though IC leaders are legal representatives of their communities in all dealings with state related to land titling, they do not have final say over all titling decisions. By law, certain key decisions, including approval of cadastral maps prepared by state authorities, are voted upon by IC general assemblies. That said, we do believe our findings reflect the preferences of the individuals in each IC likely to have the most influence over and the best information about land titling.

A second caveat relates to our estimates of total WTP for a land title: given the framing of the cost attribute in the DCE along with manner in which the costs of titling have historically been allocated among IC members, these estimates may be biased downwards. Our cost attribute was defined in a general way simply as "the annual cost over five years that the community must pay to receive a land title." Our DCE script (see Appendix A) did not specify who in the IC would pay or how. Moreover, by design, our respondents represent untitled ICs that had yet to navigate the titling process and pay the associated costs. Therefore, in principle, in making their choices and thinking about tradeoffs between the cost attribute and other attributes, respondents may well have had in mind a total cost split in some way among all households in their IC. However, as discussed in the Background Section, historically, the titling costs Peruvian ICs end up paying are mostly transactions costs incurred by IC members closely involved in the titling processes, mostly notably

IC leaders. To the extent our respondents understood that they themselves as IC leaders would likely pay a disproportionate share of IC titling costs, in responding to the DCE, they may have preferred titling contracts with relatively low costs, a preference that would bias downwards our estimates of total WTP.

What are the implications of our results for policy? They suggest that titling campaigns could boost the private benefits of IC titling by including indigenous representatives in titling teams and ensuring that these teams pay close attention to whether titles encompass lands with high cultural significance. Furthermore, our results confirm the received wisdom that the net benefits of formal legal land rights are both positive and significant. Although net benefits of interventions aimed at titling ICs would need to be compared with net benefits from other interventions to determine how to allocate resources across intervention types, our study provides preliminary evidence that further investment in IC titling is justified. Finally, our findings suggest that private net benefits of investments in titling can be maximized by targeting scarce titling resources to ICs where land is prized most highly.

In sum, we believe our study represents a proof-of-concept for the use of DCEs to analyze the private benefits of IC titling. It indicates that DCEs can help stakeholders decide whether to invest in titling campaigns, how to design them, and where to target them. A relatively low-cost strategy for fielding such DCEs is to incorporate them into baseline surveys aimed at informing and evaluating titling campaigns like the PTRT3 program in the Peruvian Amazon.

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Tables

Table 1. Choice experiment attributes and levels

Attribute	Description	Levels
cost	Payment IC must make each year for five years to receive title	• S/ 0 • S/ 500 • S/ 1000 • S/ 1500 • S/ 2000 • S/ 2500 • S/ 3000
quantity land	Hectares of IC land titled. Reference level is amount respondent indicated s/he believes will be titled (in responding to pre-experiment survey question)	• reference level • ref. level + 20% • ref. level + 40%
traditional uses	Does the title encompass burial grounds and other places with religious and customary significance?	• yes • no
duration	Years between start and end of titling process	• 1 year • 2 years
indigenous representative	Does titling team include representative of local regional federation of ICs?	• yes • no

Table 2. Variables and descriptive statistics (n = 164)

Variable	Description	Mean	S.D.	Proxy for
Respondent characteristics				
age	Age (yrs.)	45.96	12.75	C
education	More than 6 years of formal education (0/1)	0.72	0.45	C
Community infrastructure				
indoor sewage	Households with indoor sewage (%)	2.38	14.77	L
drinking water	Households with piped potable water (%)	3.85	18.66	L
Community land characteristics				
near	< 30 minutes from main road and distance known (0/1)	0.36	0.48	V
flat	Land not steeply sloped (0/1)	0.64	0.48	V
percentage agriculture	Agricultural land (%)	20.54	18.96	V
crop net revenue per hectare	Net revenue per ha crop land (/S)	4207.40	7004.17	V
parcels	Household parcels (no.)	43.34	73.50	V
land per family	Land per family (has)	143.26	470.19	V
Community institutional characteristics				
ancestral ownership	Community land obtained via “ancestral possession” (0/1)	0.76	0.43	V
land use rules	Community rules govern land use (0/1)	0.67	0.47	R
logging rules	Community penalizes unauthorized logging (0/1)	0.62	0.49	R
competing claims	Some community land claimed by outsiders (0/1)	0.13	0.34	R
land rights conflict	Outsider land claims led to conflict in last 5 years (0/1)	0.26	0.44	R
Department				
san martin	In San Martin department (0/1)	0.16	0.37	n/a

C = capacity to successfully negotiate titling process; L = liquidity needed for process; R = risk of land grabbing absent title; V = value of land

Table 3. Parameter estimates from mixed logit model (s.e.)

Variable	Coefficient (s.e.)
Mean estimates	
ASC	5.345***
	(1.261)
cost	-0.000189**
	(0.0000910)
quantity of land	0.0774
	(0.0893)
traditional uses	0.333***
	(0.119)
duration	-0.220*
	(0.118)
indigenous representative	0.610***
	(0.131)
Standard deviation	
ASC	3.473***
	(0.938)
cost	0.000307
	(0.000265)
quantity of land	-0.120
	(0.0748)
traditional uses	-0.00198
	(0.395)
duration	0.250
	(0.465)
indigenous representative	0.623**
	(0.270)
No. respondents	164
No. choices	1476
LL	-395.4
Chi-squared	42.69

ASL = alternative specific constant
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 4. Average annual marginal willingness to pay (MWTP) for generic titling option and specific attributes (s.e.) [/S]

Option	**MWTP**
alternative specific constant (ASC)	28207.4**
	(13860.0)
quantity of land	408.6
	(504.7)
traditional uses	1759.6*
	(961.7)
duration	-1158.7
	(721.8)
indigenous representative	3216.7**
	(1532.7)
No. respondents	164
No. choices	1476

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 5. Average annual and total willingness to pay (WTP) for titles with specific attributes (s.e.)[a] [/ S]

Option no.	***quantity of land***	***traditional uses***	***duration***	***indigenous rep.***	**Annual WTP**	**Total WTP[b]**
1	ref. level	no	2 years	no	30,955	117,342
2	ref. level + 20%	yes	1 year	yes	38,923	147,548
3	ref. level + 40%	yes	1 year	yes	39,389	149,315

[a]Excluding 5% top and bottom outliers
[b]Present value of five equal annual payments, assuming a 10 percent discount rate

Table 6. Determinants of total annual willingness to pay (WTP): ordinary least squares regression results (s.d.) [MDE%][a]

Variable	Model 1 capacity (C)	Model 2 liquidity (L)	Model 3 risk (R)	Model 4 value (V)	Model 5 all
Resp. characteristics					
age	39.13 (156.0) [1.11]				117.8 (165.8) [1.18]
education	2083.4 (5348.1) [38.02]				-1172.5 (4746.5) [33.74]
Community infrast.					
indoor sewage		-4.565 (132.0) [-0.94]			-22.45 (80.22) [0.57]
drinking water		-90.24 (94.38) [0.67]			-66.77 (86.74) [0.62]
Community chars.					
near				-1895.3 (4945.5) [35.16]	-1233.6 (5022.5) [35.70]
flat				-702.1 (4701.4) [33.42]	-1177.2 (4851.1) [34.49]
percentage ag.				148.2 (121.8) [0.87]	142.4 (138.7) [0.99]
crop net rev. / ha				0.173 (0.361) [0.00]	0.127 (0.395) [0.00]
parcels				-38.55* (20.09) [0.14]	-40.04** (20.01) [0.14]
land per family				-37.98*** (10.42) [0.07]	-40.82*** (11.16) [0.08]
land / family sq				0.00847*** (0.00204) [0.00]	0.00906*** (0.00221) [0.00]
Comm. instit. chars.					
ances. ownership				14677.9** (5071.9) [36.06]	12331.9** (5161.7) [36.69]
land use rules			10559.3** (4345.8) [30.89]		9149.4* (4884.0) [34.72]
logging rules			4512.2 (3779.9) [26.87]		3727.6 (3686.5) [26.21]
competing claims			-15.06 (10221.6) [72.66]		-1959.7 (11352.1) [80.70]
land rights conf.			4519.0 (8206.5) [58.34]		6420.0 (8644.5) [61.45]
Dept. fixed effect					
san martin	-8450.2** (4013.6) [28.53]	-6327.0 (4203.0) [29.88]	-10224.5** (4179.9) [29.71]	-15387.6** (6443.3) [45.80]	-15353.3* (7982.2) [56.74]
Constant					
constant	37446.7*** (9812.4) [69.75]	40755.0*** (2353.8) [16.73]	29887.1*** (4663.5) [33.15]	33350.8*** (6576.7) [46.75]	21693.9* (12360.1) [87.87]
Nobs.	148	148	148	148	148
R2	0.0164	0.0188	0.0698	0.132	0.178

[a]Dependent variable is estimated total annual WTP for titling option 2: quantity land = reference level + 20%; traditional uses = yes; duration = 1 year; indigenous rep = yes.
MDE% = [(minimum detectable effect)/(mean annual WTP)]*100
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Figure Title

Figure 1. English translation of example choice card

Endnotes

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[1] Some evidence also indicates that titling ICs can prevent forest loss and degradation, a benefit with both public and private aspects (Blackman et al. 2017; Vélez et al. 2020).
[2] This second and third paragraphs of this section are taken from Blackman et al. (2017), who in turn draw on Dandler (1998) and COFOPRI (2008).
[3] These organizations include nongovernmental organizations such as Asociación Interétnica de Desarrollo de la Selva Peruana (AIDESEP) and Instituto de Bien Común (IBC), government agencies such as Proyecto Especial de Titulación de Tierras (PETT) and later the Organismo de Formalización de la Propiedad Informal (COFOPRI), and multilateral and bilateral international cooperation agencies such as the InterAmerican Development Bank (IADB) and the US Agency for International Development.
[4] The information in this paragraph is drawn from Sarmiento, Begert and Loza (2021), Sarmiento (2023) and Monterroso et al. (2019a).
[5] Our own survey data shed some light how the observable characteristics of IC leaders compare with those of IC household heads. As discussed in Section 3.2, our DCE was part of a baseline (pre-intervention) survey of untitled ICs in several departments of Peru targeted for titling under PTRT3. For each IC included in the baseline survey, a questionnaire was administered to the IC leader and different one was administered to a convenience (i.e., nonrandom) sample of household heads. The number of household heads surveyed in each IC ranged from three to 45 and averaged 10. Although our IC leader and household head questionnaires asked about a variety of respondent characteristics, only three such questions were included in both questionnaires: they concerned respondents' age, gender, and education. For our regression sample of 164 ICs, leaders were slightly older than the household heads who happen to have been surveyed (46 years versus 43 years), more likely to have six or more years of education (72 percent versus 59 percent), and much less likely to be female (one percent versus 12 percent).
[6] J.P. Sarmiento, Center for International Forestry Research, pers. comm. January 24, 2023.
[7] J.P. Sarmiento, Center for International Forestry Research, pers. comm. January 24, 2023; P. Cronkleton, Center for International Forestry Research, pers. comm. January 24, 2023.
[8] Here and throughout the analysis, we use an exchange rate of US$0.30 per Peruvian sol, the average for 2019.
[9] We considered two alternative framings for the quantity of land attribute: (i) the reference level plus certain percentages and (ii) the reference level minus certain percentages. We decided to use (i) because we were concerned that (ii) would generate protest responses.
[10] IPDC's choice of these four departments reflected both the underlying distribution of ICs at the department-level and PRTR3 implementation challenges in certain departments. As noted in Section 2, the geographic scope of PRTR3 encompassed 10 departments in the Sierra and Amazon regions of eastern Peru. For purposes of managing the project, IPDC grouped these 10 departments into four 'Lots." IPDC excluded three of these departments—Apurimac, Cajamarca and Puno—from consideration for IC titling (but not other types of titling) because the MIDAGRI registry of ICs that was used as a sampling frame listed either one or zero eligible (recognized but not yet titled) ICs in each department. In addition, as project planning progressed, IPDC dropped all three departments in Lot 2— Huánuco, Junin, and Ucayali—from consideration for IC titling because management of the titling effort in Lot 2 were deemed too problematic. The exclusion of these six departments left the four departments that were

ultimately included in the baseline survey of IC leaders: Amazonas, Cusco, Loreto and San Martin.

[11] The mixed logit model is also known as the hybrid logit, mixed multinomial logit, random parameter logit, and random coefficient logit model.

[12] Campbell's (2007) pioneering analysis focuses on rural landscape improvements in Ireland. Subsequent applications of this approach have analyzed preferences for recreational use of forests in Lorraine, France (Abildtrup et al. 2013); biodiversity enhancement in New Zealand's planted forests (Yao et al. 2014); forest management and protection program in Poland (Czajkowski et al. 2017); power outages in Mekelle, Ethiopia (Zemo, Kassahunb, and Olsen 2019); demand for crop insurance in India (Ghosh et al. 2021); and coastal and marine conservation in Nha Trang Bay, Vietnam (Börger et al. 2021).

[13] The reason that we end up with outliers of total WTP for the contract on which we focus (contract 2 in Table 5) has to do with the way that total WTP is calculated. As explained in Section 3.3.2, for each respondent in that sample, total WTP is calculated by summing estimated MWTPs for each of the five attributes that comprise a contract. Individual respondents' MWTPs for each attribute, in turn, are calculated using Equation (4): they are the ratio of the respondent's estimated beta for that attribute and the respondent's estimated beta for the cost attribute. Given this nonlinear specification, when the latter estimated beta is relatively small, the estimated MWTP—and therefore the estimated total WTP—'explodes' and vice versa, a common phenomenon in DCE analysis (Giergiczny et al. 2012). Therefore, the distribution of estimated total WTP for the full sample (n = 164) has heavy tails—extremely large and extremely small values. As is well known, in OLS models, such outliers can lead to incorrect inferences.

[14] The assumptions implicit in this more detailed specification are that: (i) the parameters of the IC leader's utility function—α and β in Equation (1)—are themselves functions of C, L, R and V so that total WTP for a specific titling contract, w_q, is a nonlinear function of α and β, i.e., $w_q(\alpha_q\ \beta_q)$; and (ii) Equation (6a) is a reduced form linear representation of that function.

[15] A minimum detectable effect (MDE) is the smallest true absolute value of a regression coefficient that has at least an X% chance of producing a statistically significant coefficient estimate given the size and variability of the study sample (Bloom 1995). Assuming X equal to 80% (the convention, see Dong and Maynard 2013), a two-sided hypothesis test and a 5% significance level (equivalently, a one-sided test and a 2.5% significance level), MDE = 2.8 times the estimated standard error.

	Option A	Option B	Option C Current situation
Monetary cost of titling paid by the community (per year for 5 years)	S/ 500 per year for 5 years	S/ 1500 per year for 5 years	S/ 0
Quantity of community land titled	Community territory that you believe will be titled	Community territory that you believe will be titled + 20%	Current situation without title
Inclusion of territory for traditional uses	**YES** includes territory for traditional uses	**NO** does not include territory for traditional uses	Current situation without title
Duration of titling process	1 year	2 years	Current situation without title
Participation of the regional indigenous federatio in the titling team	The titling team does **NOT** include a representative of the regional indigenous federation	The titling team does **NOT** include a representative of the regional indigenous federation	Current situation without title
Choice	☐	☐	☐