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by Matching Census and Survey Data**

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Estimating Poverty for Indigenous Groups in Chile by Matching Census and Survey Data

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Summary

It is widely held that indigenous Chileans experience greater rates of poverty and indigence than non-indigenous Chileans, yet the evidence to date has been based on surveys that are not representative by ethnicity. In this paper, we use poverty mapping methodologies that are typically applied to geography to develop statistically precise estimates of poverty, indigence, poverty gaps, and indigence gaps for each of the eight indigenous groups recognized by Chilean law. We find that indigenous people experience higher rates of poverty and indigence and greater depth of poverty and indigence than non-indigenous people. These results hold within individual regions, suggesting that the differential access to economic opportunities in different parts of the country cannot fully explain the results. We also find that the burden of poverty is not shared equally across indigenous groups. Instead, the Mapuche and Aymará experience disproportionately high poverty rates. We argue that including ethnicity in criteria for identifying poor households may help policy-makers to improve antipoverty targeting.

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1. Introduction

Chile's economic growth may be characterized as being both rapid and sustained. Between 1986 and 2005, for example, GDP grew at an average rate of 6 % and real GDP per capita increased by 203 %, reaching US\$ 8,569 by 2006. The growth registered over the past two decades has been matched by an equally dramatic reduction in poverty: while GDP per capita increased from US\$ 1,679 in 1987 to US\$ 9,879 in 2007, the proportion of Chileans living below official poverty lines fell from 39.4% to 13.7%. Indigence rates also fell dramatically during this period, from approximately 14.2% to 3.2%. Although economy-wide growth explains much of the reduction in poverty rates in the past (Larrañaga 1994, Contreras 2003), a series of cash and in-kind transfers from the government to poor households also proved to be fundamental to poverty alleviation (Beyer 1997, Valdés 1999). Indeed, poverty reduction became an important policy objective beginning in the early 1980s.

With fewer poor households, the probability of inefficiently distributing assistance to the non-poor (i.e., of a Type I error) increases, making the criteria used for identifying the poor extremely important. Currently, eligibility for housing subsidies and cash and in-kind transfers from the government are determined by income and characteristics of housing construction. Agostini and Brown (2008) demonstrate sizable efficiency gains to including geographic considerations in such targeting in Chile, yet evidence from other countries suggest that poverty targeting programs based solely on geographic targeting are often not effective (e.g., Ravallion and Wodon 1997 for Bangladesh and Datt and Ravallion 1993 for Indonesia). Such findings emphasize the need for employing complementary criteria that measure income in order to further improve targeting (Bigman and Fofack 2000). Given the contemporary socioeconomic

divide between Chile's indigenous and non-indigenous population, reliable poverty indicators disaggregated by ethnicity may contribute significantly to this end.

Indigenous peoples in Chile have a long history of economic disenfranchisement, which continue to be translated into high levels of poverty. For example, Valenzuela (2003) finds that 32.3% of the indigenous population lived in poverty in 2000, compared to 20.1% of the non-indigenous population. On average, indigenous households in Chile earn less than half the income of non-indigenous families, and 65% of indigenous households are in the lowest two quintiles of the income distribution. The income gap may be partly explained by the occupational profile of the indigenous labor force: 31% have unskilled jobs and 25% work in agriculture (World Bank 2002).

However, virtually all such figures are obtained from the National Socioeconomic Characterization Survey (CASEN), a periodical survey undertaken by Chile's Ministry of Planning (MIDEPLAN). While the CASEN is broadly representative at the national and regional levels and for urban residents and rural residents as a whole (Contreras, et al. 2001), it does not contain a representative sample of each of the eight indigenous groups recognized by Chilean law – the Mapuche, Aymará, Atacameño, Quechua, Rapanui, Colla, Kawashkar, (or Alacalufe), and Yagán (or Yámana). Moreover, some remote areas in which indigenous groups comprise significant shares of the population are not surveyed at all. Estimates of poverty for indigenous groups obtained directly from the CASEN may thus be imprecise.

To illustrate this point, Table 1 presents indigenous poverty rates computed directly from the 1996 and 2000 CASEN by Valenzuela (2003) and by the authors for the 2003 CASEN. The poverty rate for the Kawashkar is reported to have increased by more than 20 percentage points to 41.9%, while the poverty rate for the Yagán is reported to have decreased from 12.3% to 0.0%

in the four-year period between the two studies. For the Colla, poverty levels are reported to have fallen by half. The poverty rates for the two largest indigenous groups, the Mapuche and the Aymará, also changed a great deal, with a decrease of five percentage points for the Mapuche, and an increase of nine percentage points for the Aymará.

These dramatic fluxes, the lack of representativeness by ethnicity, and the small sample sizes for some ethnic groups suggest that poverty estimates calculated directly from the CASEN are unlikely to be reliable. Since the CASEN is the leading source of information about incomes in Chile, this finding presents an important policy challenge: lacking a clear understanding of poverty rates and poverty depth among the indigenous population is a significant obstacle in targeting poverty. One solution to this problem entails including a representative sample of each ethnic group in the CASEN survey. Given the geographic distribution of some ethnic groups, however, the costs associated with doing so are likely to be prohibitive.

This paper makes use of recent advances in poverty mapping methodologies to suggest an alternative solution. Specifically, we combine income data from the CASEN with detailed data on demographics, housing characteristics, and assets from the national census in order to derive statistically-reliable estimates of poverty for each of Chile's indigenous groups. These methods were developed by Hentschel et al. (1999) and Elbers, Lanjouw, and Lanjouw (2003), and has been used extensively in the recent literature to develop spatial poverty maps for many developing countries. For example, Demombynes and Özler (2005) use these methods to estimate poverty indicators at lower administrative levels in South Africa and Elbers et al. (2007) do the same for Mozambique, Madagascar, Ecuador, and Cambodia. Agostini and Brown (2007) and Agostini, Brown, and Gongóra (2008) use the same techniques to produce estimators of income inequality and poverty at the county level in Chile, respectively.

We find that members of indigenous groups are poorer on average than the non-indigenous population, a result that holds at the urban, rural, and national levels as well as in Santiago. Moreover, the estimates indicate that the Mapuche and the Aymará generally experience the highest poverty rates. Although the geographic distribution of indigenous groups may play some role in their higher poverty rates, we further show that poverty rates among indigenous peoples exceed those among non-indigenous people within most regions. Although the estimates are somewhat less precise, the same general pattern holds for indigence. Based on these results, we argue that significant gains against poverty could be achieved if ethnicity was included as an additional indicator for identifying the population eligible for government transfers.

The paper is organized as follows: Section 2 describes the method of estimating poverty indicators by ethnicity and provides a review of the relevant literature on which it is based; Section 3 provides a brief overview of the socio-economic conditions of Chile's indigenous population and of the policy context; Section 4 describes the survey and census data employed for the purposes of this study; Section 5 provides the analysis of the results. Finally, Section 6 presents the conclusions.

2. Poverty Mapping Methodology

The methodology proposed by Hentschel, et al. (1999) and developed by Elbers, et al. (2003) takes advantage of the detailed data in household surveys and the universal coverage of censuses. We provide a brief overview here and a detailed accounting in Appendix 1; readers who are interested in the complete statistical properties of the estimators are referred to Elbers, et al. (2003).

First, a detailed household survey is used to estimate the joint distribution of household income and a vector of explanatory variables. Restricting the set of explanatory variables to those available in the census, these “first stage” estimates are used to estimate the distribution of income for each ethnicity represented in the population, conditioning on the observed characteristics of that subgroup. The simplest means of estimating the model is via a linear approximation of the conditional expectation, allowing geographic effects and heteroskedasticity in the distribution of the error term. The cluster component of the residual can significantly reduce the power of the estimates in the second stage, so it is important to explain the variation in income due to location via observable variables to the greatest extent possible. The result of this first-stage estimation is a vector of coefficients, a variance-covariance matrix associated with this vector, and a set of parameters that describe the distribution of the errors. The second stage utilizes this set of parameters along with the characteristics of the individuals or households in the census in order to generate predicted values of income and the relevant errors. For these effects, bootstrapping is used to simulate values of household income. The complete set of simulated values is then used to calculate the expected value of poverty for each ethnic group. This procedure is repeated 200 times, taking a new set of coefficients and errors for each simulation.¹ The mean and standard deviations of these coefficients constitute the point estimates and standard deviations for the poverty indicator, respectively. Finally, bootstrapping is used to simulate values of household income, and the complete set of simulated values is then used to calculate the headcount ratio and poverty gap measures of poverty and the Gini coefficient for each ethnicity represented in the population.

It is important to note that a fundamental assumption underlying the poverty mapping method is that the model estimated using the survey data is also applicable to the census data. In

¹ There are no significant gains in efficiency by further increasing the number of repetitions.

our case, the survey was conducted in October 2003 and the census in April 2002, so we think that this condition is met.

3. Indigenous Groups in Chile

Taken together, the Mapuche, Aymará, Atacameño, Quechua, Rapanui, Colla, Kawashkar, and Yagán represent about 700,000 households (4.6% of the total) in the 2002 Census.² However, as shown in Table 2, only three groups represent more than one percent of Chile's total population – the Mapuche (who comprise over 95% of the total indigenous population), the Aymará, and the Atacameño. Collectively, the Quechua, Rapanui, Colla, Kawashkar, and Yagán comprise considerably less than 0.2% of the total population, and the Kawashkar and Yagán peoples are considered to be in “danger of extinction” by the Chilean government, which has vowed to prevent further population decline among these groups (Gobierno de Chile 2004). Like non-indigenous Chileans, indigenous peoples are disproportionately urban. Among the Mapuche, which have the lowest urbanization rates of urbanization, less than 40% of households continue to be located in rural areas. Only in Regions I and IX (which represent portions of the ancestral homes of the Aymarás and Mapuches, respectively) are more than 20% of households headed by indigenous peoples (Table 3).³

As noted in Table 1, survey evidence suggests that poverty rates are higher among indigenous groups than the non-indigenous population, a situation which is often attributed to

² In the 1992 Census the total indigenous population numbered about one million people, or 9.6% of Chile's total population. Thus, the two censuses note a striking 30% decrease during 1992-2002. This figure may be partly explained by the wording of the question in the survey form from: “Do you consider yourself belonging to any of these cultures: Mapuche, Aymará, Rapa Nui, or none of the previous?” (1992) to “Do you belong to any of the following original or indigenous peoples: Alacaufe (Kawashkar), Atacameño, Aymará, Colla, Mapuche, Quechua, Rapa Nui, Yámana (Yagán), or none of the previous?” (2002) (Haughney 2006).

³ At the time of the census, Chile was comprised of 13 regions, generally referred to by Roman numerals from north to south. The only exception is the Santiago Metropolitan Region, sometimes referred to as Region XIII, which is located between Regions V and VI.

lower human capital among native peoples. Indeed, educational attainment among working adults in the indigenous population averages 7.3 years compared to 9.5 years for non-indigenous working adults (World Bank 2002). The educational status of the rural Mapuche is especially low, with 80% of the household heads having less than 4 years of schooling and less than 3% of the total population having any type of educational training beyond high school (World Bank 2002). Moreover, indigenous children fare poorly in school, testing at 0.3 - 0.5 standard deviations below the test scores of non-indigenous children (McEwan 2004). In terms of health status, infant mortality, childhood diarrhea, tuberculosis, and parasitosis are generally higher among indigenous peoples (Amigo et al. 2001; World Bank 2002). Such discrepancies may derive from poor access to medical services as well as to differences in income.

As part of the Chilean government's policy toward indigenous people, the National Corporation for Indigenous Development (CONADI) was established by the Ministry of Planning and Cooperation in 1993 to redress inequality and to protect the rights of indigenous people. To date, much of its effort has concentrated on land reform and the development of productive infrastructure.⁴ Despite these initiatives, indigenous groups have reportedly remained dissatisfied with the limited amount of government funding channeled through CONADI, and marginalization and lack of economic opportunities continue to be sources of dissatisfaction among indigenous peoples. In response, the government recently announced a "Social Pact for Multiculturalism" which aims to improve the political representation of the indigenous communities, to overhaul economic development projects in indigenous areas, and to create mechanisms for consulting indigenous groups in the case of public and private investments that affect their communities (Malinowski 2008).

⁴ CONADI's Land and Water Fund finances land and water right acquisition, as well as irrigation projects. The Development Fund provides credit, technical assistance, and subsidies to indigenous micro-businesses.

4. Public Policy for Poverty Alleviation

Beginning in the early 1980s, the government adopted a wide-ranging set of policies to reduce poverty. Central to this effort was the development of a standardized metric to identify poor households. The “CAS Card” (revised and renamed the “CAS-2 Card” in 1987) is administered by the county at a household’s request; it evaluates poverty on the basis of self-reported income and housing criteria, particularly construction materials, density, and access to potable water. A score is assigned to the household and remains valid for three years, at which point a re-evaluation may be requested.⁵

The CAS Card became the primary data point for setting government priorities in the provision of public housing, with the concentration of poor households in any given region in 1982 and 1992 directly influencing the allocation of housing subsidies over the subsequent decade (Soto and Torche 2004). Between 1990 and 2000, housing subsidies increased at an average rate of 10% per year in real terms, and poor neighborhoods received additional subsidies to develop public sewerage and electric systems on the basis of these criteria. These criteria were also used to identify indigent households eligible for receiving direct cash transfers.

Government subsidies to poor households fall into five main programs:

1. Family Subsidy (SUF): A subsidy provided to pregnant women, parents with children not covered by social security, and parents or guardians of persons with physical disabilities.
2. Assistance Pensions (PASIS): Pensions provided for adults aged 65 and over, physically-disabled adults, and mentally-disabled individuals regardless of age who have a total income below half of the minimum pension allowance.⁶
3. Chile Solidario: A program that includes both cash and counseling services for indigent and high-risk households, particularly those with female heads.
4. Water and Sewage Subsidy (SAP): A three-year, renewable subsidy to offset the cost of water among poor households.

⁵ Soto and Torche (2004) provide additional details on the CAS form and the classification of poor households.

⁶ The minimum monthly pension allowance was CH\$ 8,9715 in 2006.

5. Unemployment: A decreasing monthly payment for up to 12 months for individuals who lost work through no fault of their own. Eligibility is based on formal employment for at least 52 weeks during the previous two years⁷ and not having rejected job opportunities offered by the National Training and Employment Service or the county government.

In 2004, nearly 954,000 individuals (6.3% of the population) receive the Family Subsidy each month. By contrast, only 3,682 individuals received Unemployment transfers each month on average, although this is at least partially due to the fact that the government replaced the transfer with mandatory unemployment insurance for those starting new jobs since 2002; this transfer is therefore no longer a policy tool for addressing poverty. The average monthly value of Unemployment payments is CH\$ 11,491. Assistance Pensions dwarf the other subsidies, with an average benefit of CH\$ 45,059. However, only 2.8% of Chile's population receives these transfers. The distribution of this subsidy is similar to that of the Family Subsidy. The Solidarity Subsidy and Water and Sewage Subsidy are provided to households rather than individuals. Approximately 1.1% of households receive the former, with an average monthly value of CH\$ 9,842. The Water and Sewage Subsidy is allocated to almost 16% of households; unlike many other subsidies, the value of the Water and Sewage Subsidy varies by region, with beneficiaries in Regions I, II, and XI receiving far greater subsidies than households elsewhere, reflecting the cost of purchasing and transporting water in these areas.⁸

Figure 1 shows the distribution of average transfers by type by pre-transfer income decile. As the figure suggests, cash transfers have good targeting on average. Nevertheless, the top half of the income distribution receives a significant share of transfers, including transfers for which such households are technically ineligible. Thus, there is considerable room for improvement in targeting.

⁷ For self-employed workers, eligibility is based on 12 consecutive months of contributions to social security in the previous two years.

⁸ For example, the cost of drinking water is up to 66% higher than the national average in Region XI despite heavy rainfall in the area.

5. Data Description

The survey used to impute income as described above is the November 2003 CASEN, administered by the University of Chile on behalf of the MIDEPLAN. The survey utilizes multistage random sampling with regional stratification and clustering. In the first stage, the country is divided between rural and urban areas for each of the 13 regions, and the primary sampling units are selected according to a probability sample based on the 2002 census. Within each sampling unit, households are selected with equal probability.⁹ The data collected include income, ethnicity, household demographics, ownership of specific assets, and housing quality as well as other measures of socioeconomic well-being. The Economic Commission for Latin America and the Caribbean (ECLAC) corrects these data for non-response and reporting errors and discrepancies.¹⁰

The 2003 sample covers 68,155 households, including 4,940 households headed by ethnic Mapuche; 1,012 headed by the Aymará; 326 headed by the Atacameño; 59 headed by the Quechua; 9 headed by the Rapanui; 19 headed by the Colla; 13 headed by the Kawashkar, and one Yagán household. The CASEN is representative at the national level, at the level of each region, and for all urban areas and all rural areas (Contreras et al. 2001; Pizzolito 2005), but is not representative by ethnicity. As a result, as noted in the Introduction, using the CASEN alone

⁹ Further methodological details are provided by Pizzolito (2005).

¹⁰ In the case of non-response, the average value of the income group to which the household belongs according to the intersection of several criteria (region, gender of household head, education, employment, etc.) is imputed to replace the missing value. In the case of under- or over- reporting of income, the Household Income and Expenditures Accounts System of the Central Bank of Chile is used as a reference for adjusting income categories for each individual surveyed in the CASEN, on the key assumption that misreporting differs across income categories and not income levels. For additional details, refer to ECLAC, IPEA, and INDP (2002). Although these adjustments may theoretically bias our estimates, Contreras (2003) argues that any bias introduced in this way is minimal.

to estimate poverty by ethnicity yields weak results given the magnitudes of the standard errors for some ethnic groups.

The 2002 census collects data from 4,112,838 households comprising 15,545,921 people. Some 4.6% of all Chilean households are headed by indigenous peoples, 86% of which self-identify as being Mapuche (Table 2). Aymará-headed households comprise an additional 0.33% of the total number of households, while Atacameño-headed households comprise 0.16% and Quechua-headed households comprise 0.04%. Collectively, Rapanui-, Colla-, Kawashkar-, and Yagán-headed households comprise less than 0.10% of the total. Headcount ratios are calculated according to the official poverty (indigence) lines: 43,712 (21,856) Chilean Pesos per capita in urban areas and 29,473 (16,842) Chilean Pesos per capita in rural areas (MIDEPLAN 2005). These lines are based on the costs of a weighted average of basic daily requirements for food consumption, equivalent to approximately 2,176 daily calories for the two poverty lines (MIDEPLAN 2005).

6. Results from Ethnicity Mapping

The poverty mapping methods described above are used to estimate income by ethnicity. Each of the specifications includes demographics, housing characteristics, and asset ownership variables that are available in both the CASEN and the census, as well as various interactions of these variables. The purpose of each model is not to causally describe the determinants of household income, but rather to maximize the share of the variation in income that the explanatory terms predict jointly.

The first stage estimates of household income for all urban households, for all rural households, for all households in the country, and for all households within the Santiago

Metropolitan Region are presented in Appendix Table 1. To summarize these results, all of the regressors are statistically significant at the 99% confidence level and all signs are as expected: for example, durable assets are associated with increases in per capita income while poor access to services and demographic indicators such as high dependency ratios are associated with a lower per-capita income. Moreover, the unadjusted R-squared varies between 0.405 in rural areas to 0.575 in the metropolitan region of Santiago, similar to those obtained in studies of geographic mapping of poverty (Elbers et al. 2007).

Table 4 presents the poverty and indigence estimates for urban households, rural households, and both urban and rural households together. In order to ease the interpretation of the results, Figures 2, 3, and 4 depict the estimates for the three levels of analysis. The 90% confidence intervals included in the figures facilitate straightforward comparison between the eight indigenous groups being studied and the non-indigenous population. The ethnic groups are ordered from left to right in terms of headcount size.

For urban households (Figure 2), rural households (Figure 3), and for urban and rural households combined (Figure 4), the poverty rate for indigenous people pooled together is greater than that for non-indigenous groups at the 90% confidence level. For urban households, for example, the estimated poverty rate is 34.3% for indigenous households and 24.0% for non-indigenous households. Moreover, each individual indigenous group exhibits higher poverty rate than non-indigenous people for urban and rural households combined, except the Yagán. Although the point estimates for the Yagán are higher than for non-indigenous people, the small number of Yagán-headed households implies that the standard errors become large, making inference tenuous.¹¹ The estimates are quite precise for larger indigenous groups, often with 90% confidence intervals of less than $\pm 1\%$. The two largest indigenous groups, the Mapuche

¹¹ Even so, poverty is estimated precisely, with 90% confidence intervals smaller than $\pm 3.5\%$.

and the Aymará, present the highest poverty incidence: at the 90% confidence level, the headcount ratios for these groups are at least seven percentage points higher than for non-indigenous people, higher when considering rural and urban households together. The Mapuche and the Aymará also have higher levels of poverty rates than any of the other indigenous groups when considering urban households and all households together except for the Quechua and the Colla, for which the 90% confidence intervals overlap slightly.

For rural households, very small sample sizes for several indigenous groups complicate similar comparisons. For example, sample sizes of fewer than 150 households for the members of Rapanui, Colla, Kawashkar, and Yagán communities result in estimates with large standard errors. Nevertheless, the rural estimates suggest a different pattern of poverty among Chile's ethnic groups. Specifically, the rural Atacameño, Rapanui, Kawashkar, and Yagán experience poverty at rates similar to the non-indigenous population. Still, the large difference in poverty rates between the Mapuche and the Aymará on the one hand and the non-indigenous population on the other is preserved.

Similar observations can be made in regard to estimates of indigence. For urban households and for urban and rural households combined, the non-indigenous population has lower rates of indigence than all of the indigenous groups except for the Rapanui, Kawashkar, and Yagán (Figures 2 and 4). In rural areas, when considering indigenous groups separately, only the Mapuche and the Aymará present higher rates of indigence at the 90% level of significance. Again, small sample sizes make inference difficult, although the difference in indigence between the non-indigenous population and all indigenous groups pooled together is comparable to the difference in urban areas, suggesting that indigence rates are indeed higher in the indigenous community.

Poverty depth can also be assessed through the poverty gap measure.¹² As shown in Table 4, transferring about 8% of the total income available to non-indigenous Chileans to those living below the poverty line is sufficient to eliminate poverty, whereas 12.4% of the total income available to the Aymará must be redistributed to eliminate poverty in that community. At the 90% confidence level, the poverty gap for non-indigenous Chileans is lower than that for any other ethnic group except the Yagán, while the poverty gap for the Aymará is higher than that for any other ethnic group except the Colla. The poverty gap statistics correlate strongly with the values estimated for the indigence gap at the level of each indigenous group. At the national level, the indigence gap of the non-indigenous population is lower than any of the estimates for individual indigenous groups. Thus, indigenous groups experience both greater incidence and greater depth of poverty than non-indigenous people.

Of course, higher poverty rates for certain ethnic groups may reflect geography as much as ethnicity because poverty rates differ by region and because ethnicities are not evenly distributed across the country. For example, the overall poverty rate in Region IX (the heart of the ancestral Mapuche home lands) is 29.7% compared to 11.2% in Region II (ancestral home of the Atacameño), as shown in Table 5. That is, high headcount ratios among some indigenous groups may reflect geographic disparities in economic opportunities rather than economic opportunities for indigenous people *per se*. To account for this possibility, we adopt two strategies. First, we examine poverty and indigence by ethnic group in the Santiago Metropolitan Region. Santiago represents the only region in which all indigenous groups are well represented,¹³ so restricting the sample to households in Santiago may help to better isolate ethnic differences in poverty and indigence. Important differences between the non-indigenous

¹² The poverty gap is measured by the Foster-Greer-Thorbecke statistic.

¹³ For example, more Aymará live in Santiago than in Region I, where the group has its historical roots. Similarly, almost as many Mapuche live in Santiago as in Region IX.

and some indigenous groups are present even in this restricted area (Table 6 and Figure 4). For example, the poverty rate for the Mapuche is still almost 10 percentage points greater than that for the non-indigenous population, similar to the situation for the country as a whole. The poverty rate for the Quechua is also significantly higher. However, a different pattern is observed for other indigenous groups: the point estimates for the headcount ratio of the Aymará, the Atacameño, the Colla, and the Yagán are all smaller than the headcount ratio for non-indigenous Chileans, although these differences are not statistically significant at the 90% confidence level.

Second, we compare poverty and indigence rates for all indigenous groups combined to these rates for non-indigenous people in each of the 13 regions. Table 7 and Figure 5 demonstrate a statistically significant disparity in poverty rates between the indigenous and non-indigenous populations in eight of the 13 regions. In Region IX, for example, the estimated poverty rate among indigenous Chileans is 38.8%, five percentage points higher than for the non-indigenous population. In Region I, the corresponding estimates are 29.0% for the indigenous population and 18.8% for the non-indigenous population. Small sample sizes in Regions XI and XII contribute to the relatively large standard errors associated with the point estimates. In each case, the 90% confidence intervals just overlap. Poverty rates are not statistically different in Regions II, III, or IV: in Region II, the relatively low rates of poverty for both groups is likely the result of high growth in copper mining; in Regions III and IV, relatively high poverty rates are shared by non-indigenous Chileans as well as indigenous people.

The disparity between the non-indigenous and indigenous populations in terms of indigence is even more striking, in most regions, than the disparity in poverty rates. For example, the indigence rate calculated for indigenous groups in Region I (9.1%) is almost double than that estimated for the non-indigenous population (4.6%). Very high differences in indigence rates are

also to be observed in Regions VIII, X, XI, XII and XIII. The only region in which the non-indigenous population displays a higher estimate of indigence than the indigenous population is Region IV, yet this difference in these estimates is far from statistically significant.

The poverty and indigence gap statistics calculated at the level of each region indicate that, with the exception of Regions III and IV, the indigenous population is not only affected by greater rates of poverty, but also by a more acute poverty depth. Once again, Regions I, VIII, XII, and XIII stand out as the areas containing the greatest disparities between the two categories of the population.

7. Conclusions

The Chilean government has already taken important steps to better identify poor households by eliminating the CAS-2 with the “Social Protection Card”; while the former emphasized housing and asset ownership in identifying the poor, the latter evaluates households on a range of measures that reflect income generating potential, including income stability, educational level, labor experience, age structure, disabilities, health status, number of people in the household, housing ownership, urban/rural location, and regional unemployment levels. These new criteria will likely result in more effective targeting, although they do not yet consider ethnicity in the calculation.

In this study, we have demonstrated that a clear disparity in the rates of poverty and indigence for indigenous and non-indigenous populations at all spatial levels considered: national, urban, and rural. For example, poverty rates for indigenous households at the national level are approximately 10 percentage points higher than for non-indigenous households. Indeed, with the exception of the Yagán (for whom the sample is very small), poverty rates are higher for

each individual indigenous group than for the non-indigenous majority at the 90% confidence level. Poverty rates are especially high among the Mapuche and the Aymará, with approximately one-third of all households living below the poverty line. In addition, higher headcount rates are strongly correlated with greater poverty depth. For example, the estimated poverty gap is 7.9% at the national level for non-indigenous Chileans compared to 12.4% for the Aymará, 11.5% for the Mapuche, and 11.2% for the Colla. Indigence rates follow similar patterns, and the point estimates for the indigence gap among the Aymará is nearly twice that of non-indigenous people.

These general patterns also hold within individual regions. For example, headcount ratios for indigenous Chileans are statistically larger in eight of Chile's 13 regions (and nearly so in two others). These results suggest that ethnic variation in geographic distribution cannot fully explain the different incidence of poverty among indigenous groups. Instead, it appears that ethnicity is a strong predictor of poverty and indigence, suggesting perhaps that indigenous groups may experience differential access to economic opportunities despite the existence of CONADI. Thus, including ethnicity in criteria for identifying poor households can substantially improve the performance of existing poverty targeting programs.

Appendix 1: First-Stage Estimation of Household Income at the National Level

	National		Rural		Urban		Santiago	
	Coef	Std. Err.	Coef	Std. Err.	Coef	Std. Err.	Coef	Std. Err.
Constant	11.5384	(0.0356)	11.4457	(0.0368)	11.5033	(0.0396)	12.0405	(0.0819)
Internet	0.2394	(0.0113)	1.0085	(0.1769)			0.3004	(0.0181)
Washing machine	0.1325	(0.0064)	0.1298	(0.0108)	0.1422	(0.0083)	0.138	(0.0143)
Water heater	0.1728	(0.0087)	0.1639	(0.0166)	0.1872	(0.0117)	0.1266	(0.0210)
Cell phone	0.1123	(0.0092)	0.1493	(0.0239)			0.2109	(0.0272)
Fixed Phone	0.2482	(0.0294)	0.2333	(0.0186)	0.1733	(0.0102)	0.1503	(0.0185)
Cable or Satellite TV	0.1698	(0.0081)			0.2197	(0.0229)	0.1666	(0.0264)
Microwave	0.2529	(0.0286)	0.2133	(0.0189)	0.1619	(0.0155)	0.1006	(0.0146)
Education of household head	0.0373	(0.0056)	-0.024	(0.0093)	-0.0389	(0.0047)	-0.0902	(0.0072)
Electric energy - public system	-0.0952	(0.0247)						
Electric energy – generator			0.3354	(0.0398)				
No electricity					-0.1239	(0.0627)		
Woman household head	-0.1655	(0.0144)	-0.1136	(0.0196)	-0.1086	(0.0193)	-0.1616	(0.0337)
Fraction of household members with disability	-0.2762	(0.0211)	-0.3078	(0.0343)				
Fraction of children in household	-1.6785	(0.1080)	-1.3442	(0.1387)	-1.1896	(0.1002)	-0.7322	(0.1493)
Number of household members with disability					-0.0257	(0.0128)		
Number of children in household	0.2226	(0.0237)	0.1542	(0.0498)			0.1281	(0.0408)
Number of household members	-0.4035	(0.0066)	-0.3938	(0.0269)	-0.2875	(0.0119)	-0.4336	(0.0136)
Number of household members squared	0.0263	(0.0006)	0.0253	(0.0024)	0.0103	(0.0009)	0.022	(0.0012)
Zinc roof	-0.1539	(0.0074)	-0.0495	(0.0148)	-0.1444	(0.0095)		
Thatched roof	-0.2732	(0.0351)	-0.2498	(0.0435)	-0.2322	(0.0487)		
Number of rooms	0.1232	(0.0052)			0.0347	(0.0054)	0.0715	(0.0139)
Urban household	0.1264	(0.0297)						
Brick walls	-0.0236	(0.0073)			-0.0806	(0.0117)	-0.199	(0.0176)
Wood walls	-0.0545	(0.0081)			-0.138	(0.0137)	-0.2737	(0.0253)
Adobe or clay walls			-0.0865	(0.0134)	-0.1579	(0.0219)	-0.2854	(0.0409)
Waste materials walls					-0.1098	(0.0218)	-0.1446	(0.0426)
Public system water supply			-0.0293	(0.0095)				
Water piped into dwelling			0.0535	(0.0135)				
Water piped outside of dwelling			0.0353	(0.0154)				
Interactions	Yes		Yes		Yes		Yes	
R-squared	0.536		0.405		0.530		0.575	
Observations	67,557		25,441		42,114		13,519	

Notes:

All coefficients are significant at the 99% level

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Table 1: Poverty Rates by Ethnicity Calculated from the CASEN Surveys

	1996	2000	2003
Non-indigenous	22.7%	20.1%	22.0%
Mapuche	38.4%	32.9%	31.1%
Aymará	23.7%	32.7%	27.5%
Atacameño	29.3%	19.2%	10.4%
Quechua	27.1%	25.8%	17.0%
Rapanui	12.3%	14.4%	44.4%
Colla	13.9%	7.5%	10.5%
Kawashkar	17.0%	41.9%	23.1%
Yagán	12.3%	0.0%	0.0%

Source: Ministry of Planning (MIDEPLAN) - CASEN 1996, 2000, and 2003 surveys

Table 2: Distribution of the Indigenous Households at the National Level and in Urban versus Rural Areas

	Non-indigenous	Mapuche	Aymará	Atacameño	Quechua	Rapanui	Colla	Kawashkar	Yagán
National (% of total population)	3,950,936 (95.40)	164,543 (3.97)	13,823 (0.33)	6,739 (0.16)	1,760 (0.04)	1,238 (0.03)	1,038 (0.03)	846 (0.02)	482 (0.01)
Rural (% of total ethnic group population)	487,594 (12.34)	61,405 (37.32)	3,217 (23.27)	1,133 (16.81)	309 (17.56)	120 (9.69)	143 (13.78)	122 (14.42)	75 (15.56)
Urban (% of total ethnic group population)	3,463,342 (87.66)	103,138 (62.68)	10,606 (76.73)	5,606 (83.19)	1,451 (82.44)	1,118 (90.31)	895 (86.22)	724 (85.58)	407 (84.44)

Source: 2002 National Census

Notes:

Percentages reported in parentheses

Table 3: Distribution of the Indigenous Population in Chile by Regions

Region	Total population	Non-indigenous	Mapuche	Aymará	Atacameño	Quechua	Rapanui	Colla	Kawashkar	Yagán
I	111,873 (2.70)	97,900 (2.48)	1,702 (1.03)	11,380 (82.33)	394 (5.85)	323 (18.35)	29 (2.34)	87 (8.38)	26 (3.07)	32 (6.64)
II	124,105 (3.00)	117,302 (2.97)	1,243 (0.76)	746 (5.40)	4,125 (61.21)	574 (32.61)	9 (0.73)	62 (5.97)	23 (2.72)	21 (4.36)
III	68,684 (1.66)	66,350 (1.68)	602 (0.37)	109 (0.79)	995 (14.76)	17 (0.97)	20 (1.62)	577 (55.59)	10 (1.18)	4 (0.83)
IV	166,902 (4.03)	165,363 (4.19)	1,006 (0.61)	126 (0.91)	233 (3.46)	22 (1.25)	14 (1.13)	109 (10.50)	13 (1.54)	16 (3.32)
V	440,703 (10.64)	434,683 (11.00)	4,698 (2.86)	214 (1.55)	194 (2.88)	52 (2.95)	753 (60.82)	21 (2.02)	52 (6.15)	36 (7.47)
VI	214,247 (5.17)	211,249 (5.35)	2,846 (1.73)	33 (0.24)	43 (0.64)	17 (0.97)	14 (1.13)	14 (1.35)	20 (2.36)	11 (2.28)
VII	252,191 (6.09)	249,755 (6.32)	2,292 (1.39)	36 (0.26)	24 (0.36)	20 (1.14)	11 (0.89)	8 (0.77)	23 (2.72)	22 (4.56)
VIII	503,017 (12.15)	489,015 (12.38)	13,712 (8.33)	65 (0.47)	50 (0.74)	43 (2.44)	29 (2.34)	9 (0.87)	40 (4.73)	54 (11.20)
IX	238,313 (5.75)	185,468 (4.69)	52,572 (31.95)	23 (0.17)	22 (0.33)	126 (7.16)	25 (2.02)	22 (2.12)	36 (4.26)	19 (3.94)
X	295,910 (7.15)	267,555 (6.77)	27,915 (16.97)	59 (0.43)	32 (0.47)	78 (4.43)	35 (2.83)	20 (1.93)	154 (18.20)	62 (12.86)
XI	25,693 (0.62)	23,472 (0.59)	2,076 (1.26)	11 (0.08)	13 (0.19)	19 (1.08)	5 (0.40)	1 (0.10)	74 (8.75)	22 (4.56)
XII	43,216 (1.04)	40,897 (1.04)	2,104 (1.28)	14 (0.10)	7 (0.10)	12 (0.68)	5 (0.40)	4 (0.39)	134 (15.84)	39 (8.09)
XIII	1,656,551 (40.00)	1,601,927 (40.55)	51,775 (31.47)	1,007 (7.28)	607 (9.01)	457 (25.97)	289 (23.34)	104 (10.02)	241 (28.49)	144 (29.88)

Source: 2002 National Census

Notes:

Percentages reported in parentheses reflect the regional share for each column.

Table 4: Estimated Poverty Rates by Ethnicity at the Urban, Rural, and National Levels

	Urban				Rural				National			
	Poverty Rate	Poverty Gap	Indigence Rate	Indigence Gap	Poverty Rate	Poverty Gap	Indigence Rate	Indigence Gap	Poverty Rate	Poverty Gap	Indigence Rate	Indigence Gap
Non-indigenous	24.0%	8.1%	5.9%	1.6%	20.2%	6.1%	5.5%	1.4%	23.5%	7.9%	5.9%	1.6%
	(0.0031)	(0.0017)	(0.0022)	(0.0009)	(0.0043)	(0.0018)	(0.0023)	(0.0008)	(0.0030)	(0.0016)	(0.0020)	(0.0008)
Indigenous	34.33%	12.68%	10.35%	3.05%	31.91%	10.81%	10.91%	2.97%	34.16%	12.39%	10.96%	3.16%
	(0.0041)	(0.0025)	(0.0034)	(0.0016)	(0.0082)	(0.0043)	(0.0059)	(0.0023)	(0.0039)	(0.0021)	(0.0028)	(0.0013)
Mapuche	33.8%	12.0%	9.3%	2.6%	29.2%	9.4%	9.1%	2.4%	33.1%	11.5%	9.9%	2.7%
	(0.0042)	(0.0025)	(0.0035)	(0.0015)	(0.0056)	(0.0028)	(0.0040)	(0.0015)	(0.0037)	(0.0022)	(0.0031)	(0.0013)
Aymará	34.0%	12.5%	10.2%	2.9%	30.7%	10.3%	10.1%	2.8%	33.9%	12.4%	10.6%	3.0%
	(0.0062)	(0.0035)	(0.0050)	(0.0021)	(0.0121)	(0.0055)	(0.0088)	(0.0030)	(0.0056)	(0.0029)	(0.0040)	(0.0017)
Atacameño	29.3%	10.4%	8.1%	2.2%	21.2%	6.7%	6.4%	1.7%	28.6%	10.0%	8.0%	2.2%
	(0.0072)	(0.0036)	(0.0053)	(0.0021)	(0.0145)	(0.0066)	(0.0106)	(0.0039)	(0.0070)	(0.0033)	(0.0047)	(0.0018)
Quechua	31.0%	11.1%	8.7%	2.4%	25.7%	8.3%	8.0%	2.1%	30.8%	10.9%	8.9%	2.5%
	(0.0126)	(0.0061)	(0.0088)	(0.0033)	(0.0297)	(0.0122)	(0.0207)	(0.0067)	(0.0122)	(0.0054)	(0.0079)	(0.0028)
Rapanui	28.0%	9.7%	7.3%	1.9%	19.4%	6.6%	6.5%	2.0%	27.5%	9.5%	7.3%	2.0%
	(0.0135)	(0.0061)	(0.0093)	(0.0032)	(0.0388)	(0.0151)	(0.0249)	(0.0100)	(0.0140)	(0.0064)	(0.0096)	(0.0033)
Colla	31.5%	11.2%	8.8%	2.4%	29.7%	10.2%	10.2%	3.1%	31.2%	11.2%	9.0%	2.5%
	(0.0168)	(0.0072)	(0.0111)	(0.0042)	(0.0433)	(0.0223)	(0.0348)	(0.0138)	(0.0145)	(0.0060)	(0.0100)	(0.0034)
Kawashkar	29.2%	10.0%	7.5%	1.9%	20.6%	6.5%	6.2%	1.7%	29.1%	9.9%	7.7%	2.0%
	(0.0178)	(0.0072)	(0.0110)	(0.0036)	(0.0410)	(0.0173)	(0.0268)	(0.0093)	(0.0176)	(0.0080)	(0.0117)	(0.0040)
Yagán	27.7%	9.6%	7.3%	1.9%	21.4%	6.6%	5.9%	1.5%	27.0%	9.4%	7.3%	2.0%
	(0.0238)	(0.0103)	(0.0154)	(0.0053)	(0.0558)	(0.0221)	(0.0339)	(0.0119)	(0.0204)	(0.0085)	(0.0136)	(0.0049)

Notes:

Standard errors reported in parentheses

Table 5: Measures of Poverty and Indigence by Region

Region	Region Name	Poverty Rate	Indigence Rate
I	Tarapacá	18.46%	3.21%
II	Antofagasta	11.22%	3.24%
III	Atacama	24.85%	8.09%
IV	Coquimbo	21.54%	5.29%
V	Valparaíso	19.40%	4.65%
VI	O'Higgins	19.22%	3.97%
VII	Maule	23.10%	5.61%
VII	Bío Bío	28.01%	8.44%
IX	Araucanía	29.71%	9.47%
X	Los Lagos	21.83%	4.80%
XI	Aisén	14.19%	4.22%
XII	Magallanes	12.29%	2.45%
XIII	Santiago	13.08%	2.85%

Source: MIDEPLAN – CASEN 2003

Table 6: Measures of Poverty and Indigence by Ethnicity in Santiago de Chile

	Poverty Rate	Poverty Gap	Indigence Rate	Indigence Gap
Non-indigenous	18.6%	5.9%	4.0%	1.00%
	(0.0058)	(0.0026)	(0.0027)	(0.0009)
Indigenous	28.8%	9.98%	7.57%	2.16%
	(0.0072)	(0.0043)	(0.0055)	(0.0024)
Mapuche	28.1%	9.3%	6.5%	1.66%
	(0.0083)	(0.0041)	(0.0046)	(0.0015)
Aymará	16.2%	5.2%	3.5%	0.92%
	(0.0129)	(0.0053)	(0.0071)	(0.0024)
Atacameño	16.8%	5.2%	3.4%	0.87%
	(0.0159)	(0.0063)	(0.0086)	(0.0029)
Quechua	22.3%	7.2%	5.0%	1.29%
	(0.0189)	(0.0084)	(0.0119)	(0.0038)
Rapanui	22.2%	7.5%	5.6%	1.44%
	(0.0257)	(0.0104)	(0.0155)	(0.0054)
Colla	14.7%	4.3%	2.6%	0.66%
	(0.0350)	(0.0129)	(0.0169)	(0.0056)
Kawashkar	22.7%	7.0%	4.4%	1.03%
	(0.0298)	(0.0121)	(0.0160)	(0.0049)
Yagán	17.4%	5.7%	4.1%	1.09%
	(0.0329)	(0.0130)	(0.0196)	(0.0064)

Notes:

Standard errors reported in parentheses

Table 7: Poverty and Indigence Estimates by Region

Region	Poverty Rate		Poverty Gap		Indigence Rate		Indigence Gap	
	Non-indigenous	Indigenous	Non-indigenous	Indigenous	Non-indigenous	Indigenous	Non-indigenous	Indigenous
I	18.8%	29.0%	6.3%	10.6%	4.6%	9.1%	1.3%	2.8%
	(0.0164)	(0.0216)	(0.0083)	(0.0122)	(0.0096)	(0.0154)	(0.0036)	(0.0064)
II	15.2%	18.4%	4.4%	5.5%	2.5%	3.3%	0.6%	0.8%
	(0.0163)	(0.0212)	(0.0070)	(0.0092)	(0.0068)	(0.0096)	(0.0020)	(0.0029)
III	23.1%	26.7%	9.1%	10.7%	8.1%	10.0%	2.8%	3.4%
	(0.0145)	(0.0181)	(0.0081)	(0.0099)	(0.0097)	(0.0125)	(0.0042)	(0.0056)
IV	26.9%	26.6%	9.3%	9.1%	7.4%	7.1%	2.1%	2.0%
	(0.0127)	(0.0176)	(0.0066)	(0.0086)	(0.0081)	(0.0111)	(0.0034)	(0.0044)
V	22.1%	27.1%	7.2%	9.3%	5.1%	7.0%	1.4%	2.0%
	(0.0084)	(0.0116)	(0.0041)	(0.0057)	(0.0048)	(0.0070)	(0.0019)	(0.0028)
VI	23.0%	29.3%	7.2%	9.7%	5.1%	7.3%	1.2%	1.8%
	(0.0115)	(0.0156)	(0.0060)	(0.0078)	(0.0086)	(0.0121)	(0.0031)	(0.0048)
VII	27.0%	31.6%	9.0%	10.9%	7.1%	8.7%	1.8%	2.3%
	(0.0097)	(0.0131)	(0.0054)	(0.0072)	(0.0070)	(0.0105)	(0.0028)	(0.0042)
VIII	33.4%	41.3%	12.5%	15.9%	10.8%	14.6%	3.2%	4.4%
	(0.0070)	(0.0087)	(0.0044)	(0.0056)	(0.0059)	(0.0081)	(0.0028)	(0.0038)
IX	33.9%	38.8%	12.6%	14.1%	10.8%	13.8%	3.0%	3.9%
	(0.0116)	(0.0101)	(0.0060)	(0.0055)	(0.0077)	(0.0078)	(0.0030)	(0.0032)
X	25.6%	32.6%	8.7%	11.3%	6.9%	9.8%	1.8%	2.6%
	(0.0094)	(0.0116)	(0.0049)	(0.0060)	(0.0061)	(0.0081)	(0.0023)	(0.0032)
XI	19.4%	25.6%	7.0%	9.5%	5.9%	8.2%	1.8%	2.5%
	(0.0168)	(0.0233)	(0.0083)	(0.0118)	(0.0096)	(0.0147)	(0.0038)	(0.0060)
XII	13.8%	21.6%	4.4%	7.3%	3.1%	5.6%	0.7%	1.2%
	(0.0208)	(0.0296)	(0.0084)	(0.0127)	(0.0082)	(0.0139)	(0.0020)	(0.0034)
XIII	19.2%	28.8%	6.3%	10.0%	4.5%	7.6%	1.3%	2.2%
	(0.0051)	(0.0072)	(0.0028)	(0.0043)	(0.0034)	(0.0055)	(0.0014)	(0.0024)

Notes:

Standard errors reported in parentheses

Figure 1: Cash Transfers by Income Decile

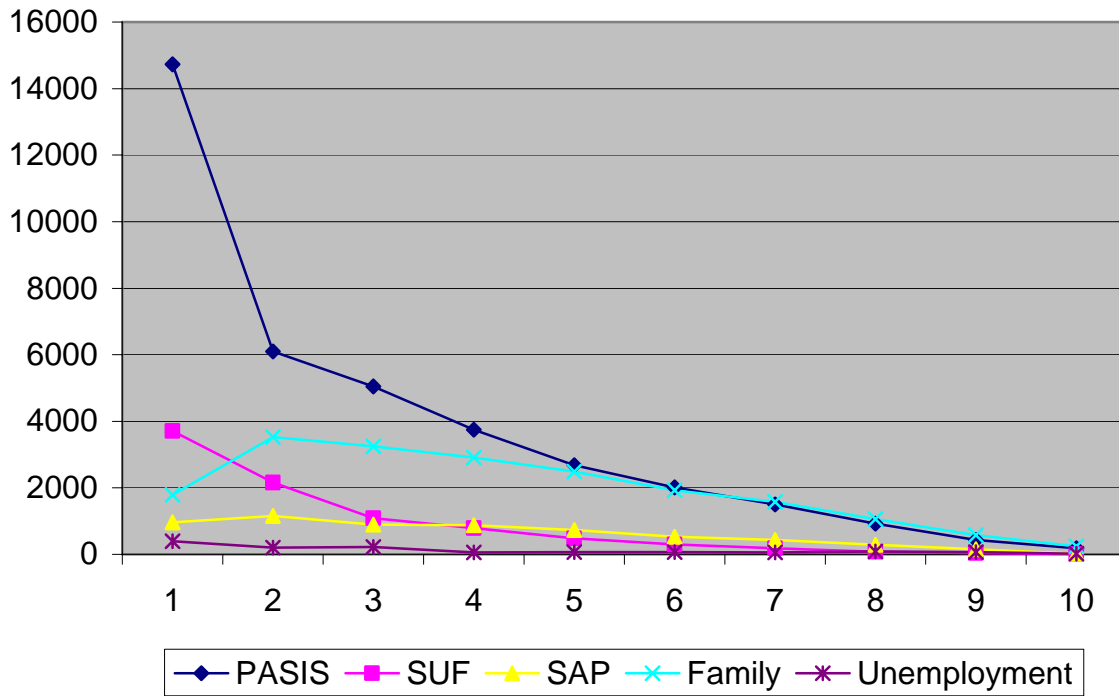


Figure 2: Poverty and Indigence Rates in Urban Chile with 90% Confidence Intervals

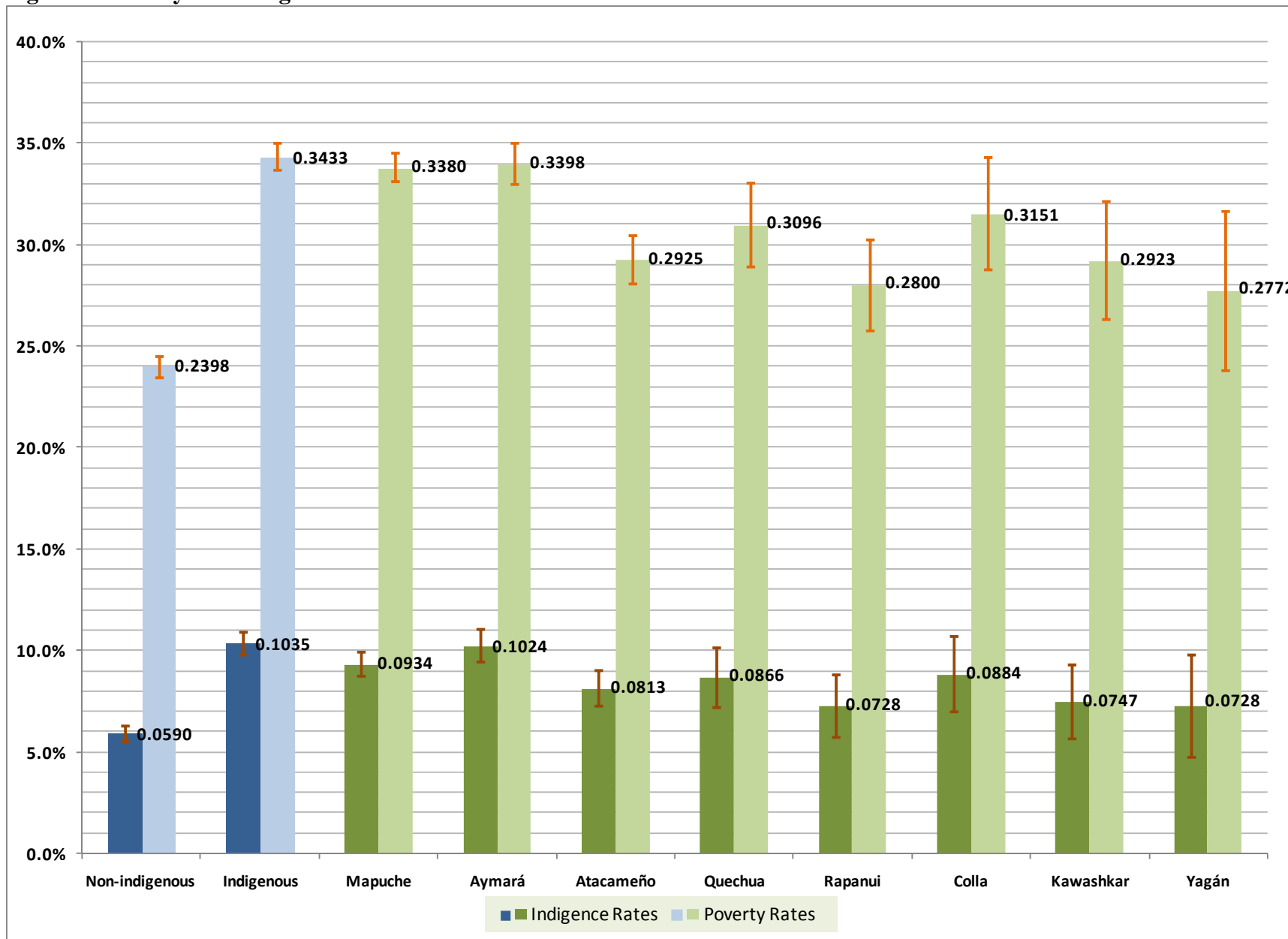


Figure 3: Poverty and Indigence Rates in Rural Chile with 90% Confidence Intervals

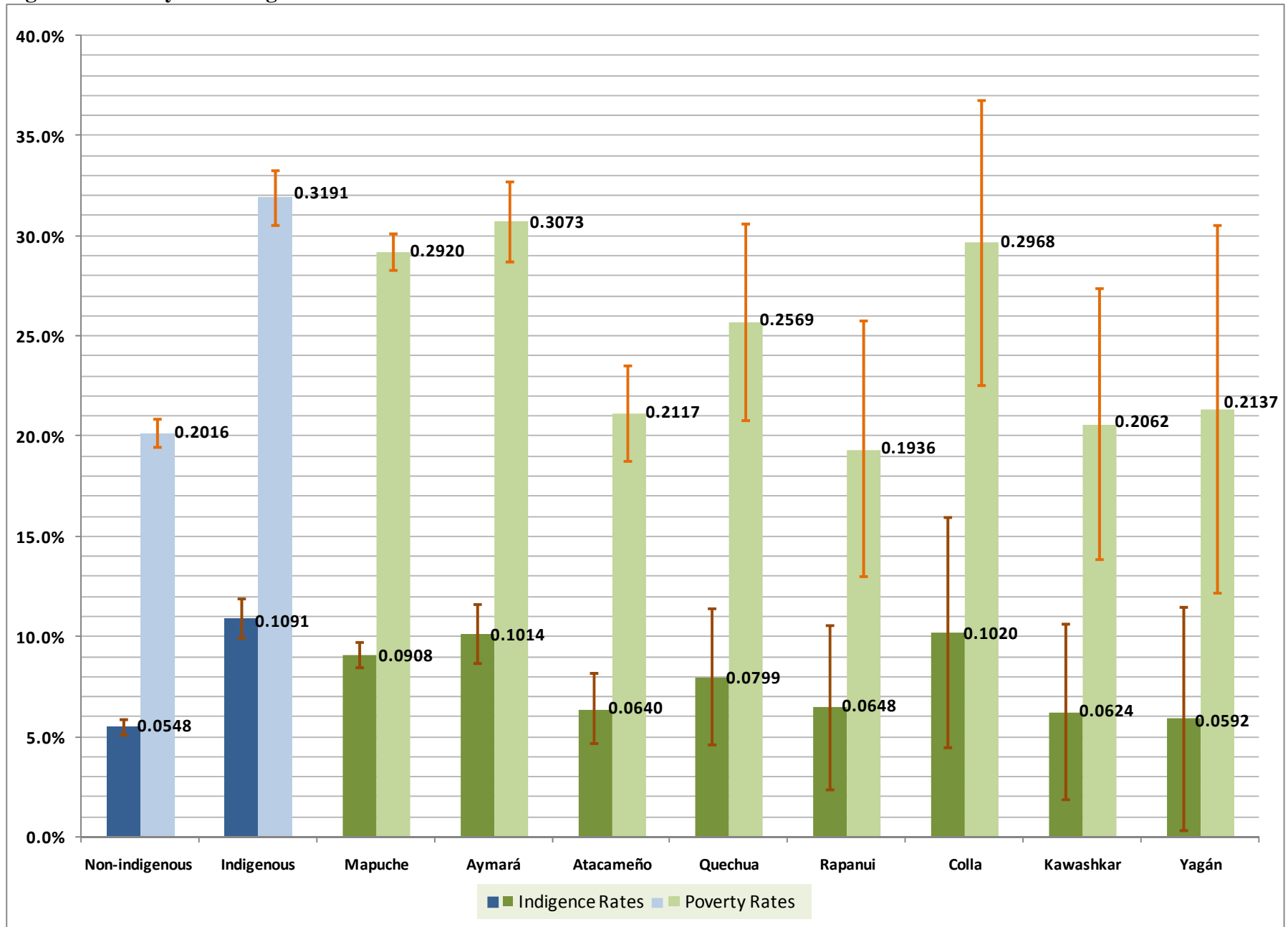


Figure 4: Poverty and Indigence Rates at the National Level with 90% Confidence Intervals

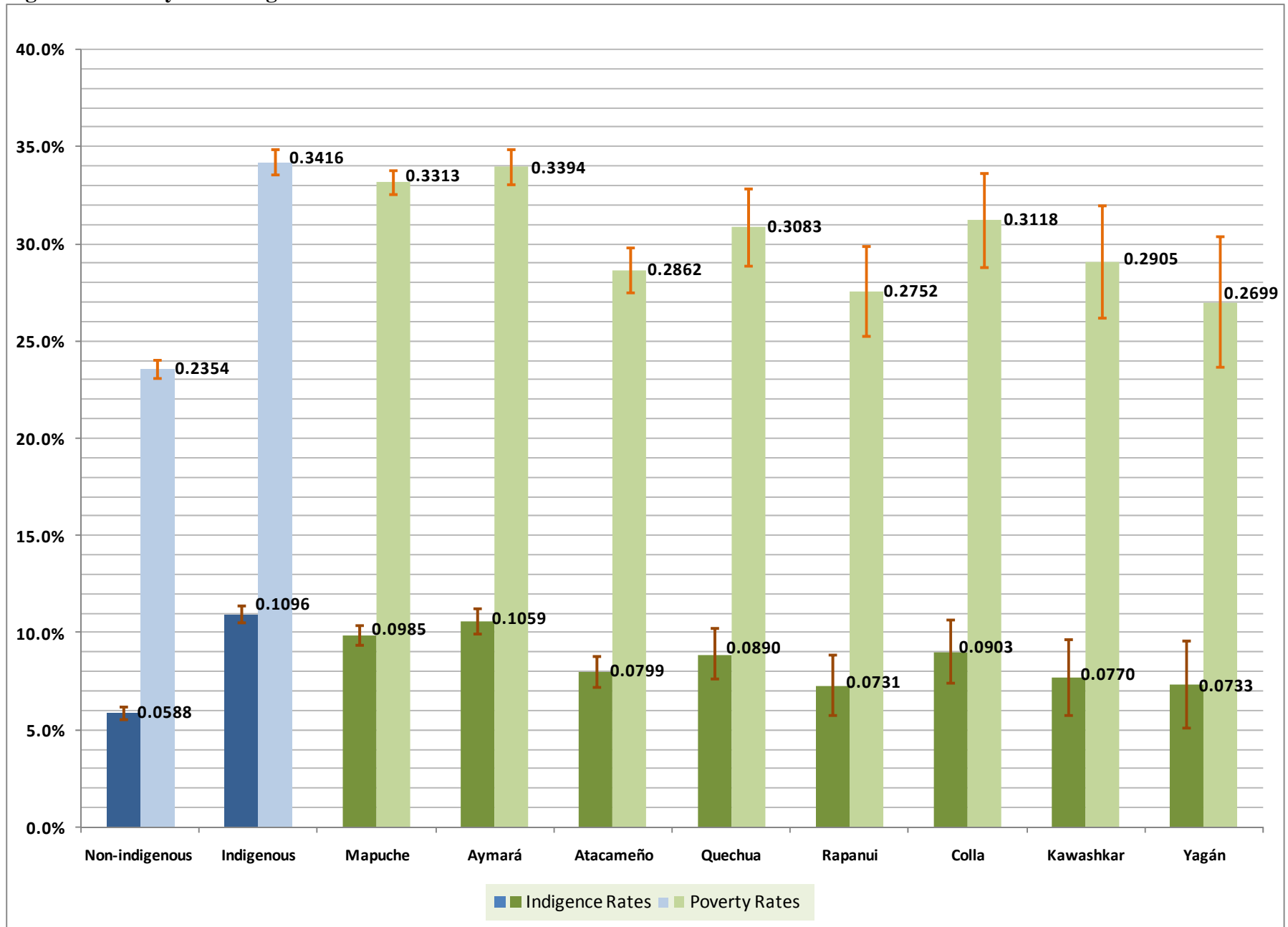


Figure 5: Poverty and Indigence Rates in Region XIII (Santiago) with 90% Confidence

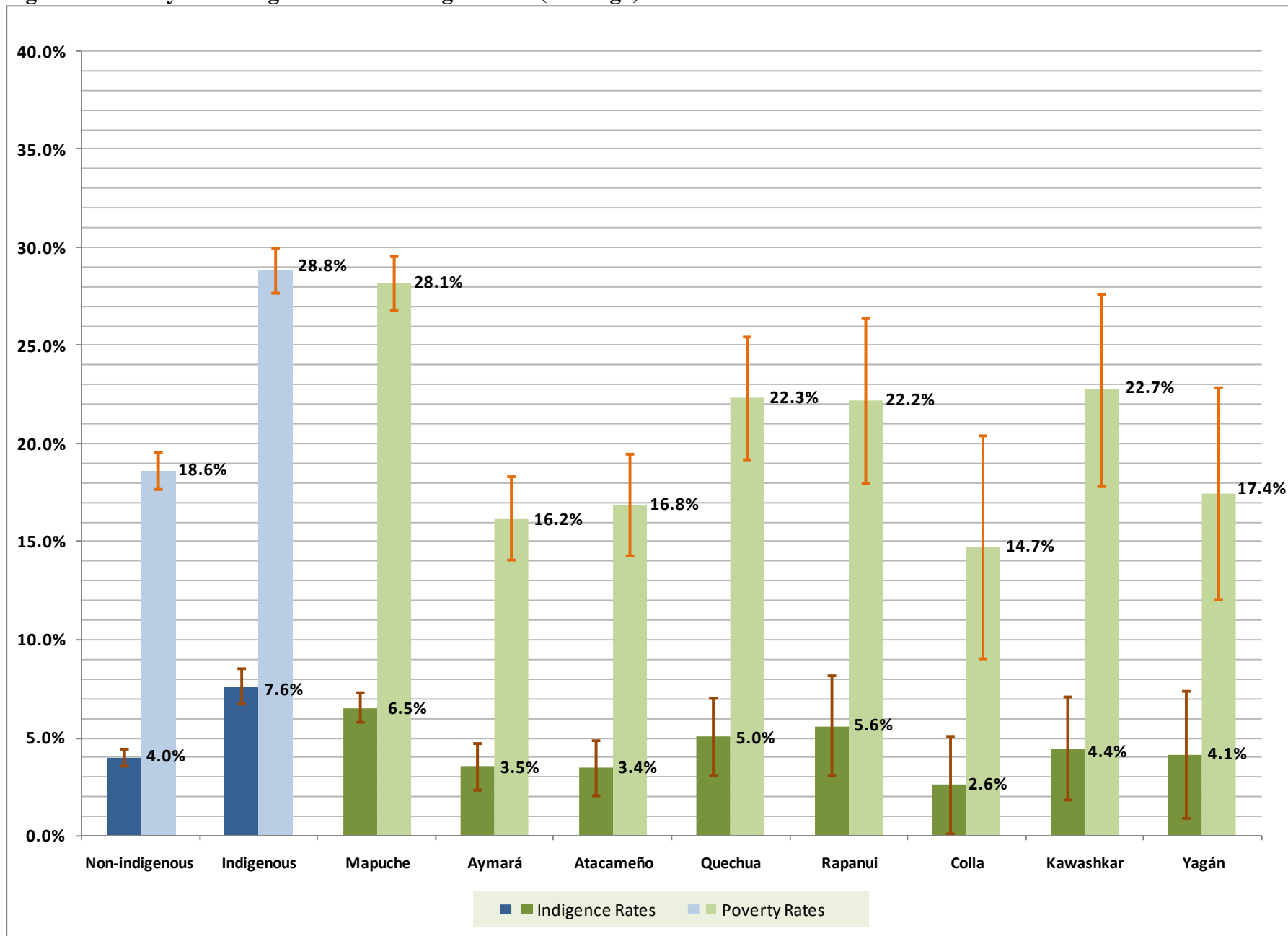
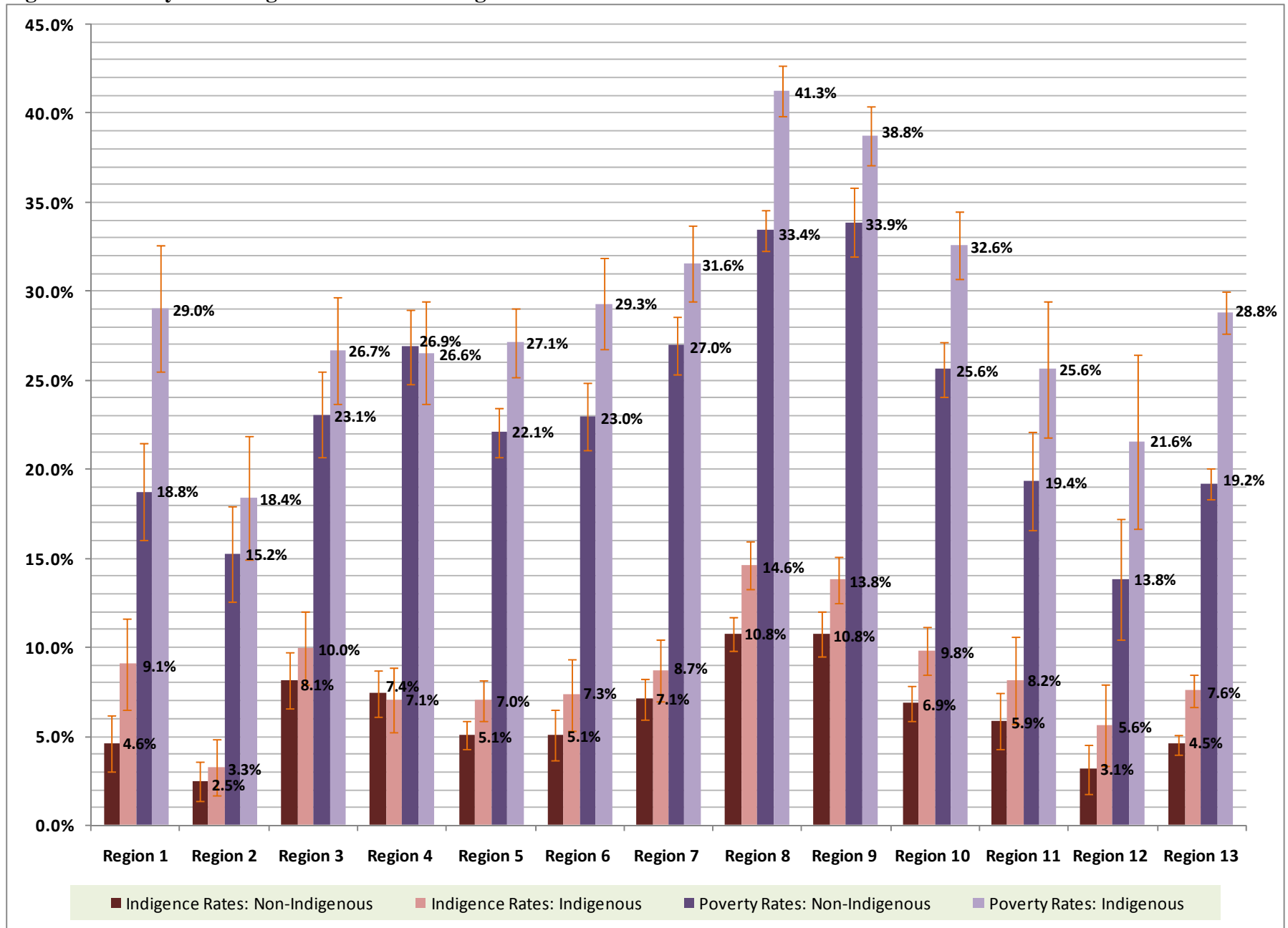


Figure 6: Poverty and Indigence Rates at the Regional Level with 90% Confidence Intervals



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