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# Data collection: Experiences and lessons learned by asking sensitive questions in a remote coca growing region in Peru

by Jaqueline Garcia-Yi and Ulrike Grote

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- not available for any reference period
- .. not available for a specific reference period
- ... not applicable
- 0 true zero or a value rounded to zero
- 0<sup>s</sup> value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
- <sup>p</sup> preliminary
- <sup>r</sup> revised
- x suppressed to meet the confidentiality requirements of the *Statistics Act*
- <sup>E</sup> use with caution
- <sup>F</sup> too unreliable to be published
- \* significantly different from reference category ( $p < 0.05$ )

# Data collection: Experiences and lessons learned by asking sensitive questions in a remote coca growing region in Peru

Jaqueline Garcia-Yi and Ulrike Grote<sup>1</sup>

## Abstract

Coca is a native bush from the Amazon rainforest from which cocaine, an illegal alkaloid, is extracted. Asking farmers about the extent of their coca cultivation areas is considered a sensitive question in remote coca growing regions in Peru. As a consequence, farmers tend not to participate in surveys, do not respond to the sensitive question(s), or underreport their individual coca cultivation areas. There is a political and policy concern in accurately and reliably measuring coca growing areas, therefore survey methodologists need to determine how to encourage response and truthful reporting of sensitive questions related to coca growing. Specific survey strategies applied in our case study included establishment of trust with farmers, confidentiality assurance, matching interviewer-respondent characteristics, changing the format of the sensitive question(s), and non enforcement of absolute isolation of respondents during the survey. The survey results were validated using satellite data. They suggest that farmers tend to underreport their coca areas to 35 to 40% of their true extent.

Key Words: Coca; Cocaine; Sensitive question; Misreporting; Nonresponse; Peru.

## 1. Introduction

Over the last 30 years, surveys have been increasingly used to explore sensitive topics (Tourangeau and Yan 2007). For example, data obtained from surveys have been used to investigate “socially undesirable” behaviors, such as the prevalence of illicit drug use (*e.g.*, Botvin, Griffin, Diaz, Scheier, Williams and Epstein 2000; Fergusson, Boden and Horwood 2008), illegal abortion (*e.g.*, Johnson-Hanks 2002; Varkey, Balakrishna, Prasad, Abraham and Joseph 2000), or alcohol consumption among adolescents (*e.g.*, Strunin 2001; Zufferey, Michaud, Jeannin, Berchtold, Chossis, van Melle and Suris 2007). Such surveys have been commonly utilized in academic research and policy analysis (Davis, Thake, and Vilhena 2009), even though asking sensitive questions has generally been seen as problematic. The responses have been considered to be prone to error and bias because respondents consistently underreport socially undesirable behaviors (Barnett 1998; Tourangeau and Yan 2007). Low response rates have been an additional concern. Those who are selected for a survey can simply refuse to take part in the survey or they can participate but refuse to answer the sensitive questions (Tourangeau and Yan 2007).

Recent surveys at the household level have incorporated sensitive questions related to the extent of coca growing areas (see *e.g.*, Ibanez and Carlsson 2010). Coca is a native bush from the Amazon rainforest in South America from the leaves of which cocaine is extracted. Colombia’s coca bush area represents 40%, Peru’s 40%, and Bolivia’s 20% of the total area under coca cultivation worldwide, amounting to

154,100 hectares (UNODC 2011). In Peru and Bolivia, the leaves of this bush have been traditionally used for many purposes from around 3000 B.C. (Rivera, Aufderheide, Cartmell, Torres and Langsjoen 2005) until today. Those traditional uses mainly include coca chewing and coca tea drinking to overcome fatigue, hunger and thirst; and to relieve “altitude sickness” and stomach ache symptoms, respectively (Rospigliosi 2004). Since the 1970s, however, coca cultivation skyrocketed because of its use as the raw material for the production of cocaine (Caulkins, Reuter, Iguchi and Chiesa 2005). The cocaine content of the coca leaves is below 1%, and ranges from 0.13 to 0.86% (Holmstedt, Jaatmaa, Leander and Plowman 1977). Therefore narcotics traffickers need large quantities of coca leaves to obtain enough of the alkaloid for commercialization in the illegal market. In general, growing coca for the narcotics trafficking business is a profitable activity. In fact, the income of a coca growing farmer has been calculated to be 54% higher than the income of a non coca growing farmer (Davalos, Bejarano and Correa 2008).

Consequently, coca-related research has become oriented towards evaluating the profitability of coca versus other cash crops (see, *e.g.*, Gibson and Godoy 1993; Torrico, Pohlan and Janssens 2005). Different attempts were made to replace coca by other crops, but it has been generally established that crop substitution as an anti-drug policy has been a failure (UNODC 2001). Decision makers and researchers have recognized that there are relevant socio-economic determinants that lead to coca growing other than economic profitability. These include social capital (Thoumi 2003),

1. Jaqueline Garcia-Yi, chair of Agricultural and Food Economics Technical University of Munich Weihenstephaner Steig 22, 85350, Freising, Germany. E-mail: jaqueline.garcia-yi@tum.de; Ulrike Grote, Professor, Institute for Environmental Economics and World Trade, Leibniz University Hannover, Königsworther Platz 1, 30167 Hannover, Germany. E-mail: grote@iuw.uni-hannover.de.

saving account functions and financial reserve for large expenses (Bedoya 2003; Mansfield 2006). Comprehensive databases which include specific household-level information for coca growing areas are required to test those latter hypotheses.

Coca growing is not illegal *per se* in Peru (During the 1990s, the primary focus of the Peruvian Government was on “pacifying” the country by bringing terrorist groups under control. The Peruvian Government implemented what is currently known as the “Fujimori Doctrine”. The idea underlying this Doctrine was that the coca cultivation was not criminal in nature, but attributable to poverty. Consequently, the Fujimori Doctrine decriminalized all coca farmers, which diminished the farmers’ need for protection from terrorist associations, therefore making it easier for the Government to fight those violent groups (Obando 2006).), which partly reflects the social acceptance of traditional uses of coca in this country (UNODC 2001). Thus, the current legal framework seems to facilitate narcotics trafficking because coca used in illegal trade can be cultivated under the guise of traditional uses (INCB 2009; Durand 2005). Accordingly, Garcia and Antezana (2009) suggest that some farmers sell coca to those who purport to be traditional-use traders, but are actually narcotics traffickers who process coca leaves in different places, such as small towns at the border with Bolivia.

Even though coca farming is not illegal, coca-growing regions which are perceived to be supplying narcotics traffickers (*e.g.*, regions with large coca fields) can be targeted by the Government for the implementation of forced eradication programs (Obando 2006). After eradication, coca growers are likely to incur large economic losses, depending on the total extent of their individual coca cultivation areas. Thus, some of the farmers might be reluctant to provide information on whether or not they have any coca under cultivation. It should also be expected that some of the farmers who admit to cultivating coca, would not report the true extent of the area, given their fear that large coca fields could be more prone to eradication.

Since there are both political and policy concerns in accurately and reliably measuring coca growing areas, it is necessary for survey methodologists to determine how to encourage response and truthful reporting of answers to sensitive questions related to coca growing. This article suggests and evaluates a number of strategies to increase both the reporting and the reliability of household-level responses in a remote coca growing region in Peru.

Although the topic of this article is specifically related to coca growing, the lessons learned about survey design and implementation could be used as a reference for dealing with other sensitive topics such as health-related issues (*e.g.*, anti-conception and sexual behavior) or undesirable

behaviors (*e.g.*, illegal drug use) in other regions in different countries.

The structure of the article is as follows: Section 2 describes the community in Peru subject to study, the specific strategies to reduce non-response and misreporting as well as the lessons learned from data collection related to sensitive questions in the research area. Section 3 presents the coca growing-related survey results and their validation, while Section 4 is comprised of a summary of the main results followed by the conclusion.

## 2. Data collection in a coca-growing community in rural Peru

This section describes the coca-growing community, and the primary data collection strategies applied in our study and the lessons learned.

### 2.1 Description of the research area

The research area was located in the Upper Tambopata valley at the border with Bolivia, one of the most remote and difficult to access Amazon rainforest areas in Peru (UNODC Office in Peru 1999). This valley lies in the Vilcabamba-Amboro Biodiversity Corridor in close proximity to national protected areas (see Figure 1). The entire population of the upper Tambopata valley is composed of immigrants, especially descendants from the Aymara indigenous population. Aymara is a native ethnic group originally from the Andes and Altiplano regions of South America. During the 1950s, most of the farmers were seasonal immigrants who left their Altiplano subsistence plots for only three to six months every year, and made the 320 km journey to the upper Tambopata valley to cultivate coffee on their individually owned agricultural plots (Collins 1984). Over time, most farmers became permanent settlers in the upper Tambopata valley, and cultivate coffee as their main cash crop (*ibid*).

Before 1989, coca cultivation in the upper Tambopata valley was very minor. Small-scale coca production was limited to self-consumption or local markets for traditional uses such as coca chewing by Andean farmers and miners. After 1989, coca cultivation was intensified, primarily in the neighboring upper Inambari valley. The change did not appear to be in response to increases in local demand or external demand by traditional users (UNODC Office in Peru 1999). Coca from those valleys is considered as low quality due to its bitterness, and it is in less demand for traditional chewing than coca from Cuzco region (Caballero, Dietz, Taboada and Anduaga 1998). Those increases were therefore related to narcotic traffic demand. In recent years, large increases in coca cultivation in the upper Tambopata valley have been consistently reported by the

United Nations (UN), as observed in Table 1. The percentage variation per year in the upper Tambopata valley is above the annual change of around 4% at national level.

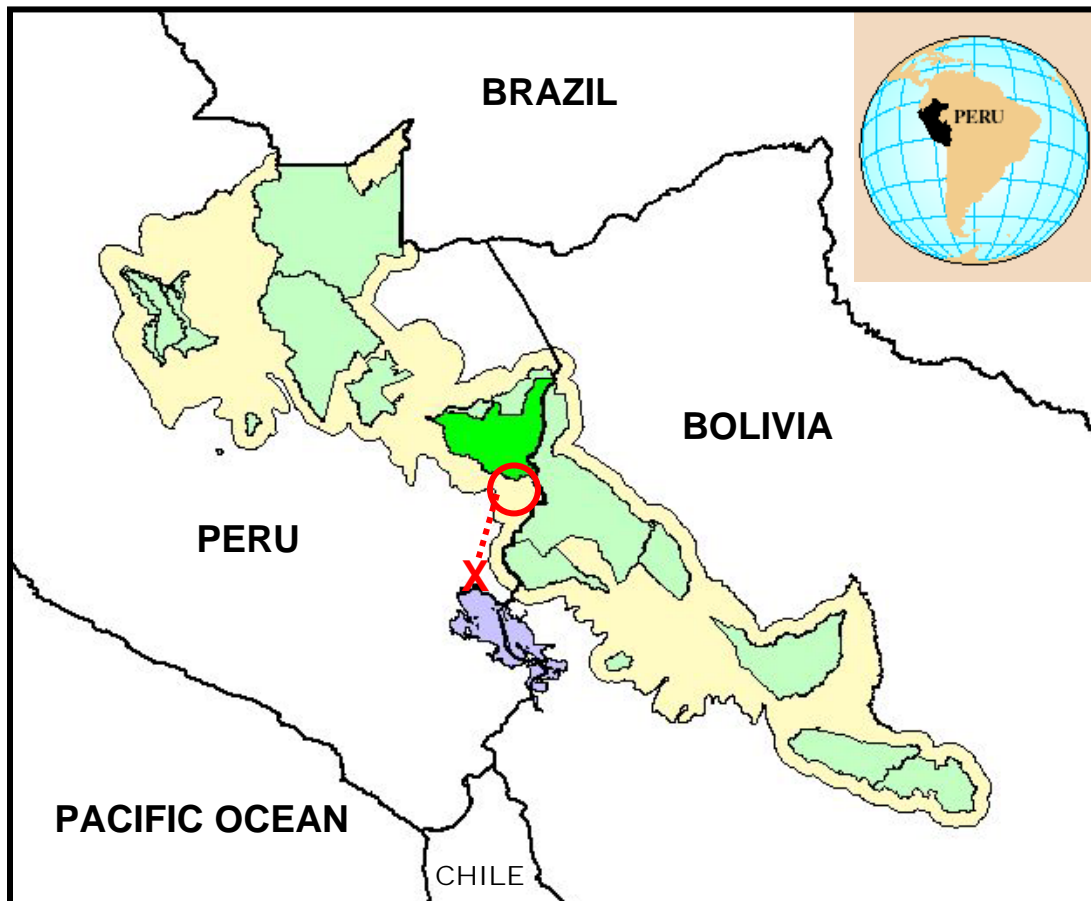
**Table 1**  
Coca cultivation in the upper Tambopata Valley (2005-2008)\*

Year	Hectares	Percentage of variation in relation to previous year
2005	253	-
2006	377	49.0
2007	863	128.9
2008	940	8.9

\* Since 2009 coca areas from the upper Tambopata valley are aggregated with coca areas from Inambari valley in UNODC reports. Therefore, it is not possible to estimate the percentage of variation in relation to previous year only for Tambopata valley during later years.

Source: Own calculation using data from UNODC (2009).

Coca provided by the upper Tambopata valley and upper Inambari valley seems to mainly supply cross border trade associations between Peruvian and Bolivian narcotics traffickers. Bolivia remains the world's third largest producer of cocaine, and it is a significant transit zone for cocaine of Peruvian-origin (U.S. Department of State 2009). Those valleys constitute a strategic coca production area for narcotics traffickers due to their proximity to an external exit route (UNODC Office in Peru 1999). Coca leaves are not always transformed into cocaine in the agricultural plots. Narcotics traffickers seem to take advantage of the large quantities of coca leaves transported to urban areas, ostensibly for traditional user markets. This coca is then purchased and processed at hidden facilities in urban areas near the Bolivian border. In this way the risk of being caught by authorities is reduced. From Bolivia the cocaine is dispatched to Brazil and Europe (Garcia and Antezana 2009).



Source: Own elaboration

**Map Description:**

- X Altiplano area
- Upper Tambopata Valley
- - Immigration Route

- Bahuaja Sonene National Park
- Other protected areas
- Vilcabamba-Amboro Biodiversity Corridor
- Titicaca Lake

**Figure 1** Map of the research area

Coca cultivation does not necessarily translate into better quality of life for the farmers in South America (Davalos, *et al.* 2008). According to the last population census, the living conditions in San Pedro de Putina Punco (SPPP), the district located in the heart of the Upper Tambopata valley, are difficult: 72% of the houses are rammed earth constructions, 88% have dirt floors, 16% have public electricity, 12% have public water, and only 9% have access to public sewage (INEI 2007). This situation is common in the major coca growing areas in Peru, where 70% of the inhabitants continue to live in poverty, and 42% in extreme poverty (Commission on Narcotic Drugs 2005).

## 2.2 Data collection strategies and lessons learned

A feasibility study to test if farmers would answer coca-related questions was conducted in December 2007. The pilot study for the designed questionnaire took place in May 2008, and the final survey was conducted between June and August 2008. The feasibility and pilot studies and the final survey were focused on the farmers located in San Pedro de Putina Punco (SPPP), a district in the upper Tambopata valley which is located in the deepest rainforest. All the farmers in the research area produce coffee as cash crop and some supplement their income with coca cultivation. There are five coffee co-operatives in SPPP. Farmers have to become a member of one of these co-operatives in order to be able to sell their coffee, because restrictions to coffee intermediaries are in place. The final survey was only conducted among the members of four of these co-operatives because most of the members of the remaining co-operative are based in San Juan del Oro, a district outside the research area.

The final survey consisted of a structured questionnaire which focused on agricultural production and social capital. The questionnaire was comprised of 15 sections:

1. General information about the farmer and household
2. General information about the agricultural plot and coffee area
3. Additional economic activities
4. Organic certification information
5. Cognitive social capital and identity
6. Information and communication
7. Personal aspirations and risk attitudes
8. Structural social capital
9. Covariant and idiosyncratic shocks
10. Human capital
11. Social networks
12. Coca use traditions
13. Detailed agricultural production costs
14. Labor access
15. Additional questions

The sensitive question related items of the survey are presented in the Appendix 1.

Asking farmers about their coca growing area is a sensitive question. Farmers who cultivate large areas of coca fear that the information provided could be accessed by authorities responsible for eradication programs. Thus, they might have concerns about the possible consequences of giving a truthful answer should the information become known to a third party. In these cases, the farmers need to be assured anonymity. Farmers could also be tempted to provide socially desirable answers to the interviewers. Coca has become an important focal symbol in the indigenous population's struggle for self-determination (Office of Technology Assessment 1993). Coca "yes", cocaine "no" constitutes the slogan of indigenous people (Henman 1990); the formulation tries to clearly separate traditional uses ("coca") from narcotics trafficking ("cocaine"). Hence, traditional uses such as coca chewing are ethnicity symbols (Allen 1981) and their persistence could be related to feelings of nationalism in Peru (Henman 1990). In this sense, it could be expected that farmers would not find it very problematic to indicate that they grow coca, as long as they can associate it with traditional uses. On the other hand, due to the association of larger production areas with illegal activities, coca growers may underreport the total extent of their coca production areas in an attempt to give the impression that they are growing only for traditional use.

Several strategies can help to reduce the potential biases associated with question sensitivity, item and unit nonresponse and deliberate misreporting. These strategies include: confidentiality assurances; careful selection of the data collection mode and setting of the sensitive question format; and tailoring interviewer characteristics and behavior (see Coutts and Jann 2008; Tourangeau and Yan 2007). Further information on the implementation of these strategies in our case study is provided below.

### *Establishing trust, and anonymity assurances*

Farmers in coca growing areas tend to distrust external people. In this particular area, we found out that they trust the coffee co-operative directors. One of the directors of the coffee co-operatives signed a letter of presentation authorizing our research related to agricultural cultivation. The letter was shown to the farmers prior to conducting the survey. A pilot test conducted with and without the presentation letter demonstrated that the letter was important to reduce survey participation refusals. In the survey introduction, it was also indicated by the interviewer that the co-operative director authorized the survey because the director expected the results to benefit co-operative members. In addition, farmers were clearly told at the beginning of the survey that the data collected would remain confidential, and the academic purpose of the questionnaire was

high-lighted (see Appendix 1a). This anonymity assurance was short and precise in order to minimize suspicion among farmers as suggested by Singer, Hippler and Schwarz (1992). Coca growing was treated as a common and ordinary behavior in the research region, and a long and elaborate confidentiality assurance might have aroused farmers' reservations instead of alleviating them. A brief reminder of the assurance of confidentiality was included in the middle of the questionnaire, before the questions related to traditional coca uses and prior to the sensitive question on the coca area. The reminder stated: "In this part of the survey, we will ask questions about coca uses and cultivation. Please remember that the survey is anonymous and that there are no correct or incorrect answers" (See Appendix 1b). This follows Willis (2005) who mentions that it is important to have warm-up questions and an announcement of the switching to the sensitive topic to reduce resistance to answer.

#### *Data collection mode*

Paper and pencil self-administration as data collection method was initially considered to try to reduce interviewer bias. However, during the feasibility study, it became evident that many farmers, even those with above elementary school education (52% of the population; INEI 2007), were not able to read effortlessly. Farmers work in their fields almost all day long and do not have many opportunities to practice their reading skills. Similarly, audio computer-assisted self-interviewing (ACASI) the method of choice for collecting data on sensitive topics in developed countries (Mensch, Hewett and Erulkar 2003), was out of the scope of this project due to the lack of equipment and power supply, and the computer illiteracy in the research area. The use of computers was likely to have increased the anxiety and suspicion about the survey as described in the African situation by Mensch, *et al.* (2003). Therefore, a face-to-face interview was the data collection mode selected and emphasis was placed on the selection of interviewers, their training and behavior.

#### *Selection of interviewers, training, and interviewers' behavior*

One problem with the selection of the interviewers was the lack of sufficiently educated professionals in the research area. Thus, a group of ten students from the nearest public university, located 16 hours away from the research area, was chosen as interviewers. All of the interviewers had Aymara or Quechua ethnic backgrounds; this was an attempt to partially match interviewer-respondent characteristics. It was thought that this could increase the likelihood of participation because the matching was likely to increase trust and sympathy between the interviewer and the respondent (Tourangeau and Yan 2007). The interviewers

presented themselves as students from the local university, and no additional information was given about any university or organization outside of the country financing the study to avoid potential misunderstandings and reduce distrust among the respondents. During the pilot study, some farmers had indicated concerns about externally financed coca eradication programs and therefore references to external institutions were minimized. As a result, only partial information was given to the respondents. This is unconventional, but under the specific circumstances of the study, there was no other alternative without facing potential security problems.

For training, the interviewers first attended a two-day workshop in Puno city, followed by a three-day workshop in the research area. The same group of interviewers also conducted the pilot study to test the questions and questionnaire with the objective of identifying comprehension, recall, judgement and acceptability issues in the survey, and allowing rephrasing, eliminating or adding questions. The pilot study also allowed assessment of the performance of the interviewers, and in some cases identified areas requiring tailored training based on the feedback on performance. For example, at the beginning one of the interviewers was hesitant about asking the coca-related question and that interviewer obtained a higher than average number of nonresponses to the sensitive question. After tailored training, the interviewer was able to modify their interviewing approach.

#### *Format of the sensitive question*

The question format presupposed the sensitive behavior under study, as suggested by Tourangeau and Yan (2007). Therefore, farmers were not first asked if they had any coca areas, and then asked for the total extent of their coca areas. Instead, all farmers were directly requested to state the total extent of their coca areas ("What is your coca growing area in meters or hectares?"). However, it was found during the pilot study that the farmers did not feel comfortable with this question format and they either skipped the question or simply withdrew from the survey. As a consequence, the question format was changed and a forgiving wording was used instead. Farmers were asked: "How many 'little bushes of coca' do you have in your agricultural plot?" Thus, the farmer could answer "Only a little, I have... coca bushes". Even though a difference was hardly perceptible, with the former question it was more difficult for the farmers to start their answers with "Only a little...". So, using the latter question, it was easier for the farmers to add apologetic explanations to their answers making them feel more relaxed. This latter sensitive question format also had the advantage of employing a familiar wording for the Aymara who commonly use diminutives in their daily conversations. On the other hand, this question format might indirectly

imply that the interviewer expected that the respondent had a small number of coca bushes likely resulting in underreporting. Consequently, while nonresponses were avoided using this latter question format, underreporting was still expected to some extent.

#### *Time period for conducting the survey and data collection setting*

The farmers' agricultural plots are scattered in the mountainous Amazon rainforest in Peru. It was difficult to reach individual farmers on their agricultural plots for the survey. Therefore, to conduct the survey, we mainly took advantage of the Saint Peter's Day celebration and the General Assembly meetings of the co-operatives in June and August 2008 respectively, when the farmers congregated in the town square. Attendance to the General Assembly meetings is mandatory for all co-operative members so all of the targeted respondents would have been accessible at those events. The only way to reach or exit the town square is through an unpaved road. To take advantage of this, the survey was conducted in a large tent that was erected on the unpaved road on those key days. This tent had ten divisions, one for each pair of interviewer and respondent. Absolute privacy was not enforced because during the pilot study, it was found that farmers did not feel comfortable being the "only one" who was being interviewed; they preferred to see others doing the same. However, farmers were not able to overhear other farmers' responses. Given that all farmers have to use the same unpaved road to reach the town square regardless of their specific geographic location, potential geographical biases, which in turn can be related to important variables such as farm size and income, were likely minimized in this research.

#### *Sampling representativeness*

A convenience sampling method was applied, but at the end of the survey, we asked the farmers for their co-operative registration number and used the co-operative registration lists to infer the sample's representativeness. The co-operative registration number provided by the farmer was written on separate piece of paper and was not attached to the respondent's questionnaire. Respondents were informed about this procedure and were able to witness the procedure.

The four co-operatives under study have 3,265 members in SPPP. Table 2 shows the number of respondents per co-operative. The number of collected questionnaires amounted to 508. In total, 12 respondents were excluded from the sample because their co-operative registration number was missing. In two cases, the farmers had refused to provide this information and in ten cases, the interviewers had forgotten to ask the respondents about their registration

number at the end of the interview. Therefore the absence of information was more associated with interviewer error than with the farmers' unwillingness to provide this information.

**Table 2**  
**Number of respondents per co-operative**

	<b>Total Number of Co-operative Members in SPPP</b>	<b>Survey's Sample Size</b>	<b>Percentage of Co-operative Members Interviewed (%)</b>
Co-operative 1	756	106	14
Co-operative 2	911	138	15
Co-operative 3	887	138	16
Co-operative 4	711	114	16
Total	3,265	496	15

Source: Own survey.

In order to test for representativeness of the sample, the distribution of the co-operative registration numbers obtained from the survey sample was compared with the distribution of the co-operative registration numbers from a simulated simple random sample without replacement obtained from co-operative lists. The co-operative lists were ordered by the registration number of the co-operative members and co-operative registration numbers are associated with the members' date of registration. Thus, most of the older farmers have lower registration numbers and the younger farmers have higher ones. Unfortunately, the co-operatives did not have other membership data available such as total land, coffee or coca hectares that might be used to select a stratified random sample. Two types of tests were used for comparison of the samples: a two-sample Wilcoxon rank-sum (Mann-Whitney) test and a two-sample Kolmogorov-Smirnov test for equality of distribution functions. The first test assesses how probable it is that the two groups come from the same distribution, and assumes that differences observed are caused by chance fluctuation. The second test is similar to the first one, but in addition it is sensitive to differences in both the location and shape of the empirical cumulative distribution functions of the two groups. The results of both tests failed to reject the null hypothesis of equality of distribution between the survey sample and the simulated simple random sample at a significance level of 0.05. Thus, the results suggest that the survey sample is equivalent to a simple random sample, and therefore representative of the population under study.

### **3. Survey results and validation issues**

#### **3.1 Survey results**

The survey response rate was around 90%, which is well above the minimum recommended response rate of 60% (Punch 2003). From the 496 completed questionnaires, 19



respondents (less than 4%) did not answer the coca-related question. When comparing the descriptive statistics of socio-economic, institutional, and coca-related variables, there were some significant differences between all the observations (without the non-respondents) and the 'sensitive question non-respondents' (see Appendix 2). The sensitive question non-respondents were all male, with a larger percentage of Aymara ethnic background, and more children. In addition, a larger percentage of them used coca as medicine. Interestingly, significantly more non-respondents are highly risk averse (73.7%) compared to all the other respondents (28.6%). This could indicate a potential fear of the 'sensitive question non-respondents' of interviewer disclosure of information to third parties. The setup of the risk aversion test followed by Binswanger (1980) is presented in Appendix 1c.

Basic comparative descriptive statistics of coca and non coca growers are presented in Table 3. The number of valid questionnaires was 477, if we do not account for the non respondents of the sensitive question. Of them, 64% indicated that they are coca growers.

There are no statistically significant differences with respect to general socio-economic characteristics (age, sex,

ethnic group, and number of children) between coca and non-coca growers. The only difference was observed in education. Non-coca growers have more years of schooling than coca growers. Coca growers have less total and primary forest areas, and more fallow land than non coca growers, although these differences are not statistically significant. Coca and non-coca growers have similar coffee and staple food areas. On the contrary, coca growers and non-coca growers show statistically significant differences in the social capital variables. More non-coca growers than coca growers find it important to obey national law. On the other hand, less non-coca growers than coca growers have experienced a negative change in trust towards their neighbors during the last five years, and have worked in community activities during the last year.

There is a statistically significant relationship between coca growing and traditional uses. A higher percentage of coca growers than non-coca growers chew coca and uses coca as medicine. More importantly, more coca growers find it easier to sell coca leaves than non-coca growers in the hypothetical case that they would cultivate coca for commercial purposes.

**Table 3**  
Comparative descriptive statistics between coca and non coca growers

Variable	Coca Growers	Non Coca Growers
Age	42.5 (12.7)	41.7 (12.5)
Male (%)	93.9	94.9
Aymara (%)	81.4	82.5
Number of Children	3.0 (2.0)	2.9 (2.1)
Years of schooling	8.2* (3.3)	8.7* (3.3)
Total area (ha)	7.9 (8.4)	8.0 (7.8)
Coffee area (ha)	2.2 (2.0)	2.2 (1.4)
Area secondary forest (fallow area)	1.6 (2.4)	1.4 (2.1)
Primary forest area (ha)	3.9 (7.5)	4.2 (7.0)
Staple food area (ha)	0.5 (0.7)	0.5 (0.6)
No other economic activities (%)	46.8	48.9
High risk aversion (%)	30.5	25.3
Important to obey national laws (%)	81.9**	88.6**
Negative change in trust in the last 5 years (%)	19.3**	12.5**
Have worked in community activities in 2007 (%)	92.0**	84.7**
Farmer chews coca (%)	76.0***	53.1***
Farmer uses coca as medicine (%)	81.7***	54.8***
Perception that it is easy to sell coca leaves (%)	26.4**	18.5**
Number of coca bushes	3,093 (6,710)	-
Number of Observations	305	172

Standard deviations are in parentheses for continuous variables.

Coca Growers and Non Coca Growers means are statistically different (T-test with unequal variances) at:

\* 0.1 significance level, \*\* 0.05 significance level, \*\*\* 0.01 significance level.

Source: Own calculations.

Finally, it is important to mention that the average number of coca bushes is relatively low, which could be due to underreporting of commercial coca growing areas or to coca cultivation only for self-consumption, or both. It is not possible to distinguish between those two scenarios, which makes it easier for commercial coca growers to disguise themselves as coca growers who produce for traditional uses.

### 3.2 Validation issues

The validity of individual responses cannot be verified directly because there is little prior empirical research on this topic, and there is an absence of other sources of confirming data. However, it is possible to provide a rough comparison between the survey data and the total area of coca production recounted by international organizations for the upper Tambopata valley using satellite data. The United Nations Office on Drugs and Crime (UNODC 2009) indicates that 940 hectares of coca were cultivated in the upper Tambopata valley in 2008. The conventional coca cultivation density for regions with traditional coca growers could be between 35,000 and 40,000 bushes per hectare (UNODC 2001) (During the 90s, the coca cultivation density was lower, between 20,000 and 25,000 bushes per hectare (UNODC 2009)). The coca cultivation density in the particular valley is relatively low because coca growers intercrop coca with coffee and staples, although the yields per bush have increased during the last years (UNODC 2009). Therefore, it is expected that the total number of coca bushes for this valley would be approximately from 32.9 to 37.6 million.

Our sample of 477 respondents (excluding farmers who did not report their co-operative registration number and non respondents to the sensitive question) reported a total of 960,000 coca bushes. This sample corresponds to 14.6% of a total of 3,265 co-operative members in SPPP. Thus, extrapolating for the total number of co-operative members located in the SPPP district would result in a total of 6.6 million coca bushes. In addition, we need to consider that the upper Tambopata valley also includes San Juan del Oro district which has around the same population as SPPP district (INEI 2007). Under the very strong assumption that farmers in SPPP behave similarly to the farmers in San Juan del Oro - at least in terms of coca cultivation - this would double the number of coca bushes for the entire upper Tambopata valley to around 13.2 million. This last estimate is between 35 and 40% of the 32.9 to 37.6 million obtained from UNODC satellite data. This result is in the expected range of reporting on sensitive issues. For reporting on abortion, this range is between 35 to 59% (Fu, Darroch, Henshaw and Kolb 1998), and for the use of opiates or cocaine between 30 to 70% (Tourangeau and Yan 2007).

## 4. Summary and conclusions

Coca, a raw material for the production of cocaine, is cultivated in Colombia, Peru and Bolivia. In the latter two countries, traditional uses of coca by indigenous populations date back to around 3000 B.C. (Rivera, *et al.* 2005). Nevertheless, asking farmers about the extent of their coca cultivation areas is considered a sensitive question. Coca growers are afraid of eradication programs even if they do not sell coca to the narcotics traffic business because it is difficult to distinguish between coca growers whose production is commercially oriented and those who produce only for self-consumption. Thus, farmers tend not to participate in surveys, not to answer any sensitive questions, or to underreport their coca cultivation areas in an attempt to minimize their identification for possible eradication.

Against this background, household-level data collection procedures need to consider and evaluate strategies to reduce nonresponses and misreporting. Most of the strategies used in our research area in Peru were based on best practices reported in the literature review. Some of the strategies that worked in our case were establishment of trust with the farmers using a presentation letter from a coffee co-operative director, confidentiality assurance at the beginning and in the middle of the questionnaire, matching of interviewer-respondent ethnic background characteristics, training of interviewers to reduce their hesitance to ask sensitive questions, changing the format of the sensitive question to a familiar and forgiving wording, and non enforcement of absolute privacy to prevent each farmer from feeling that they were the "only one" who was interviewed.

The validity of farmers' individual responses on their coca area extensions cannot be checked because the topic has produced little prior empirical research, and there is an absence of other sources of household-level confirming data. Thus, the extent of misreporting was evaluated using aggregate data. The results suggest that farmers only reported between 35 to 40% of their actual coca areas. Still, those values are between the ranges of what could be expected for answers to sensitive questions. In terms of survey nonresponse and sensitive question nonresponses, the results were more encouraging indicating values of 10% and of around 4%, respectively.

When conducting the survey, we mainly took advantage of celebrations and co-operative General Assemblies for which farmers congregated in town, since farmers are otherwise highly dispersed in the rainforest. The survey followed a convenience sampling method but it was possible to test the representativeness of this sample because all of the farmers are registered in one of the co-operatives in the research area. The obtained sample was compared with a simulated simple random sample without replacement

where each farmer had the same probability to be selected by chance from the co-operative member lists. There were no statistical differences in the distribution functions, so the sample is equivalent to a simple random one. The main drawback of this approach is that after the interview, we needed to ask the respondents for their co-operative member number. Even though the respondents were told that the co-operative identification number was not attached to their questionnaires, some farmers might have had doubts about it, and this could have had effects on confidentiality assurance credibility in following interviews due to word spreading.

On the other hand, comparing the characteristics of non-respondents to sensitive questions with the rest of respondents indicates that non-respondents were highly risk averse. Even though the number of non-respondents was small (less than 4% of the total sample), this could suggest that the main reason for item non-reporting is the fear of the consequences of the information leaking to third parties.

The coca areas reported by the farmers were on average very small. This could be an attempt by commercial coca growers to appear to be cultivating only for self-consumption. Coca growing for traditional uses does not have a negative connotation *per se* given that it is a symbol of ethnicity and the indigenous population's struggle for self-determination (Office of Technology Assessment 1993). It is not possible to distinguish farmers who underreported the extent of their coca cultivation areas from those who grow coca for self-consumption. Unfortunately, commercial coca growers can take advantage of this situation to continue growing coca under the guise of traditional uses.

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## Appendix 1

### Relevant parts of the questionnaire

**A) Presentation:**

Good morning/afternoon/night. My name is \_\_\_\_\_. I am a student at \_\_\_\_\_. We are conducting a survey to identify the risks and vulnerabilities of coffee producers in your community. The coffee co-operative directives are aware of this survey and believe that the result could benefit the community. If you decide to answer our questionnaire, you may skip any questions or withdraw from this study at any time. The data collected in this survey will remain CONFIDENTIAL and will be used only for ACADEMIC purposes. Your answers and opinions are extremely important for the co-operative and us. Would you be prepared to respond to some questions?

- a) Yes (proceed)
- b) No (thank the respondent, withdraw the survey, and indicate the characteristics of the person in format 1)

**B) Coca Related Questions:**

*In this part, we will ask about coca uses and cultivation. Please, remember that this survey is anonymous and that there are no correct or incorrect answers.*

- Do you chew coca leaves?* a) Yes b) No
- Do you use coca leaves as medicine?* a) Yes b) No
- Do you feel obligated to offer coca leaves to your guests during ayni and minka activities?* a) Yes b) No
- Do you use coca leaves for rituals?* a) Yes b) No
- Do you use coca leaves for payment to external workers?* a) Yes b) No
- Do you use coca leaves as product exchange or as a gift for friends and relatives?* a) Yes b) No
- How many little bushes of coca do you have in your agricultural plot?* \_\_\_\_\_

**C) Risk Aversion Question:**

*This is a game. Before playing it, you need to choose one of the options displayed below. Then I toss a coin. If for example you have chosen option H, and I toss the coin and it is heads, you do not win any money at all; but if it is tails, you win S/200. On the other hand, if you have chosen option A, you receive S/.50 regardless of if the tossed coin is heads or tails. Which option from all of the above would you choose before I toss the coin?*

OPTION	If it is heads, you win:	If it is tails, you win:
A	50 soles	50 soles
B	45 soles	95 soles
C	40 soles	120 soles
D	35 soles	125 soles
E	30 soles	150 soles
F	20 soles	160 soles
G	10 soles	190 soles
H	0 soles	200 soles

## Appendix 2

### Comparative descriptive statistics between all observations and sensitive question non respondents

Variable	All Observations <sup>a</sup>	Sensitive Question Non Respondent
Age	42.2 (12.6)	45.9 (9.9)
Male (%)	94.3***	100***
Aymara (%)	81.8**	94.7**
Number of Children	3.0** (2.0)	4.1** (2.0)
Years of schooling	8.4 (3.3)	7.5 (2.9)
Total area (ha)	7.9 (8.3)	6.8 (3.2)
Coffee area (ha)	2.2 (1.8)	2.5 (1.2)
Area secondary forest (fallow area)	1.6 (2.3)	1.4 (1.1)
Primary forest area (ha)	4.0 (7.3)	2.9 (3.3)
Staple food area (ha)	0.5 (0.7)	0.6 (0.6)
No other economic activities (%)	47.5	57.9
High risk aversion (%)	28.6***	73.7***
Important to obey national laws (%)	84.3	89.5
Negative change in trust in the last 5 years (%)	16.8	26.3
Have worked in community activities in 2007 (%)	89.4	89.5
Farmer chews coca (%)	67.7	73.7
Farmer uses coca as medicine (%)	72.0*	84.2*
Easy to sell coca leaves (%)	23.6	27.8
Number of Observations	477	19

Standard deviations are in parentheses for continuous variables.

a) All observations without sensitive question non respondents.

Non respondent means are statistically different from the entire sample (T-test with unequal variances) at:

\* 0.1 significance level, \*\* 0.05 significance level, \*\*\* 0.01 significance level.

Source: Own calculations.

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