SMERU

Research Report

Asep Suryahadi
Wenefrida Widyanti
Rima Prama Artha
Daniel Perwira
Sudarno Sumarto

Developing a Poverty Map for Indonesia:

A Tool for Better Targeting in Poverty Reduction and Social Protection Programs

Book 1:
Technical Report

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For further information, please contact SMERU, Phone: 62-21-31936336; Fax: 62-21-31930850; E-mail: smeru@smeru.or.id; Web: www.smeru.or.id

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Asep Suryahadi
Wenefrida Widyanti
Rima Prama Artha
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Abstract

Experience shows that locating the target for poverty reduction and social protection programs is one of the most crucial and difficult problems in the implementation of these programs. In Indonesia – a populous country which is very large in size, and where poverty statistics are reliable only down to the provincial-urban/rural level – geographic targeting of the poor is not an easy undertaking. Significant efforts to map poverty at small administrative areas in Indonesia only started in the mid 1990s.

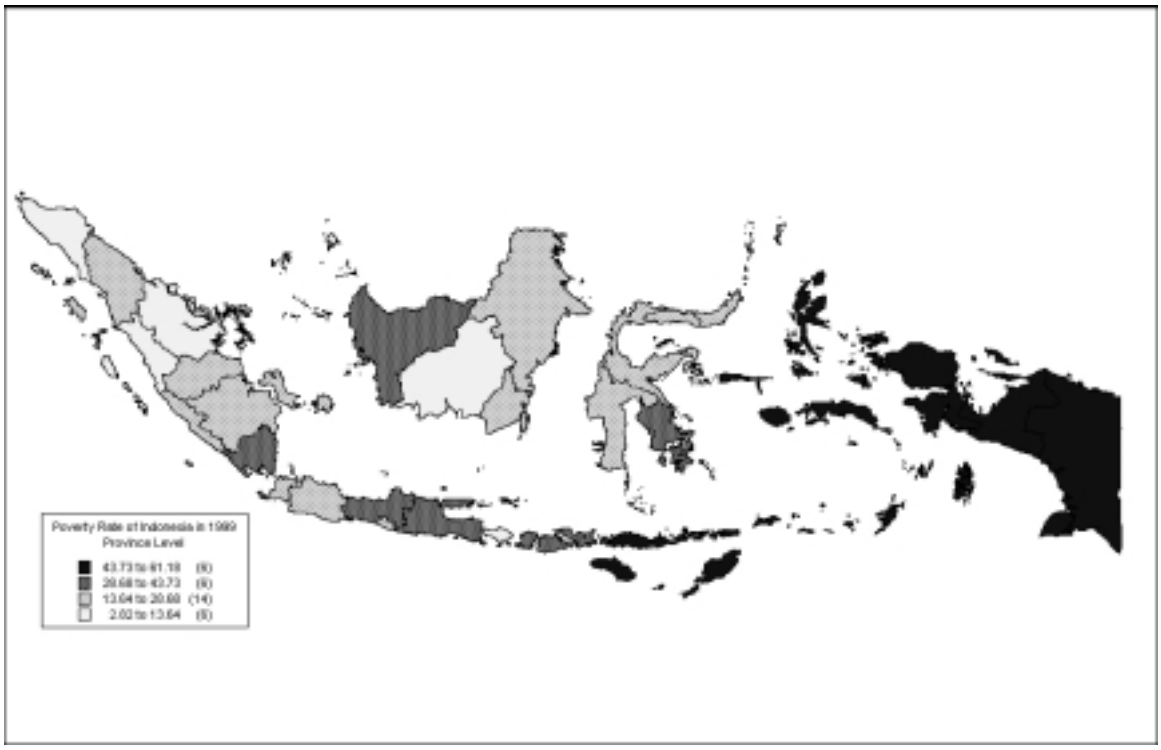
Recently, an effort has been made to create a poverty map of Indonesia using a newly developed ELL (Elbers, Lanjouw, and Lanjouw) method. Through a competitive grant from the Ford Foundation's "Regional Research Initiative on Social Protection in Asia", the SMERU Research Institute has completed the application of this poverty mapping method to all provinces in Indonesia. The final result of this work is a poverty map for the whole country, disaggregated at provincial, district, subdistrict, and village levels.

This report describes the aforementioned effort to develop poverty maps of all provinces in Indonesia. Overall, this report consists of four volumes, respectively: (i) Technical Report; (ii) Results of Model Estimations; (iii) Poverty Estimates; and (iv) Field Verification. In addition, a CD-Interactive visualizing the poverty maps is also available as an integral part of this report.

I. BACKGROUND

Experience shows that locating the target of various poverty reduction and social protection programs – the poor and vulnerable groups – is one of the most crucial and difficult problems in the implementation of these programs.[1] In Indonesia, a country with a large size and population, and where poverty statistics are reliable only down to the provincial-urban/rural level, geographic targeting of the poor is even more difficult. For example, Figure 1 shows the poverty map of Indonesia based on the available estimates of poverty rates at the provincial level.[2] While this map is useful for identifying poverty differentials across broad regions – it shows that the provinces in the eastern part of Indonesia are the poorest regions in the country – it is less useful for the purposes of practical program targeting or budget allocation.

Figure 1. Poverty Map of Indonesia Based on Provincial Poverty Rates



In 1999, it was estimated that more than 27 percent out of a total population of around 200 million was considered to be living in absolute poverty.[3] In addition, around one third to one half of the population was considered vulnerable to poverty, implying that they could easily fall into poverty when negative shocks occur.[4] Consequently, poverty reduction efforts will continue to be an important endeavor in Indonesia, even long into

[1] See Bigman and Fofack (2000), van de Walle (1998).

[2] The estimates of provincial poverty rates are taken from Pradhan *et al.* (2001).

[3] Pradhan *et al.* (2001).

[4] Suryahadi and Sumarto (2003), Pritchett *et al.* (2000).

the future. Therefore, there is an urgent need to develop tools for more effective geographic targeting of the poor than those that have been used in the past.
Ideally, geographic targeting would be based on a description of poverty incidence and other indicators of economic welfare at small areas or low administrative levels. More generally, the analysis of poverty and welfare in a country could benefit tremendously from detailed and disaggregated data on the distribution of economic welfare. In the context of Indonesia, administrative levels go from the upper national level all the way down to the 'village' level (*desa/kelurahan*).[5]

Such detailed poverty maps at small administrative areas provide benefits to help address the shortcomings of aggregate poverty profiles in many ways. Poverty analysis is often based on national level indicators that are compared over time or across countries. The broad trends that can be identified using aggregate information are useful for evaluating and monitoring the overall performance of a country. For many policy and research applications, however, the information that can be extracted from aggregate indicators is not sufficient. This is because they hide significant local variations in living conditions within countries.

Poverty maps at small administrative areas can greatly enhance and sharpen poverty analysis. First, small area poverty maps obviously can reveal the variations in local poverty levels. Almost all countries in the world have regions that are better off and others that are lagged behind. Such differences are often obscured in national level statistics – a problem that is particularly critical in large and heterogeneous countries such as Indonesia.

Second, poverty maps can improve targeting of interventions, so that resources can be used more effectively. Poverty maps have the potential to reduce the risk of leakage of benefits from a program to non-poor households. Similarly, they can also reduce the risk of under-coverage that poor households will be missed by a program.

Third, poverty maps can help governments to state their policy goals objectively. Basing allocation decisions on observed geographic poverty data, rather than subjective rankings of regions, increases the transparency and credibility of government decision making. Poverty maps can therefore help limit the influence of special interests in allocation decisions. This is particularly relevant in the context of currently decentralized Indonesia. By increasing transparency, poverty maps can help prevent the regional autonomy policy from being hijacked by local elites.

Fourth, poverty maps can become an important tool for local empowerment and decentralization. Disaggregated information on human welfare and other locally relevant information is useful not only to governments and decision makers, but also to local communities. Poverty maps therefore provide local stakeholders with the facts that are required for local decision making and for negotiation with government agencies.

[5] The hierarchy of government administrative units in Indonesia below the central government are provinces (*provinsi*), districts (*kabupaten*) or cities (*kota*), subdistricts (*kecamatan*), and villages. A village which is located in a rural area is called a *desa*, while a village which is located in an urban area is called a *kelurahan*.

Fifth, poverty maps are useful tools to evaluate the impact of various interventions. In addition, poverty maps open up more opportunities to undertake detailed empirical research on the causal relationships between local poverty, income inequality, and various other social outcomes, both at the individual and the community levels.

Sixth, estimation of small area indicators of poverty allows their incorporation into geographical information systems (GIS). This feature of poverty maps facilitates the combination of poverty information with other indicators from policy-relevant subject areas. Examples are geographic databases of transport infrastructure, public service centers, access to input and output markets, or information on natural resources quality. Using geographic overlay techniques and spatial analysis methods, the newly constructed databases on poverty can thus be used to address a range of multidisciplinary questions. The databases can also be used by the private sector to guide them in determining the locations for new investment opportunities.

This report describes the efforts to develop small-area poverty maps in Indonesia. In particular, it focuses on the effort to develop a poverty map for the whole country that has been undertaken by the SMERU Research Institute, supported by the Ford Foundation's Regional Research Initiative on Social Protection in Asia. This study uses the relatively recent poverty mapping technique, the ELL (Elbers, Lanjouw, and Lanjouw) method. In principle, this method combines detailed information collected in a household survey with the complete population coverage of a population census. The final result of this study is a poverty map for the whole country, disaggregated at provincial, district/city, subdistrict, and village levels.

II. PAST EFFORTS TO MAP SMALL-AREA POVERTY IN INDONESIA

The efforts to map poverty at small administrative areas are a relatively new undertaking in Indonesia. In fact, although the majority of Indonesians were considered poor during the period preceding the1990s, poverty reduction was never explicitly set as a development goal in the first five rounds of the 'Five Year Development Plan' (Pelita I to V) between 1969 and 1994. Only in 1994, at the start of Pelita VI, did the government for the first time explicitly identify the target for the reduction and eventual elimination of poverty.[6]

To achieve this target, direct and indirect approaches were utilized. Among the direct poverty reduction programs launched, four of the major ones were: (i) The Presidential Instruction on Disadvantaged Villages (IDT); (ii) Family Welfare Development Program (Takesra/Kukesra); (iii) Income Generating Project for Marginal Farmers (P4K); and (iv) the twin Urban and Rural *Kecamatan* Development Programs (P2KP and PPK).

As part of the programs' designs to identify the target groups, some efforts to map small-area poverty in the country were also initiated. In particular, the IDT program and the Family Welfare Development Program undertook the first two major efforts to map poverty at small areas nationally. The IDT program was run from 1994 to 1997. The targeting approach used in the IDT program was to classify all villages in Indonesia into two categories: poor (backward) villages and non-poor villages. This means that the IDT program actually targeted poor areas rather than poor people.

The classification of villages into poor and non-poor was based on the PODES (Village Potential) database. PODES is a complete enumeration of all villages in the country, which is conducted by BPS (Statistics Indonesia). This village census mainly collects information on the presence (or absence) of infrastructure and facilities such as: types of road, health facilities, schools, market facilities, water supplies, electricity, telephone links, public toilets, etc.

In the IDT village classification method, village characteristics measured in Podes were given scores ranging from 0 (undesirable) to 5 (most desirable). Based on a correlation analysis, a set of 25 relevant variables for urban areas and 27 variables for rural areas were used as the determining indicators. The determination of whether a village was poor or not was based on the range and standard deviation of village scores of those indicators within provinces, complemented by the personal evaluation and perceptions of the subdistrict head (*Camat*). Based on the 1993 Podes, BPS determined that 20,622 villages or 31 percent of all villages in Indonesia were classified as poor or backward villages. Of these poor villages, 19,615 villages or 95 percent were located in rural areas, while only 1,007 villages or 5 percent were located in urban areas.

[6] Sumarto *et al.* (1997).

However, when the distribution of these poor villages was compared with the distribution of poor people according to BPS own definition from the same time period, there were striking differences. First, the percentage of villages classified as poor (31 percent) was much higher than the percentage of population classified as poor (13.7 percent). Second, the geographic distributions of poor villages and poor people were markedly different. Whereas more than half of the poor people were found in Java, more than 70 percent of poor villages were located off Java. This means that poor areas do not perfectly identify the location of poor people. As also commonly found in other countries, a large number of the poor live outside poor areas and, on the other hand, a significant number of people who live in poor areas are not poor.

Meanwhile, the Family Welfare Development Program, which was managed by the Family Planning Coordinating Board (BKKBN), tried to target poor families directly. The BKKBN classified all families in Indonesia into five welfare categories: (i) Pre-Prosperous Families (*Keluarga Pra Sejahtera* or KPS), (ii) Prosperous Families Level I (*Keluarga Sejahtera* I or KS I), (iii) KS II, (iv) KS III, and (v) KS III+.[7] Poor families are often equated as the KPS families, but sometimes they are defined to include the KPS and the KS I families as well.

A family is classified as a KPS family if it does not meet any of the following five criteria: (i) all family members practice their religious obligations; (ii) all family members eat at least twice a day; (iii) all family members have a different set of clothing for work, school and visits; (iv) the largest part of house floor is not made of earth; and (v) sick family members and contraceptive users use modern medical services. To reach the highest welfare status of KS III+, a family has to satisfy a total of 22 indicators.

BKKBN claims to have data on these indicators for all Indonesian families, collected by its cadres all over the country. Even though the cadres are supposed to collect the data through direct household visits and interviews, in many cases they collect the information from neighborhood or community leaders (RTs and RWs). This has led some to doubt the accuracy and reliability of the data.

When the economic crisis hit Indonesia in mid 1997, and led to a worsening and chaotic situation during much of 1998, the government responded by establishing several social safety net programs. The majority of these programs – sale of subsidized rice, scholarships for school children, free medical services – use the BKKBN data to target their beneficiaries. It was realized that the static nature of the BKKBN indicators may not be able to capture shocks suffered by households. There was, however, no alternative household database available in the country.[8]

The use of BKKBN data for targeting of the social safety net programs partially contributes to the problems of under-coverage and leakage in the implementation of these programs.[9] This has led to the need to conduct a 'poverty census'. The main idea was that in this poverty census, households would be assessed on their poverty status. The purpose was to

[7] BKKBN (1994).

[8] Sumarto *et al.* (2003).

[9] Sumarto *et al.* (2002).

have a household database which was more suitable for targeting of poverty reduction programs than the existing BKKBN database.

The main obstacle to implementing this idea was, however, that a poverty census was considered too expensive. The initiative was then introduced to the provincial governments. Out of 30 provinces in Indonesia, three provinces – Jakarta, East Java, and South Kalimantan – were interested in implementing the idea. To facilitate the implementation and reduce costs, the poverty census in these three provinces was conducted at the same time and in conjunction with the Population Census 2000.

Although the original idea of a poverty census is to assess the poverty status of each household in the country, so that a very detailed poverty map down to the household level can be created, in practice the poverty status reported in the data was measured indirectly. Instead of directly measuring household income or expenditure, the poverty census used several indicators which were considered to represent the characteristics of the poor. In the poverty census in Jakarta, for example, seven indicators of poor households were used. Every household which matched any three out of the seven poverty indicators was classified as a poor household.

These indicators of poverty were obtained from the National Socio-Economic Survey (SUSENAS) data. Based on very detailed household consumption data from the three-yearly Consumption Module of SUSENAS, and using a standard poverty measurement method, poverty statistics in Indonesia are regularly calculated. The main limitation of these poverty statistics is, however, that they are representative only for a large area, which is the urban or rural area of a province. Therefore, they are deemed less useful for practical program targeting or budget allocation purposes.

To overcome this limitation of too broad an area of representation, BPS has also calculated district level poverty statistics based on the yearly-collected Core SUSENAS. The main weakness of these district poverty statistics, however, lies in the data itself. The Core SUSENAS only collects data on the value of household consumption of several aggregated consumption items.[10] This means that district level poverty lines cannot be directly calculated from the data as there is no information on prices and quantities of consumed items. BPS approximates the district level poverty lines from the province level poverty lines adjusted by food-share of average district level consumption. Despite the apparent weaknesses, this district level poverty map is widely used by government agencies for both program targeting and budget allocation purposes.[11]

[10] This results in lower estimates of household consumption than the estimates from SUSENAS Consumption Module by around 15 percent. See Sumarto *et al.* (2002).

[11] Recently, this Core SUSENAS-based district level poverty map and other district level statistics have been published by the National Development Planning Agency (Bappenas, 2003).

III. NEW SMALL-AREA POVERTY MAPPING INITIATIVE

Village level information on the distribution of economic welfare can be obtained by carrying out a household survey that is representative of all villages in Indonesia. However, with a total of around 70,000 villages in Indonesia, such a household survey is prohibitively large and expensive to carry out. For comparison, the current poverty statistics in Indonesia are based on the Consumption Module of SUSENAS, which has a sample size of only around 65,000 households.

Fortunately, as a result of recent methodological advances in small area poverty mapping, a new methodology has been developed to estimate poverty using statistical data collections that are normally available in a country.[12] Following the names of its proponents, the method is called the ELL method, an acronym of Elbers, Lanjouw and Lanjouw.[13] The core of the method is to combine the information obtained from a household survey with the information collected through a population census.

This method has been successfully implemented in other countries, in particular in South Africa and Ecuador.[14] These early applications of the method have shown that the method can be implemented if the required data sources are available. The results also indicate that the standard errors of the estimation for small area statistics are reasonably acceptable. Finally, the maps produced have been found to be very useful for various purposes. These successful examples have therefore encouraged the application of the method to other countries, including Indonesia.

3.1. Methodology

3.1.1. Basic Methodology

A household survey usually collects very detailed information on household characteristics, including its consumption level, but the coverage is generally limited and only representative for a relatively large geographical unit. On the other hand, a population census has a complete coverage of all households, but usually collects very limited information on household characteristics. The developed methodology tries to combine the advantage of detailed information on household characteristics obtained from a household survey with the complete coverage of a population census.

By combining the respective strengths of survey and census data, the ELL method aims to estimate welfare indicators for small administrative areas. The approach uses household survey data to estimate a model of per capita consumption expenditure (or any other household or individual-level indicator of wellbeing) as correlates of variables that are available in both the household survey and the population census.

[12] See Elbers *et al.* (2001) and Hentschel *et al.* (2000).

[13] See Davis (2004).

[14] Elbers *et al.* (2001).

The resulting parameter estimates from this procedure are then used in a simulation to predict per capita consumption for each household in the census. Using the predicted per capita consumption, household level measures of poverty and inequality are then calculated and aggregated for small areas, such as districts/cities, subdistricts or villages.

Importantly, the method allows for calculation of standard errors for whichever welfare measure is estimated. This feature is critical in that it offers a means to assess the statistical reliability of the estimates as well as of comparisons of estimates for different communities.

There are several other methods available to develop small area poverty maps.[15] However, in the context of Indonesia, the ELL method provides some benefits relative to other methods. First, poverty maps obtained through the ELL method can provide poverty estimates down to subdistrict and village levels. These are much higher resolution maps compared to the SUSENAS-based provincial and district level poverty maps. Second, poverty maps obtained through the ELL method are calculated based on household income or expenditure, that are direct measures of household welfare. This is different from BKKBN and poverty census data which both use indirect welfare measures in the forms of indicators of poverty. Third, poverty maps obtained through the ELL method also provide the standard errors of the estimates, which are the measure of precision of the poverty estimates calculated. Fourth, the ELL method uses existing data and so it does not require a new effort to collect data. On the other hand, this increases the utilization of existing data.

3.1.2. Consumption Model

Following *Elbers et al*. (2001, 2002), the empirical model of household consumption is defined as:

$$\ln y_{vh} = E(y_{vh} \mid x_{vh}) + u_{vh} \qquad (1)$$

where $\ln y_{vh}$ is the logarithm of per capita consumption of household *h* in village *v*, x_{vh} is a vector of observed characteristics of this household (including village level variables), and u_{vh} is the error term. Note that u_{vh} is uncorrelated with x_{vh}. This model is simplified by using a linear approximation to the conditional expectation $E(y_{vh} \mid x_{vh})$ and decomposing u_{vh} into uncorrelated terms:

$$u_{vh} = \eta_v + \varepsilon_{vh} \qquad (2)$$

where η_v represents a village level error term common to all households within the village, and ε_{vh} is a household specific error term. It is further assumed that η_v is uncorrelated across villages and ε_{vh} is uncorrelated across households.

With these assumptions, equation (1) reduces to:

$$\ln y_{vh} = x_{vh}\beta + \eta_v + \varepsilon_{vh}. \qquad (3)$$

[15] See Davis (2004).

Estimation of the parameters underlying this equation, in particular the vector of parameters β and the distributional characteristics of the error terms, can be done by using standard tools from econometric analysis (Elbers *et al.*, 2002).

3.2. Pilot Study

In Indonesia, the new poverty mapping method was first introduced to a large audience consisting of policy makers, statisticians, academics, researchers, and the general public in a seminar held in BPS in June 2001. The speaker at the seminar was Peter Lanjouw from the World Bank, who highlighted the features of the method and provided examples of the applications of the method in other countries and also illustrated some uses of the poverty maps that had been produced.

The seminar sparked interest, among some participants of the seminar to utilize the method and apply it in Indonesia. In a follow up meeting, three institutions – BPS, the SMERU Research Institute, and the World Bank – got together and agreed to collaborate in an effort to apply the method and develop a poverty map of Indonesia. The ultimate purpose was to create high resolution poverty maps down to district/city, subdistrict, and village levels.

Through a grant from the World Bank and in cooperation with BPS, the SMERU Research Institute has successfully implemented a pilot study to create poverty maps in Indonesia. The objective was to test the feasibility of applying the new poverty mapping method in the context of Indonesia. Until then, the method had never been applied in a large country. Therefore, it was decided that the effort would be initiated through a pilot study, where the method would be applied to data from only three provinces out of the total 30 provinces in Indonesia.

When the pilot study was started in mid 2001, the 2000 Population Census data was not yet available. Hence, it was decided that the three pilot provinces would be selected simply on the basis of data availability. Chronologically, the provinces for which the data was first available and hence included in the pilot study were East Kalimantan, Jakarta, and East Java.[16] The pilot study was completed in May 2003 and the results showed that, given data availability, the ELL method can be applied in Indonesia.

[16] The report of the pilot study can be found in Suryahadi *et al.* (2003a and 2003b).

IV. MAPPING IMPLEMENTATION AND RESULTS

At the conclusion of the pilot study, SMERU submitted a proposal to continue developing a poverty map of Indonesia to a research competition held by the Ford Foundation through its "Regional Research Initiative on Social Protection in Asia". The SMERU's proposal was selected as one of the winners of the competition and as a result SMERU obtained a funding grant to continue the application of the poverty mapping method to the rest of provinces in Indonesia. This section summarizes the poverty mapping work that has successfully achieved its objective to create a poverty map for the whole country, disaggregated at provincial, district/city, sub-district, and village levels.

4.1. Data Sources

Four sources of data are used in this mapping work: (i) Consumption Module SUSENAS 1999; (ii) Core SUSENAS 1999; (iii) Population Census 2000; and (iv) PODES (Village Census) 2000. All of them were collected by BPS. In the consumption model estimation, the data on household consumption is obtained from the Consumption Module SUSENAS, the data on household characteristics is obtained from the Core SUSENAS, while the data on village-level characteristics is obtained from the PODES and village means of the Population Census.

SUSENAS, the National Socio-Economic Survey, is a nationally representative household survey, covering all areas of the country. A part of the SUSENAS is conducted every year in February, collecting information on the characteristics of over 200,000 households and 800,000 individuals. This part of the SUSENAS is known as the Core SUSENAS. Another part of the SUSENAS is conducted every three years, specifically collecting information on very detailed consumption expenditure from around 65,000 households. This is known as the Consumption Module of SUSENAS.[17] The sample households are a randomly selected subset of the 200,000 households in the Core SUSENAS sample of the same year.

Population Census 2000 is the fifth population census conducted in Indonesia since its independence. The previous censuses were conducted in 1961, 1971, 1980, and 1990. The 2000 population census was conducted in June, covering all population living in the territory of Indonesia. Data on 15 demographic, social, and economic variables at both individual and household levels were collected in the census.

PODES, meanwhile, is a complete enumeration of villages throughout Indonesia. The information collected through this village census only includes village characteristics such as size of area, population, infrastructure and local industries. The questionnaires are filled out by the local subdistrict officials who are responsible for collecting statistical data (*mantri statistik*). The information is obtained from official village documents as well as interviews with village officials. The PODES survey is usually conducted three times in every ten years, usually prior to and as a preparation for an agricultural census, an economic census, and a population census. A PODES survey was conducted in September

[17] During the two years in between, BPS conducts two other modules of SUSENAS.

and October 1999 as a preparation for the population census in 2000.[18] In total, the PODES 2000 enumerates 68,783 villages.

4.2. Implementation Procedure

As a result of the previous pilot study, a standard procedure to utilize the ELL method to develop a poverty map has been formulated. The same procedure is adopted in this work. This procedure consists of five steps:

Step 1: Matching Variables in the Survey and the Census
In order to obtain rigorous estimates of consumption levels of the households in the census, the explanatory variables selected in the consumption correlates model have to be measured in the same way in both the household survey and in the population census. If the sample of the household survey is randomly selected and nationally representative, and if the timing of the survey and that of the census are not too far apart, the distribution of each explanatory variable in the household survey can be expected to be the same as its distribution in the census.

Step 2: Selecting Explanatory Variables for the Consumption Model
The selection of the explanatory variables in the consumption model starts by running a regression of log per capita consumption on the matched variables identified in Step 1, plus some variables that can be created from those variables (for example, the square and cube of household size). In order to obtain a robust specification, variables are only selected for inclusion in the model if they contribute significantly to the explanation of per capita consumption. Hence variables with low statistical significance are dropped from the model.

After a promising set of variables has been selected in this way, the regression is run again and the residuals of this regression are saved. These residuals need to be scrutinized to check if there are some outliers in the observation. If indeed there are some residual values which are far out of the range of most residual values, then these observations must be checked for coding or other errors. Ultimately, it may be necessary to delete them from the data.

The next step is to select village-level independent variables to complete the consumption model specification. The village level variables are obtained from either the population census data aggregated at the village level (for example the total population or means of age of household heads in each village) or from the village census (PODES) data. These variables are then grouped into several sets such as demographic variables, village infrastructure variables and village economic variables.

The residuals of the last regression are then aggregated at the village level to calculate the mean of these residuals for each village. The variable selection is then done by running separate regressions of the village-level mean of residuals on each set of the village-level variables. The variables with significant t-values are selected as the candidates for inclusion in the consumption model.

[18] Although conducted in 1999, officially it is called PODES 2000.

The feasibility of including these candidate village-level variables in the consumption model is tested by running regressions of village dummy variables on these variables. One regression is run for each village dummy variable. If the coefficient of a certain variable in a regression is one, it shows that there is a perfect multicollinearity between this variable and the village dummy variable. This will happen if, for example, a village has a certain infrastructure while no other villages have, or on the other hand, all villages except one have a certain infrastructure. Such variables are necessarily excluded from the model.

Step 3: Estimating the Consumption Model

The result of step 2 is a complete specification of the consumption model, incorporating both household-level and village-level independent variables of the model. The next step is to test whether there is heteroscedascity in the data. This will determine the method to be employed to estimate the model. The first step to do this is to estimate the model of equation (3) using Ordinary Least Squares (OLS) and save the residuals as a variable $\hat{u}_{vh}$. Based on equation (2) the residuals $\hat{u}_{vh}$ are then decomposed into uncorrelated components as:

$$\hat{u}_{vh} = \hat{u}_{v\bullet} + \left(\hat{u}_{vh} - \hat{u}_{v\bullet} \right) = \hat{\eta}_{v} + e_{vh} \qquad (4)$$

To investigate the presence of heteroscedasticity in the data, a set of potential variables that best explain the variations in e_{vh}^2 are used to estimate the following logistic model:

$$\ln\left[\frac{e_{vh}^2}{A - e_{vh}^2} \right] = z_{vh}^T \hat{\alpha} + r_{vh} \qquad (5)$$

where we take A equal to $1.05 * \max\left\{ e_{vh}^2 \right\}$ as in Elbers *et al.* (2002). This specification puts bounds on the predicted variance of ε_{vh}^2.

In the case where homoscedasticity is rejected, a household specific variance estimator for ε_{vh} is calculated as:

$$\hat{\sigma}_{\varepsilon,vh}^{2} = \left[\frac{AB}{1+B} \right] + \frac{1}{2} \hat{\mathrm{Var}}(r) \left[\frac{AB(1-B)}{(1+B)^3} \right] \qquad (6)$$

where $B = \exp\left\{ z_{vh}^T \hat{\alpha} \right\}$. The consumption model is then re-estimated using the Generalized Least Squares (GLS) method, utilizing the estimated variance-covariance matrix, $\hat{\Sigma}$, resulting from equation (6) and weighted by the population weight, l_{vh}. The estimated parameters, $\hat{\beta}_{GLS}$, and their variance, $\mathrm{Var}\left(\hat{\beta}_{GLS} \right)$, are saved for use in the simulation.

Step 4: Simulations on Census Data

The purpose of this step is to apply the parameters estimated in the previous step to the census data. However, since the values of these parameters are obtained through estimations, they are not the precise values of these parameters and subject to sampling error. This needs to be taken into account in applying the parameters to the census data

by taking into account the sampling error of the coefficient estimates. To start, recall that the purpose is to calculate the simulated version of equation (3):

$$\ln y_{vh}^{s} = x_{vh}\beta^{s} + \eta_{v}^{s} + \varepsilon_{vh}^{s} \qquad (7)$$

where the superscript *s* refers to simulated version of each parameter or variable and now x_{vh} refers to characteristics of the households in the population census data.

Simulation of β. The simulated value of β is obtained through a random draw, assuming $\beta \sim N\left(\hat{\beta}_{GLS}, \text{Var}\left(\hat{\beta}_{GLS}\right)\right)$. Note that the draw has to take into account the covariance across β's. The randomly drawn parameter is defined as β^{s}. The next step is then to apply this simulated parameter to each household in the census data to calculate the value of $x_{vh}\beta^{s}$.

Simulation of η_{v}. The process of obtaining the simulated value of η_{v} requires two steps of simulations. This is because the variance of η itself is estimated with error. Hence, the first step is to obtain the simulated variance of η, σ_{η}^{2s}. Elbers *et al.* (2002) propose to draw σ_{η}^{2s} from a gamma distribution: $\sigma_{\eta}^{2} \sim G\left(\hat{\sigma}_{\eta}^{2}, \hat{\text{Var}}\left(\sigma_{\eta}^{2}\right)\right)$. Accordingly, a random draw of the variance for the whole sample is exercised and its mean is defined as σ_{η}^{2s}. Then the second step is to randomly draw η_{v}^{s} for each village in the census data, assuming $\eta_{v} \sim N\left(0, \sigma_{v}^{2s}\right)$.

Simulation of ε_{vh}. The process of obtaining the simulated value of ε_{vh} requires the use of the results of estimation of equation (5). Assuming $\alpha \sim N\left(\hat{\alpha}, \text{Var}\left(\hat{\alpha}\right)\right)$, a random draw of α is made and defined as α^{s}. Like in the case of β, the draw has to take into account the covariance across α's. The simulated parameter is then used to simulate the household specific variance estimator for ε_{vh} as defined in equation (6) for each household in the census data. Finally, the simulated value of household specific idiosyncratic shock, ε_{vh}^{s}, for every household in the census data is obtained by taking a random draw, assuming $\varepsilon_{vh} \sim N\left(0, \sigma_{vh}^{2s}\right)$.[19]

Collecting. Now all the three components of equation (7) have been simulated, the value of $\ln y_{vh}^{s}$ for all households in the census data can be calculated by summing up the values of $x_{vh}\beta^{s}$, η_{v}^{s}, and ε_{vh}^{s} that have been obtained. The whole set of simulations is then repeated a number (100) of times, so that in the end a database of 100 simulated values of (log) per capita household expenditure of all the households in the census data is created.

[19] Elbers *et al.* (2002) mention alternatives for the assumption that the error component terms follow normal distributions. In separate sets of simulations we have experimented with these alternative assumptions. In no case did this lead to significantly different results.

Step 5: Calculation of Poverty and Inequality Indicators

The final output of Step 4 is a database of 100 simulated values of household expenditure of all households in the census data. This database is used as the basis for calculating point estimates and standard errors of various poverty and inequality measures at the provincial, district, sub-district, and village levels. The point estimate of each measure is the mean of the calculated measure over the 100 simulated household expenditure. Meanwhile, the standard error of this estimate is equal to the standard deviation of the calculated measure over the 100 simulated household expenditure. The welfare indicators of a region – at any level – is calculated directly from the data of all individual households residing in that region.[20]

4.3. Results

The overall procedure is applied separately for each region, where every province is divided into two regions: urban and rural areas. With a total of 30 provinces, and with the exception of Jakarta that only consists of urban region, overall there were 59 different applications of the method implemented in this study. The second volume of this report provides the results of variable matching between SUSENAS and Population Census as well as the results of both OLS and GLS estimations of the consumption correlates model for each of the 59 regions.

4.3.1. Poverty Estimates and Their Standard Errors

The final result of this study is a complete poverty map of Indonesia disaggregated at provincial, district/city, subdistrict, and village levels. The third volume of this report provides the estimated poverty rates and their standard errors for all provinces, districts/cities, subdistricts, and villages in the country.[21]

Table A1 in the Appendix compares the estimated headcount poverty rate for each region as calculated directly from the SUSENAS data and those estimated through the ELL method. In general, there is an increase in precision, as indicated by smaller standard errors, of the census-based ELL estimates compared to the SUSENAS-based estimates. This is a well-known phenomenon, employed extensively in the statistical technique of 'small-area estimation'.[22]

Table A1 shows the advantage of using the ELL method to increase the precision of poverty estimates. However, the real advantage of the poverty mapping method is its ability to produce poverty estimates and other welfare indicators at smaller areas – district/city, subdistrict, and village levels – than the aggregate provincial-urban/rural level presented in Table A1.

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[20] The application of this poverty mapping exercise from step 3 to 5 is implemented using a computer program called PovMap (Version 1.1a), which runs on the SAS computer software with at least BASE, STAT, ETS, and IML modules installed. The program is developed by Qinghua Zhao at the World Bank.

[21] This work has encountered some data problems in some provinces, notably Aceh and Papua. In particular, the data problem in Papua has made the estimations of poverty rates at the village level in this province could not be implemented.

[22] However, when the sample size in the SUSENAS is sufficiently large, the increase in the precision of the estimates is not large.

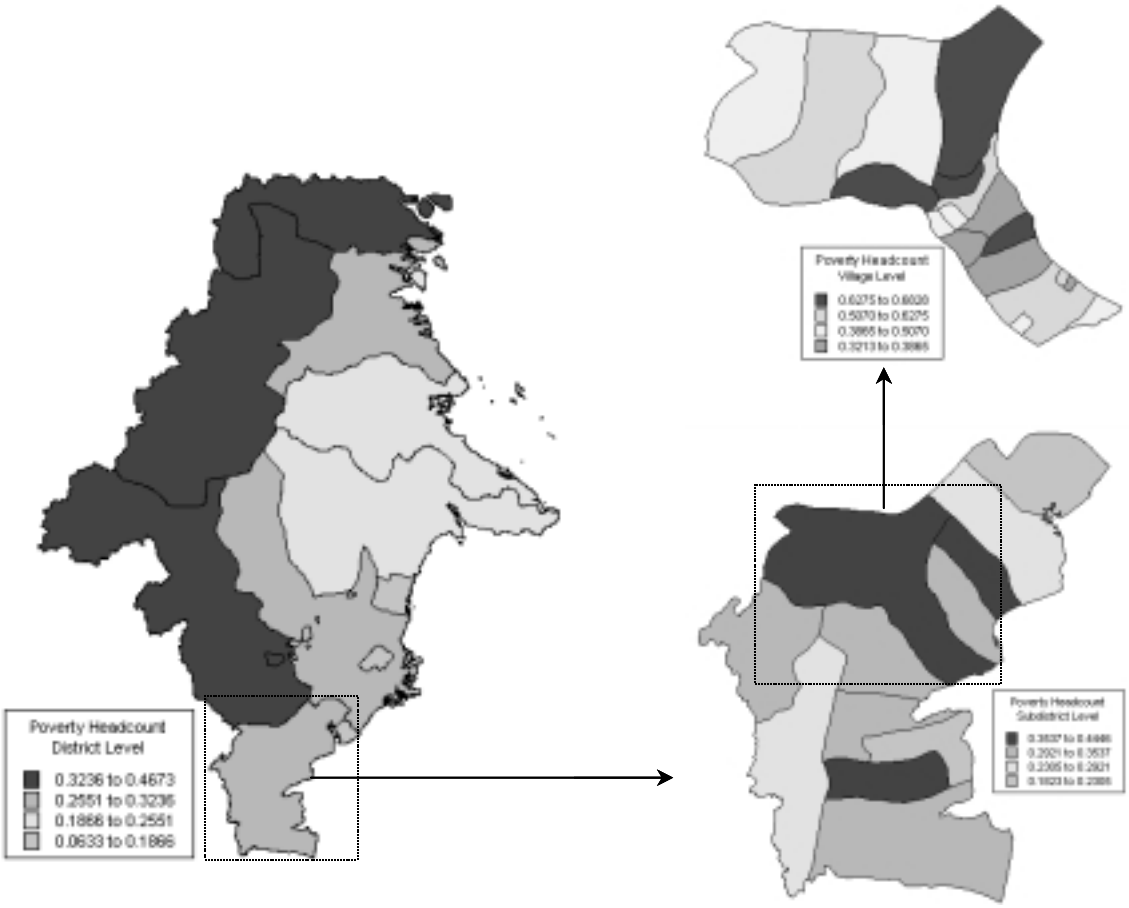
The first time availability of accurate welfare indicators at district/city, subdistrict, and village levels is already an achievement. But the real power of poverty mapping is in presenting the outcomes in a geographical map, making it possible to overlay the poverty data with all kinds of spatial characteristics. An Interactive-CD accompanying this report provides the visual representation of the table-form poverty maps presented in the third volume of this report.

Figure A1 in the Appendix shows the distribution of poverty in the island of Sumatra, with Figure (a) showing the poverty distribution by province, while Figure (b) shows the poverty distribution by district/city. Comparing the two figures clearly indicates that the heterogeneity of poverty within a province is quite large. Consequently, there are significant differences on the information conveyed by the two figures on the distribution of poverty in the island. Figures A2 to A6 provide the same information on poverty distribution for the islands of Java, Bali and Nusa Tenggara, Kalimantan, Sulawesi, and Maluku and Papua respectively.[23]

Furthermore, Figure 2 provides an example of the level of detail of the poverty map that has been developed in this study and available for the whole country in the accompanying CD-Interactive. Starting from the provincial and district/city poverty rates in Kalimantan island provided in Figure A4, one could examine further the distribution of poverty across subdistricts within a district/city. Finally, one could go down further to examine the distribution of poverty across villages within one subdistrict.

[23] When inspecting these maps it should be noted that they have been developed using the *expected* headcount. The *true* headcount for a location, however, will differ from the expected headcount because of sampling and modeling errors. It is important to note that the maps do not take the errors into account.

Figure 2. Detailed Poverty Map of a Province by District/City, Subdistrict, and Village



4.3.2. Measure of Precision of the Estimates

In addition to the estimated poverty rates, the results of this study also provide the standard errors of those estimates as a measure of their precision. Table A2 in the Appendix provides the summary statistics of the standard errors as a proportion of the point estimates for each province. For example, the table shows that the standard error at the provincial level ranges from 1.75 percent of the point estimate for South Kalimantan to 17.65 percent for Jakarta. Across districts/cities within a province, the mean of standard errors ranges from 2.36 percent of the point estimate for South Kalimantan to 37.45 percent for Riau. For the subdistrict level, the mean of standard errors ranges from 4.74 percent for South Kalimantan to 62.98 percent for Jakarta. Meanwhile, for the village level, the mean of standard errors ranges from 13.86 percent for South Kalimantan to 135.18 percent for Riau.

Table A2 indicates at least two observations about the standard errors. First, the magnitudes of the standard errors are clearly related to the population size. Hence, the lower the aggregation level, which implies the smaller the population size, then the larger the standard error of the estimate. Second, in general the range of standard errors at the

provincial, district/city, and subdistrict levels are reasonably acceptable. At the village level, however, there are great variations in the precision of poverty headcount estimates across villages within a province. This implies that the poverty mapping results for the village level need to be used with caution. For villages with high standard errors, other information is required to verify the estimates.[24]

In interpreting the statistics in Table A2, a word of caution is warranted, however. The proportion of standard error from point estimate can be high due to two different reasons: the large magnitude of the standard error or the small magnitude of the point estimate. A good example of the latter is the statistics for Jakarta. It appears that the estimates for Jakarta at various levels always have higher proportional standard errors compared to other provinces. This, however, is due to the fact that Jakarta has much smaller poverty headcount point estimates than other provinces. In such cases, it is better to examine the absolute magnitudes of the standard errors rather than their proportions from the point estimates.

4.3.3. Distribution of Small-Area Poverty

Poverty maps obviously can reveal the variation of welfare across areas. The higher the resolution of the map, then the greater the variation that can be revealed. The evidence of this can be seen in Table A3 in the Appendix, which shows the distribution of poverty rates at the district/city, subdistrict, and village levels by group of islands in Indonesia. On the island of Sumatra, for example, there is no district/city which has a poverty rate exceeding 50 percent. At the village level, however, 7.5 percent of villages do have poverty rates above 50 percent.

Similar patterns can also be found in other groups of islands. Interestingly, on the island of Sulawesi, a similar phenomenon but at the other end of the distribution is also observed. While there are only two percent of districts/cities in this island which have poverty rates below 10 percent, there are more than 14 percent of villages which have poverty rates below 10 percent.

[24] See the fourth volume of this report on the results of field verification of the poverty maps conducted in this study.

V. CONCLUDING REMARKS

Poverty reduction and social protection efforts will continue to be an important endeavor in Indonesia, even long into the future. Learning from past experiences with targeting difficulties in these efforts, there is clearly a need to develop tools for more effective geographic targeting than those that have been used in the past. Ideally, geographic targeting should be based on a description of poverty incidence and other indicators of economic welfare at small-areas or low administrative levels. However, obtaining social welfare data that is representative for small-areas could be prohibitively costly.

This report describes the application of the recently developed ELL poverty mapping method in Indonesia to create a poverty map for the whole country. The method estimates poverty measures and other welfare indicators for small areas using data that are already available, and hence does not require a new data collection effort. As a result of this work, a complete small-area poverty map of Indonesia is now available. In addition to its uses for program targeting and budget allocation, the availability of this map provides a wealth of data that opens avenues for investigating practical as well as research questions, which were impossible to answer previously.

This study has successfully calculated various poverty and inequality indicators at the provincial, district/city, subdistrict and village levels with reasonable – and better than SUSENAS based calculations of – standard errors. In particular, the standard errors at the provincial, district/city, and subdistrict levels are reasonably acceptable. At the village level, however, there are great variations in the precision of poverty headcount estimates across villages within a province. The implication of this is that the poverty mapping results for the village level need to be used with caution. For villages with high standard errors, other information is required to verify the estimates.

This implies that improving the quality of poverty maps produced is a challenge that needs to be addressed in the future. This is directly related to the need to improve the quality of data used in the exercise. In addition, one prospective avenue for improving the quality of maps produced is to incorporate GIS type data such as land use, land quality, rainfall, and so forth in the model. However, this requires an integration of BPS data with data produced by other institutions, which currently is difficult to implement.

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APPENDICES

Table A1. Estimates of Provincial Headcount Poverty Rates
Based on SUSENAS and ELL Poverty Mapping Method

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
Aceh:					
SUSENAS 1999:					
- Urban	10.41	3.96	38.04	401	1,782
- Rural	16.57	4.13	24.92	543	2,504
- Total	14.24	3.02	21.21	944	4,286
Poverty Mapping:					
- Urban	6.99	1.64	23.46	86,783	357,781
- Rural	14.47	1.76	12.16	262,065	1,128,760
- Total	12.67	1.73	13.65	348,848	1,486,541
North Sumatra:					
SUSENAS 1999:					
- Urban	11.53	2.02	17.52	1,226	5,750
- Rural	18.82	2.50	13.28	1,601	7,314
- Total	15.52	1.65	10.63	2,827	13,064
Poverty Mapping:					
- Urban	10.15	1.21	11.92	835,476	3,694,469
- Rural	16.81	1.52	9.04	1,600,085	7,079,967
- Total	14.52	1.42	9.78	2,435,561	10,774,436
West Sumatra:					
SUSENAS 1999:					
- Urban	9.13	2.73	29.90	489	2,040
- Rural	10.02	1.81	18.06	1,209	5,495
- Total	9.77	1.39	14.23	1,698	7,535
Poverty Mapping:					
- Urban	9.33	1.73	18.54	196,864	782,221
- Rural	9.09	1.04	11.44	803,478	3,338,692
- Total	9.14	1.20	13.13	1,000,342	4,120,913

Table A1. *Continued*

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
Riau:					
SUSENAS 1999:					
- Urban	8.28	2.69	32.49	780	3,437
- Rural	10.07	2.82	28.00	817	3,685
- Total	9.35	1.91	20.43	1,597	7,122
Poverty Mapping:					
- Urban	6.99	1.18	16.88	459,915	1,834,777
- Rural	12.09	1.79	14.81	587,941	2,473,163
- Total	9.92	1.56	15.73	1,047,856	4,307,940
Jambi:					
SUSENAS 1999:					
- Urban	15.81	3.78	23.91	470	2,093
- Rural	25.19	4.64	18.42	642	2,645
- Total	22.36	3.46	15.47	1,112	4,738
Poverty Mapping:					
- Urban	16.20	2.00	12.50	118,636	507,056
- Rural	20.96	2.70	12.88	471,833	1,879,614
- Total	19.95	2.57	12.88	590,469	2,386,670
South Sumatra & Bangka-Belitung:					
SUSENAS 1999:					
- Urban	15.57	2.65	17.02	688	3,040
- Rural	28.27	3.25	11.50	1,214	5,365
- Total	24.35	2.46	10.10	1,902	8,405
Poverty Mapping:					
South Sumatra:					
- Urban	17.83	2.14	12.00	276,465	1,226,030
- Rural	26.83	1.97	7.32	998,462	4,233,610
- Total	24.81	2.01	8.10	1,274,927	5,459,640
Bangka Belitung:					
- Urban	15.70	3.10	19.75	82,539	337,071
- Rural	22.30	2.56	11.48	106,418	454,145
- Total	19.48	2.80	14.37	188,957	791,216

Table A1. *Continued*

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
Bengkulu:					
SUSENAS 1999:					
- Urban	9.94	2.44	24.55	481	2,123
- Rural	25.51	5.29	20.74	516	2,105
- Total	20.99	4.13	19.68	997	4,228
Poverty Mapping:					
- Urban	10.43	2.05	19.65	93,205	378,771
- Rural	23.00	2.27	9.87	243,984	988,231
- Total	19.52	2.21	11.32	337,189	1,367,002
Lampung:					
SUSENAS 1999:					
- Urban	21.69	3.14	14.48	1,246	3,460
- Rural	41.27	3.49	8.46	735	5,446
- Total	37.48	2.98	7.95	1,981	8,906
Poverty Mapping:					
- Urban	20.00	2.37	11.85	321,213	1,376,145
- Rural	38.70	2.29	5.92	1,245,464	5,114,227
- Total	34.73	2.31	6.65	1,566,677	6,490,372
Jakarta:					
SUSENAS 1999:					
- Urban	2.82	0.62	21.99	2,959	12,460
Poverty Mapping:					
- Urban	2.98	0.53	17.78	2,204,219	8,246,736
West Java:					
SUSENAS 1999:					
- Urban	22.55	2.19	9.71	2,467	10,045
- Rural	32.21	1.83	5.68	4,180	15,297
- Total	27.57	1.39	5.04	6,647	25,342
Poverty Mapping:					
- Urban	25.19	1.37	5.44	2,740,413	11,339,964
- Rural	33.29	1.19	3.57	5,465,883	21,084,755
- Total	30.46	1.25	4.10	8,206,296	32,424,719

Table A1. *Continued*

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
Central Java:					
SUSENAS 1999:					
- Urban	23.89	1.80	7.53	2,796	11,679
- Rural	38.31	1.52	3.97	4,507	17,918
- Total	33.03	1.26	3.81	7,303	29,597
Poverty Mapping:					
- Urban	21.20	1.07	5.05	2,108,044	8,387,687
- Rural	33.11	0.85	2.57	5,568,954	21,822,840
- Total	29.81	0.92	3.09	7,676,998	30,210,527
Yogyakarta:					
SUSENAS 1999:					
- Urban	21.22	2.92	13.76	978	3,268
- Rural	38.40	3.49	9.09	1,261	4,780
- Total	27.09	2.44	9.01	2,239	8,048
Poverty Mapping:					
- Urban	22.70	1.52	6.70	562,134	1,780,527
- Rural	38.17	2.70	7.07	358,237	1,317,469
- Total	29.28	2.10	7.17	920,371	3,097,996
East Java:					
SUSENAS 1999:					
- Urban	19.51	1.73	8.87	3,250	12,535
- Rural	40.94	1.55	3.79	5,285	19,593
- Total	33.34	1.24	3.72	8,535	32,128
Poverty Mapping:					
- Urban	20.32	1.33	6.55	3,703,652	13,761,133
- Rural	40.07	1.29	3.22	5,655,930	20,730,848
- Total	32.10	1.31	4.08	9,359,582	34,131,981

Table A1. *Continued*

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
Banten:					
SUSENAS 1999:					
- Urban	10.91	3.32	30.43	500	2,083
- Rural	33.26	3.24	9.74	725	3,238
- Total	22.71	2.62	11.54	1,225	5,321
Poverty Mapping:					
- Urban	10.21	1.48	14.50	991,890	3,899,236
- Rural	33.71	2.49	7.39	876,434	3,704,990
- Total	21.66	2.04	9.42	1,868,324	7,604,226
Bali:					
SUSENAS 1999:					
- Urban	10.39	2.89	27.82	760	2,896
- Rural	15.75	2.31	14.67	1,134	4,490
- Total	13.68	1.86	13.60	1,894	7,386
Poverty Mapping:					
- Urban	8.08	1.05	13.00	233,575	866,895
- Rural	17.84	1.88	10.54	564,974	2,268,350
- Total	15.14	1.69	11.00	798,549	3,135,245
West Nusa Tenggara:					
SUSENAS 1999:					
- Urban	30.11	3.95	13.12	615	2,546
- Rural	44.72	2.96	6.62	1,286	5,066
- Total	41.79	2.49	5.96	1,901	7,612
Poverty Mapping:					
- Urban	31.50	2.79	8.86	322,896	1,253,112
- Rural	45.59	2.25	4.94	607,620	2,326,630
- Total	40.65	2.45	6.03	930,516	3,579,742

Table A1. *Continued*

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
East Nusa Tenggara:					
SUSENAS 1999:					
- Urban	32.13	4.83	15.03	492	2,558
- Rural	67.63	3.27	4.84	1,094	5,021
- Total	62.18	3.12	5.02	1,586	7,579
Poverty Mapping:					
- Urban	24.53	2.11	8.60	115,517	557,030
- Rural	70.06	1.83	2.61	622,391	2,957,184
- Total	62.84	1.87	2.98	737,908	3,514,214
West Kalimantan:					
SUSENAS 1999:					
- Urban	6.19	1.85	29.89	499	2,343
- Rural	37.55	3.49	9.29	1,298	6,036
- Total	30.07	3.0	9.98	1,797	8,379
Poverty Mapping:					
- Urban	6.63	0.98	14.78	165,973	745,902
- Rural	35.14	2.36	6.72	649,041	2,862,274
- Total	29.24	2.15	7.35	815,014	3,608,176
Central Kalimantan:					
SUSENAS 1999:					
- Urban	7.44	2.96	39.78	481	2,032
- Rural	11.81	3.54	29.97	553	2,311
- Total	10.49	2.61	24.88	1,034	4,343
Poverty Mapping:					
- Urban	7,53	2.26	30.01	78.125	297,432
- Rural	13.26	1.98	14.93	344,912	1,329,259
- Total	12.21	2.24	18.35	423,037	1,626,691

Table A1. *Continued*

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
South Kalimantan:					
SUSENAS 1999:					
- Urban	8.51	1.71	20.09	642	2,695
- Rural	27.75	3.50	12.61	917	3,537
- Total	21.65	2.68	12.38	1,559	6,232
Poverty Mapping:					
- Urban	9.18	1.27	13.83	223,050	849,232
- Rural	26.06	1.93	7.41	476,392	1,794,213
- Total	20.63	1.75	8.48	699,448	2,643,445
East Kalimantan:					
SUSENAS 1999:					
- Urban	9.09	3.38	37.18	442	1,882
- Rural	33.33	4.61	13.83	561	2,409
- Total	21.05	3.38	15.94	1,003	4,291
Poverty Mapping:					
- Urban	10.50	1.26	12.00	349,323	1,399,814
- Rural	33.72	3.28	9.73	271,593	1,062,777
- Total	20.52	2.35	11.47	620,916	2,462,591
North Sulawesi & Gorontalo:					
SUSENAS 1999:					
- Urban	14.99	5.51	36.76	358	1,332
- Rural	26.06	4.08	15.66	812	2.983
- Total	23.25	3.37	14.49	1,170	4,315
Poverty Mapping:					
North Sulawesi:					
- Urban	13.06	2.20	16.85	187,515	672,805
- Rural	19.61	2.05	10.45	327,768	1,209,813
- Total	17.27	2.11	12.22	515,283	1,882,618
Gorontalo:					
- Urban	24.81	3.55	14.31	53,883	208,819
- Rural	52.72	4.69	8.90	156,854	605,241
- Total	45.56	4.43	9.72	210,737	814,060

Table A1. *Continued*

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
Central Sulawesi:					
SUSENAS 1999:					
- Urban	14.81	3.46	23.36	471	2,182
- Rural	33.47	4.58	13.68	608	2,739
- Total	28.32	3.46	12.22	1,079	4,921
Poverty Mapping:					
- Urban	17.20	1.70	9.88	89,375	396,603
- Rural	36.13	2.36	6.53	374,768	1,606,511
- Total	32.38	2.24	6.92	464,143	2,033,114
South Sulawesi:					
SUSENAS 1999:					
- Urban	16.85	2.64	15.67	873	3,976
- Rural	26.40	2.82	10.68	1,173	5,157
- Total	23.30	1.95	8.37	2,046	9,133
Poverty Mapping:					
- Urban	18.35	1.74	9.48	491,517	2,174,138
- Rural	28.66	1.91	6.66	1,172,543	5,177,287
- Total	25.61	1.86	7.26	1,664,060	7,351,425
Southeast Sulawesi:					
SUSENAS 1999:					
- Urban	13.84	4.35	31.43	491	2,218
- Rural	44.38	5.81	13.09	601	2,720
- Total	36.62	4.44	12.12	1,092	4,938
Poverty Mapping:					
- Urban	18.62	1.22	6.55	81,902	363,808
- Rural	40.66	2.19	5.39	296,052	1,299,914
- Total	35.68	2.02	5.66	377,954	1,663,722

Table A1. *Continued*

Province & Area	Poverty Rate (%)	Standard Error (%)		Sample Size	
		Points	Proportion	Household	Individual
Maluku & North Maluku:					
SUSENAS 1999:					
- Urban	26.39	7.56	28.65	152	718
- Rural	57.28	9.48	16.55	118	587
- Total	44.62	7.34	16.45	270	1,305
Poverty Mapping:					
Maluku:					
- Urban	21.56	2.38	11.04	47,528	215,915
- Rural	67.32	1.68	2.50	164,808	793,962
- Total	57.53	1.85	3.22	212,336	1,009,877
North Maluku:					
- Urban	20.16	2.72	13.49	21,738	107,050
- Rural	62.85	5.05	8.04	99,143	493,915
- Total	55.25	4.72	8.54	120,881	600,965
Papua:					
SUSENAS 1999:					
- Urban	9.21	6.17	66.99	333	1,445
- Rural	72.58	5.73	7.89	372	1,529
- Total	56.97	6.86	12.04	705	2,974
Poverty Mapping:					
- Urban	10.91	1.76	16.13	60,041	236,494
- Rural	73.55	3.20	4.35	242,325	958,559
- Total	61.16	2.97	4.86	302,366	1,195,053

Source: Authors' computations. The standard errors on the SUSENAS-based headcount poverty rates are calculated by bootstrapping.

Table A2. Summary Statistics of Standard Error as a Proportion of Point Estimate for Headcount Poverty by Province

Province & Region	Mean	Std. Dev.	Minimum	Maximum	N
Aceh:					
- Province	0.1367	-	0.1367	0.1367	1
- District	0.3159	0.1261	0.1571	0.5235	13
- Subdistrict	0.4880	0.3994	0.1568	3.4042	103
- Village	1.2903	1.2385	0.0869	10.0000	1,964
North Sumatra:					
- Province	0.0980	-	0.0980	0.0980	1
- District	0.2077	0.0759	0.1224	0.4088	19
- Subdistrict	0.4126	0.1734	0.1355	1.0822	265
- Village	1.0635	0.4791	0.1450	10.0000	5,270
West Sumatra:					
- Province	0.1315	-	0.1315	0.1315	1
- District	0.2540	0.0962	0.1541	0.4871	5
- Subdistrict	0.3686	0.1130	0.1979	0.8481	120
- Village	0.9618	0.3348	0.3098	6.2868	2,157
Riau:					
- Province	0.1575	-	0.1575	0.1575	1
- District	0.3745	0.1557	0.2004	74.8295	15
- Subdistrict	0.5533	0.2293	0.2462	1.3671	96
- Village	1.3518	0.5202	0.3272	6.0431	1,452
Jambi:					
- Province	0.1289	-	0.1289	0.1289	1
- District	0.1863	0.0256	0.1580	0.2391	10
- Subdistrict	0.2706	0.0552	0.1730	0.4101	60
- Village	0.7110	0.1999	0.2136	1.6186	1,160
South Sumatra:					
- Province	0.0811	-	0.0811	0.0811	1
- District	0.1196	0.0323	0.0906	0.1791	7
- Subdistrict	0.2497	0.1105	0.1115	0.6948	87
- Village	0.8406	0.3337	0.1392	7.1343	2,627

Table A2. *Continued*

Province & Region	Mean	Std. Dev.	Minimum	Maximum	N
Bengkulu:					
- Province	0.1132	-	0.1132	0.1132	1
- District	0.1680	0.0596	0.2642	0.1212	4
- Subdistrict	0.2132	0.0856	0.4896	0.1031	31
- Village	0.6214	0.0391	0.1004	6.0391	1,150
Lampung:					
- Province	0.0665	-	0.0665	0.0665	1
- District	0.1289	0.0820	0.0749	0.3515	10
- Subdistrict	0.2013	0.0758	0.0787	0.4462	88
- Village	0.5921	0.2431	0.1417	3.2751	2,064
Bangka Belitung:					
- Province	0.1439	-	0.1439	0.1439	1
- District	0.2848	0.1118	0.1880	0.4072	3
- Subdistrict	0.3674	0.1246	0.2465	0.8267	23
- Village	0.8633	0.3674	0.1209	4.3083	324
Jakarta:					
- Province	0.1765	-	0.1765	0.1765	1
- District	0.2678	0.0169	0.2489	0.2885	5
- Subdistrict	0.6298	0.1471	0.4376	1.2109	43
- Village	1.2796	0.2489	0.7472	2.2276	265
West Java:					
- Province	0.0412	-	0.0412	0.0412	1
- District	0.1217	0.0584	0.0546	0.2445	22
- Subdistrict	0.2780	0.1090	0.0919	0.9474	447
- Village	0.7242	0.2555	0.0992	4.2638	5,733
Central Java:					
- Province	0.0308	-	0.0308	0.0308	1
- District	0.1120	0.0784	0.0539	0.3453	35
- Subdistrict	0.2346	0.0887	0.0927	0.6505	534
- Village	0.6542	0.2123	0.1996	7.6067	8,540

Table A2. *Continued*

Province & Region	Mean	Std. Dev.	Minimum	Maximum	N
Yogyakarta:					
- Province	0.0718	-	0.0718	0.0718	1
- District	0.0955	0.0108	0.0843	0.1063	5
- Subdistrict	0.2366	0.0944	0.1075	0.7510	75
- Village	0.4569	0.1923	0.1129	1.4311	438
East Java:					
- Province	0.0408	-	0.0408	0.0408	1
- District	0.1165	0.0515	0.0531	0.2063	37
- Subdistrict	0.2267	0.0887	0.0620	0.5624	621
- Village	0.5501	0.2029	0.0893	1.6867	8,412
Banten:					
- Province	0.0940	-	0.0940	0.0940	1
- District	0.1517	0.0739	0.0813	0.2497	6
- Subdistrict	0.2157	0.0905	0.0906	0.5091	96
- Village	0.3021	0.1838	0.0050	0.8712	1,476
Bali:					
- Province	0.1118	-	0.1118	0.1118	1
- District	0.2128	0.0619	0.1489	0.3614	9
- Subdistrict	0.3578	0.1054	0.1749	0.6260	53
- Village	0.8552	0.2871	0.2668	2.4542	677
West Nusa Tenggara:					
- Province	0.0245	-	0.0245	0.0245	1
- District	0.0364	0.0065	0.0247	0.0444	7
- Subdistrict	0.0762	0.0331	0.0360	0.2774	59
- Village	0.1573	0.0358	0.0428	0.3454	654
East Nusa Tenggara:					
- Province	0.0298	-	0.0298	0.0298	1
- District	0.0600	0.0403	0.0252	0.1889	14
- Subdistrict	0.0990	0.0607	0.0102	0.3525	122
- Village	0.2819	0.1871	0.0082	2.0955	2,297

Table A2. *Continued*

Province & Region	Mean	Std. Dev.	Minimum	Maximum	N
West Kalimantan:					
- Province	0.0287	-	0.0287	0.0287	1
- District	0.0361	0.0029	0.0318	0.0401	9
- Subdistrict	0.0790	0.0196	0.0331	0.1315	125
- Village	0.6258	0.2147	0.1654	1.7322	1,352
Central Kalimantan:					
- Province	0.1666	-	0.1666	0.1666	1
- District	0.3250	0.1300	0.1478	0.5068	6
- Subdistrict	0.4555	0.1595	0.1335	1.0676	76
- Village	1.1876	0.7185	0.1358	10.0000	1,135
South Kalimantan:					
- Province	0.0175	-	0.0175	0.0175	1
- District	0.0236	0.0046	0.0126	0.0291	10
- Subdistrict	0.0474	0.0142	0.0127	0.0920	114
- Village	0.1386	0.0440	0.0500	0.2249	2,103
East Kalimantan:					
- Province	0.1147	-	0.1147	0.1147	1
- District	0.1873	0.1040	0.0995	0.4572	12
- Subdistrict	0.2552	0.1108	0.1300	0.6618	87
- Village	0.5282	0.3586	0.1052	4.4104	1,102
North Sulawesi:					
- Province	0.12210	-	0.1221	0.1221	1
- District	0.20071	0.0636	0.1452	0.3013	5
- Subdistrict	0.33531	0.1257	0.1302	0.7278	72
- Village	0.93451	0.5342	0.1170	4.32568	1,152
Central Sulawesi:					
- Province	0.0693	-	0.0693	0.0693	1
- District	0.0987	0.0221	0.0713	0.1371	8
- Subdistrict	0.1693	0.0766	0.0685	0.6043	69
- Village	0.4623	0.2919	0.0678	4.9237	1,393

Table A2. *Continued*

Province & Region	Mean	Std. Dev.	Minimum	Maximum	N
South Sulawesi:					
- Province	0.0726	-	0.0726	0.0726	1
- District	0.1381	0.0349	0.0779	0.2476	24
- Subdistrict	0.2450	0.0898	0.1111	0.8240	197
- Village	0.7064	0.2740	0.2116	3.0938	3,066
Southeast Sulawesi:					
- Province	0.0565	-	0.0565	0.0565	1
- District	0.0905	0.0299	0.0561	0.1221	5
- Subdistrict	0.1796	0.0992	0.0666	0.5647	67
- Village	0.6150	0.6941	0.0221	10.0000	1,532
Gorontalo:					
- Province	0.0565	-	0.0565	0.0565	1
- District	0.0905	0.0299	0.0561	0.1221	5
- Subdistrict	0.1796	0.0992	0.0666	0.5647	67
- Village	0.6150	0.6941	0.0221	10.0000	1,532
Maluku:					
- Province	0.0322	-	0.0322	0.0322	1
- District	0.0680	0.0671	0.0316	0.1874	5
- Subdistrict	0.0714	0.0651	0.0183	0.2668	29
- Village	0.2175	0.4503	0.0000	4.4408	772
North Maluku:					
- Province	0.0855	-	0.0855	0.0855	1
- District	0.1062	0.0441	0.0771	0.2895	3
- Subdistrict	0.1329	0.0534	0.0634	0.2895	26
- Village	0.2605	0.1570	0.0260	1.2330	513
Papua:					
- Province	0.0485	-	0.0485	0.0485	1
- District	0.1131	0.1079	0.0320	0.4225	14
- Subdistrict	0.1126	0.0894	0.0201	0.5985	140
- Village	0.2348	0.3088	0.0260	10.0000	1,706

Table A3. Distribution of Headcount Poverty Rates at District, Subdistrict, and Village Levels by Island Group

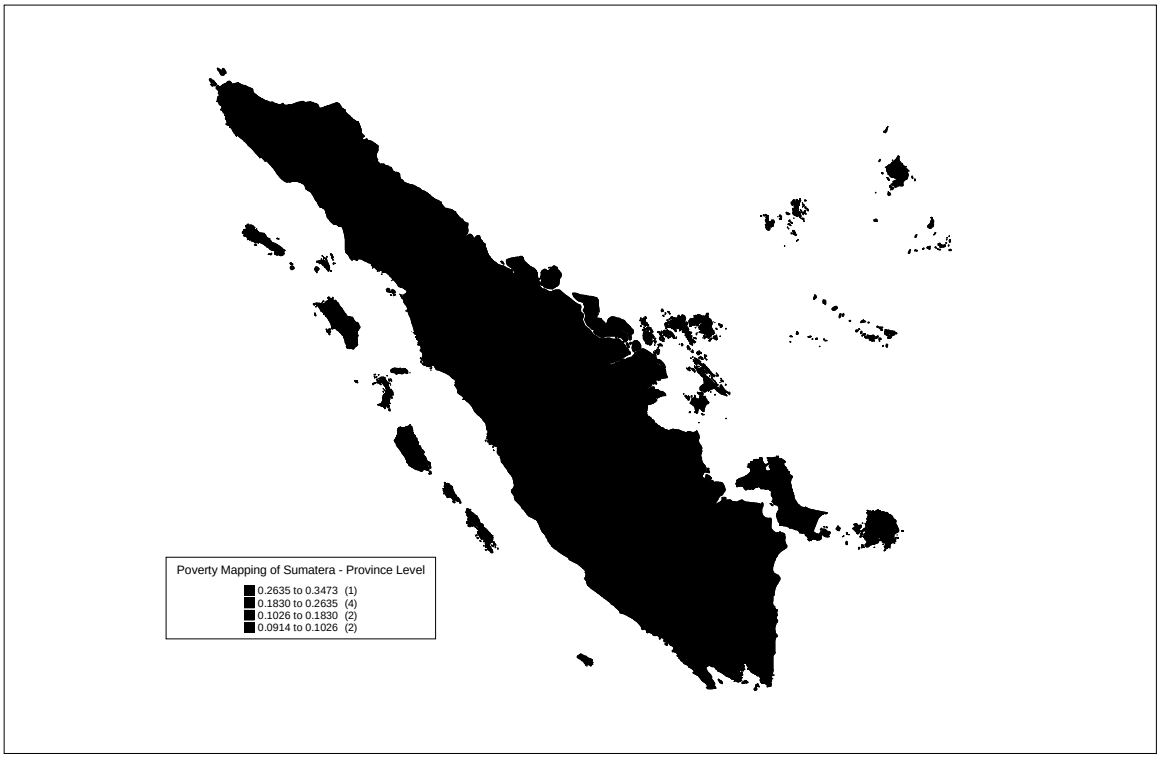
Island Group and Poverty Rate (%)	District		Subdistrict		Village	
	N	%	N	%	N	%
Sumatra:						
0 - 10	31	36.05	248	28.41	6,044	33.22
10 - 20	33	38.37	315	36.08	4,648	25.55
20 - 30	17	19.77	168	19.24	2,919	16.04
30 - 40	4	4.65	88	10.08	1,982	10.89
40 - 50	1	1.16	45	5.15	1,228	6.75
50 - 60	-	-	7	0.80	757	4.16
60 - 70	-	-	2	0.23	371	2.04
70 - 80	-	-	-	-	172	0.95
80 - 90	-	-	-	-	67	0.37
90 - 100	-	-	-	-	6	0.03
Total	86	100.00	873	100.00	18,194	100.00
Java:						
0 - 10	11	10.00	125	6.88	1,778	7.15
10 - 20	19	17.27	237	13.05	3,688	14.83
20 - 30	28	25.45	475	26.16	5,917	23.80
30 - 40	32	29.09	472	25.99	5,689	22.88
40 - 50	16	14.55	347	19.11	4,010	16.13
50 - 60	4	3.64	118	6.50	2,355	9.47
60 - 70	-	-	32	1.76	995	4.00
70 - 80	-	-	7	0.39	333	1.34
80 - 90	-	-	3	0.17	94	0.38
90 - 100	-	-	-	-	5	0.02
Total	110	100.00	1,816	100.00	24,864	100.00
Bali & Nusa Tenggara:						
0 - 10	1	3.33	14	5.98	243	6.66
10 - 20	5	16.67	25	10.68	317	8.69
20 - 30	5	16.67	22	9.40	301	8.25
30 - 40	2	6.67	27	11.54	340	9.32
40 - 50	4	13.33	24	10.26	339	9.29
50 - 60	4	13.33	30	12.82	359	9.84
60 - 70	5	16.67	31	13.25	442	12.12
70 - 80	3	10.00	45	19.23	552	15.13
80 - 90	1	3.33	15	6.41	543	14.88
90 - 100	-	-	1	0.43	212	5.81
Total	30	100.00	234	100.00	3,648	100.00

Table A3. *Continued*

Island Group and Poverty Rate (%)	District		Subdistrict		Village	
	N	%	N	%	N	%
Sulawesi:						
0 - 10	1	2.22	28	6.57	1,074	14.28
10 - 20	8	17.78	88	20.66	1,386	18.43
20 - 30	18	40.00	122	28.64	1,360	18.08
30 - 40	13	28.89	93	21.83	1,196	15.90
40 - 50	3	6.67	49	11.50	906	12.05
50 - 60	2	4.44	29	6.81	636	8.46
60 - 70	-	-	12	2.82	430	5.72
70 - 80	-	-	5	1.17	303	4.03
80 - 90	-	-	-	-	166	2.21
90 - 100	-	-	-	-	64	0.85
Total	45	100.00	426	100.00	7,521	100.00
Kalimantan:						
0 - 10	9	24.32	59	14.68	1,008	17.71
10 - 20	4	10.81	82	20.40	1,014	17.81
20 - 30	14	37.84	111	27.61	1,189	20.89
30 - 40	6	16.22	87	21.64	994	17.46
40 - 50	4	10.81	44	10.95	687	12.07
50 - 60	-	-	18	4.48	434	7.62
60 - 70	-	-	-	-	234	4.11
70 - 80	-	-	1	0.25	106	1.86
80 - 90	-	-	-	-	24	0.42
90 - 100	-	-	-	-	2	0.04
Total	37	100.00	402	100.00	5,692	100.00
Maluku & Papua:						
0 - 10	-	-	2	1.03	70	5.45
10 - 20	3	13.64	7	3.59	64	4.98
20 - 30	1	4.55	6	3.08	66	5.14
30 - 40	-	-	2	1.03	59	4.59
40 - 50	-	-	11	5.64	79	6.15
50 - 60	4	18.18	20	10.26	89	6.93
60 - 70	7	31.82	31	15.90	140	10.89
70 - 80	4	18.18	32	16.41	141	10.97
80 - 90	3	13.64	56	28.72	165	12.84
90 - 100	-	-	28	14.36	412	32.06
Total	22	100.00	195	100.00	1,285	100.00

Figure A1. Poverty Map of Sumatra

(a) Province Level



(b) District Level

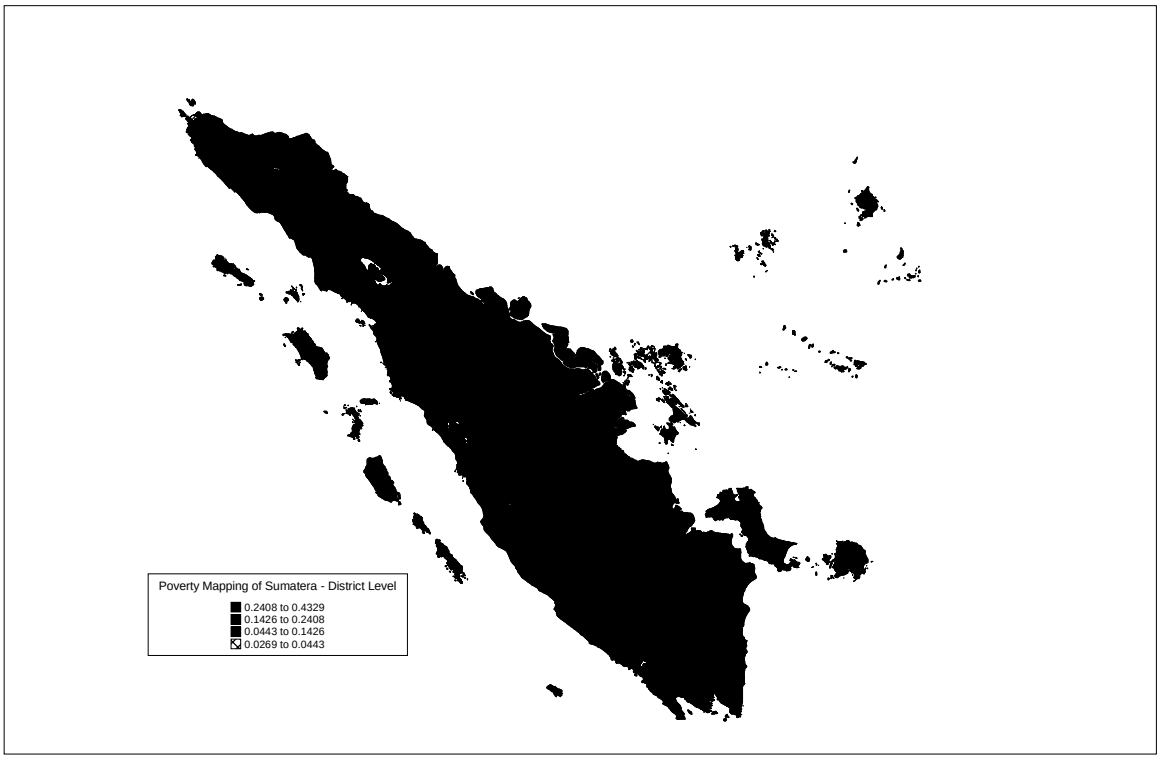
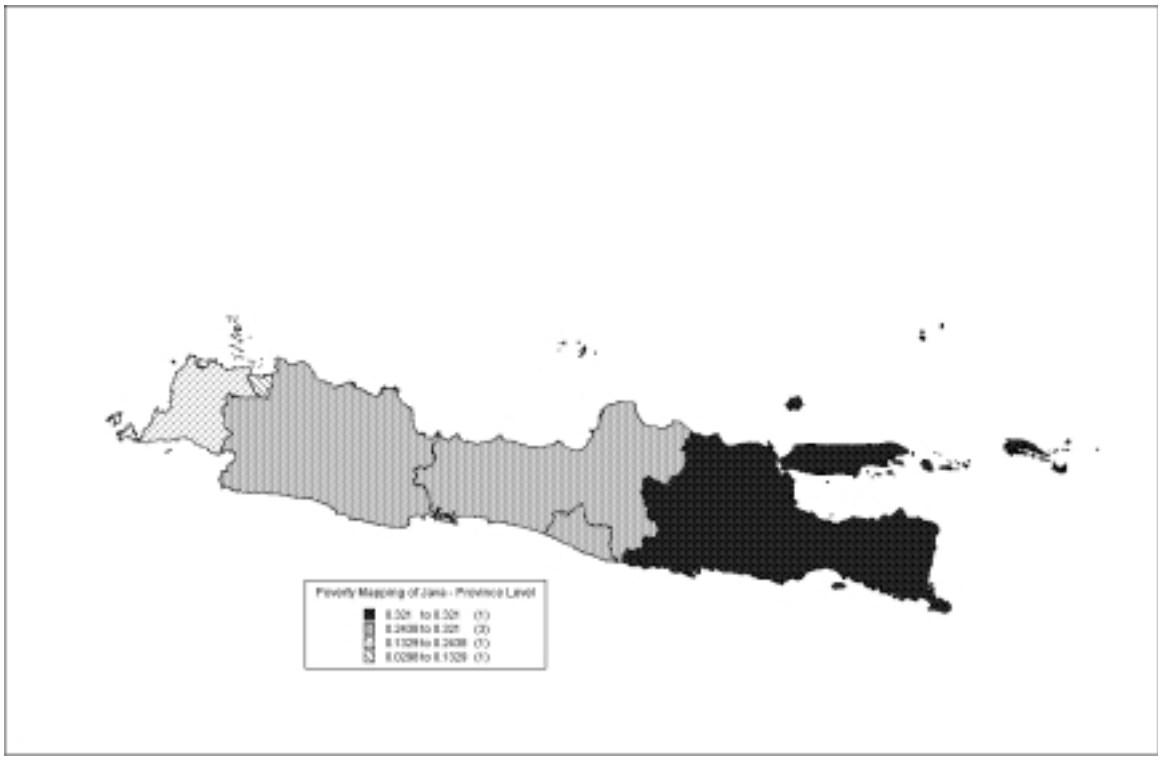


Figure A2. Poverty Map of Java

(a) Province Level



(b) District Level

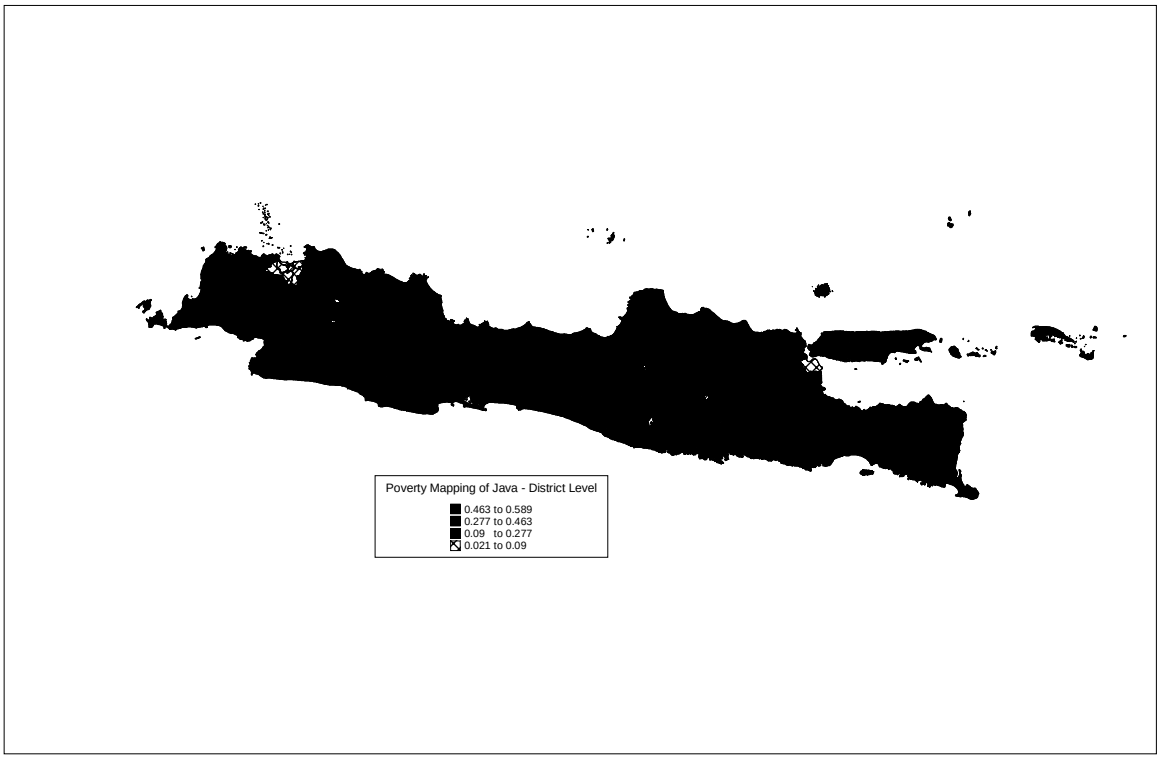
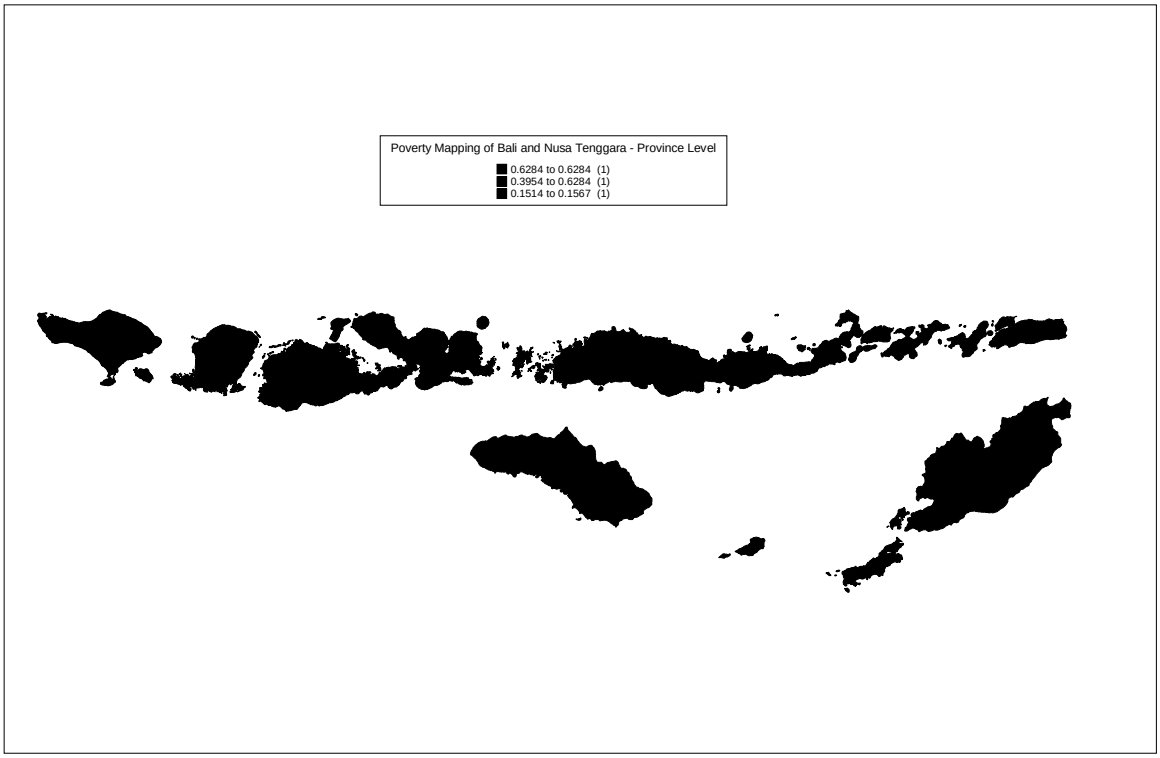


Figure A3. Poverty Map of Bali and Nusa Tenggara

(a) Province Level



(b) District Level

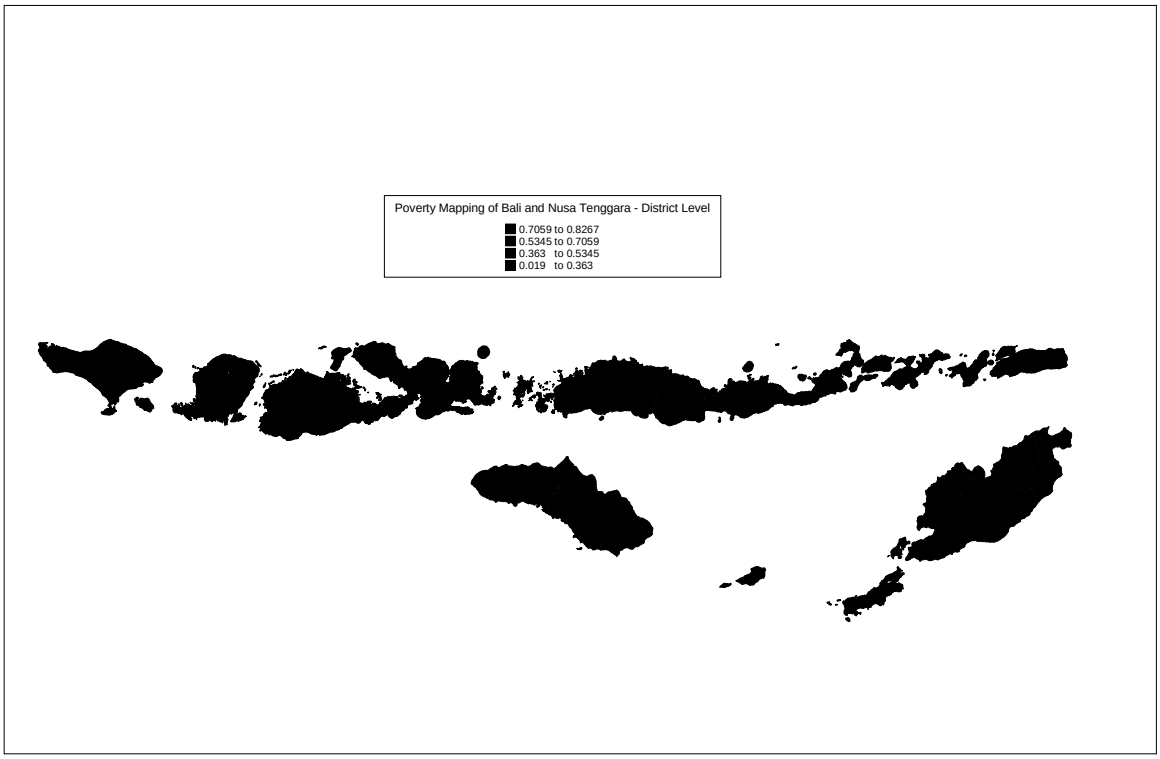


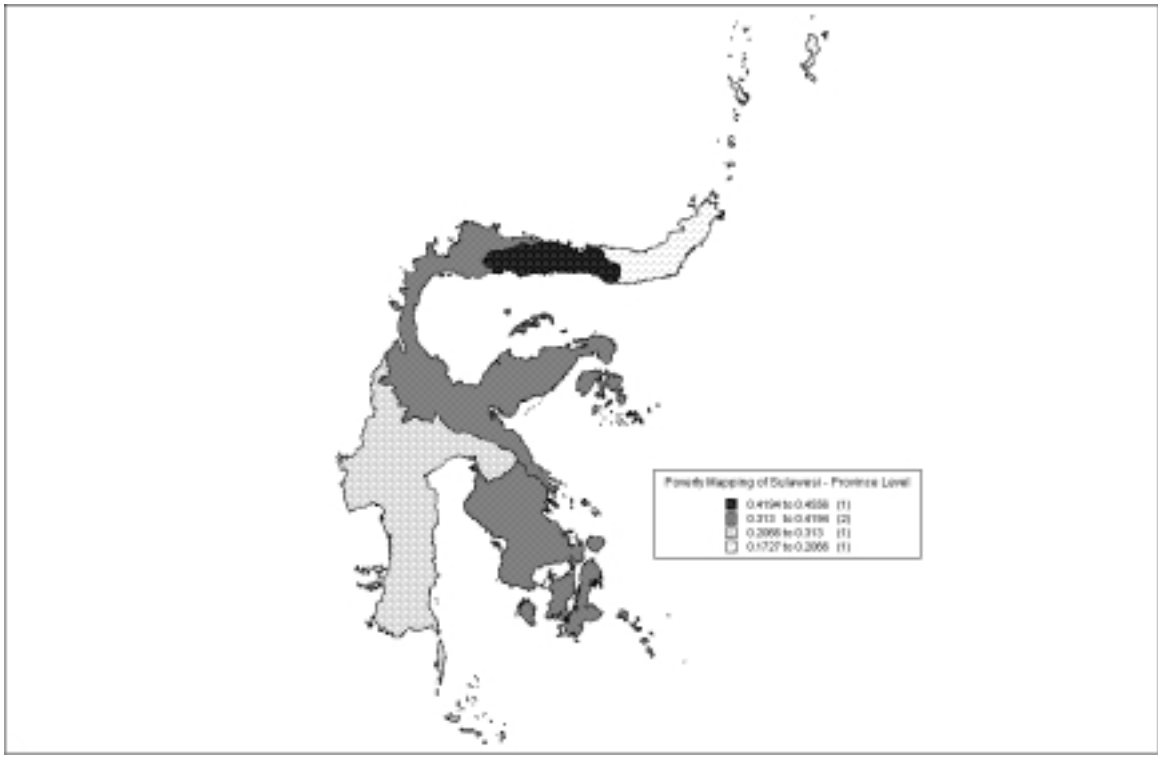
Figure A4. Poverty Map of Kalimantan

(a) Province Level

(b) District Level

Figure A5. Poverty Map of Sulawesi

(a) Province Level



(b) District Level

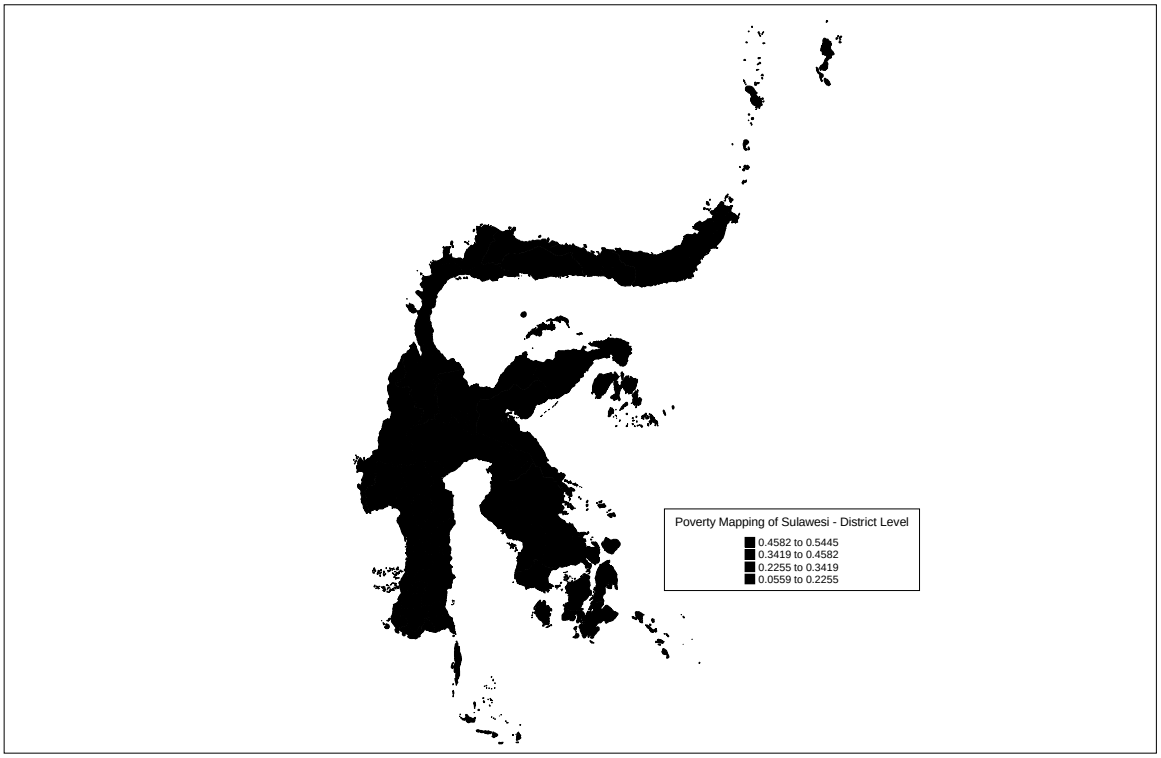
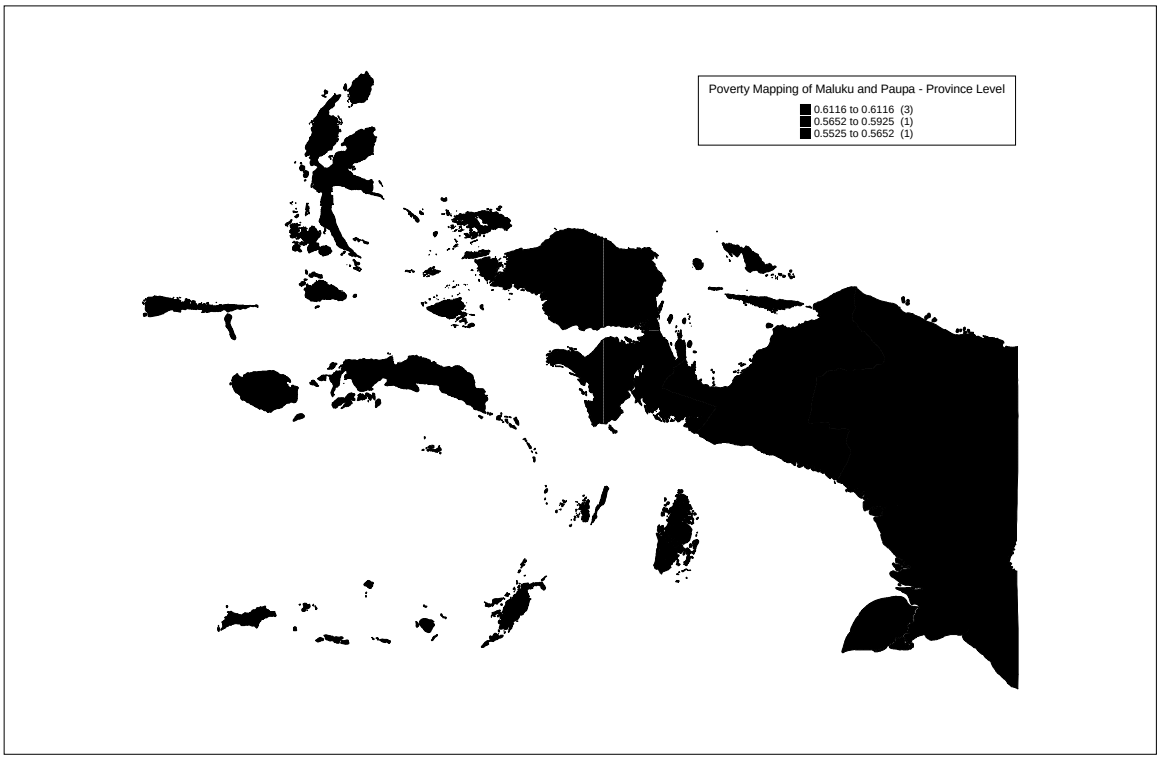


Figure A6. Poverty Map of Maluku and Papua

(a) Province Level



(b) District Level