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POVERTY MAPPING IN TAJIKISTAN: METHOD AND KEY FINDINGS

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ABBREVIATIONS

ECA	Europe and Central Asia
EB	Empirical Best
ELL	Elbers et al
HBS	Household Budget Survey
GBAO	Gorno-Badakhshan Autonomous Oblast
GLS	General Least Squares
MPI	Multi-dimensional Poverty Index
OLS	Ordinary Least Squares
RRS	Regional Republics of Subordination
SAE	Small Area Estimation
TLSS	Tajikistan Living Standards Measurement Survey
TajStat	Agency of Statistics under the President of Tajikistan
Census	2010 Population and Housing Census

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INTRODUCTION

1. National poverty rates are traditionally measured using survey data. To allow for frequent monitoring and to contain the costs of gathering detailed information, such surveys sample only a small subset of the population. When this sample of the population is representative, welfare surveys provide reliable estimates of poverty incidence for the entire population at a small fraction of the cost that would be required to survey each person in the country.

2. This approach necessarily leads to sampling errors however, and as a consequence, a typical household income or expenditure survey cannot produce statistically reliable poverty estimates for small geographic units. In the Republic of Tajikistan, the standard official poverty rates are not produced below the oblast level for this reason.

3. This report discusses two means of addressing the issue. The first is commonly referred to as "poverty mapping", and derives estimates of monetary poverty as it was officially measured in Tajikistan at the time of the surveys used in the analysis. The second is a multi-dimensional poverty index (MPI) that combines information about individual deprivations to summarize a complimentary, but unofficial, measure of poverty incidence.

4. Poverty mapping is a powerful approach to measuring welfare for highly disaggregated geographic units. Using the techniques of multiple imputation, poverty mapping efforts are undertaken to estimate poverty for small areas; indicators that would be impossible to construct with traditional survey data alone. The results are often used to target policies and assign resources to have greater poverty-reducing impact. Globally, poverty maps have been used to highlight geographic variations, simultaneously display different dimensions of poverty, understand poverty determinants, and to both design and select interventions.

5. A variety of poverty mapping methods have been devised to overcome the increasing imprecision of poverty estimates as they are disaggregated. The standard approach, used in most cases when sufficient data are available, is described in Elbers, Lanjouw, and Lanjouw (2003, henceforth ELL) and elaborated in Bedi, Coudouel, and Simler (2007). The ELL method is used for the official map described in this report.

6. The ELL approach to generating small area estimates (SAE) leverages the strengths of two data sources. First, the method makes use of traditional survey data that include detailed information on consumption and wellbeing. Second, the method employs individual or household-level information from the national Census. While censuses usually provide less detail than surveys for any individual or household, the main advantage of using census data is that they provide complete coverage of the entire population, and are therefore free of sampling error.

7. The standard strategy for estimating a poverty map involves three main stages:

   a. First, identify a comparable set of variables that appear in both the census and the household survey;
   b. Second, estimate consumption as a function of the comparable set of variables; and
   c. Finally, compute welfare indicators on census records based on the parameters derived from the estimations carried out on data from the household survey.

8. For Tajikistan, the estimation procedure uses: (i) the Tajikistan Living Standards Measurement Survey (TLSS) conducted in 2009, and (ii) the Population and Housing Census (2010). The poverty map described

below reports poverty estimates at the rayon level. All 58 rayons of the Republic of Tajikistan are included, and because some urban areas hold similar status to rayons in Tajikistan, several cities for which data was collected in the TLSS survey were also included in the mapping exercise. Dushanbe itself is divided into 4 rayons, but for the purposes of the estimation, the city was treated as a single unit.

9. The second approach to investigating welfare for small areas described below is a highly disaggregated MPI measure. This indicator is intended to compliment the imputed monetary measure, and help to identify concentrations of deprivation. There are several advantages to using an MPI. Depending on the specific indicators included, they are often relatively easy to collect, and in some cases can be less prone to measurement error. But perhaps the most important advantage in this context is that because all of the indicators needed to estimate the MPI were present in the 2010 national Census of Tajikistan, no imputation is required.

10. However, MPI estimates have some drawbacks as well. Countries define MPI indicators in many different ways, but unlike monetary measures, such indexes are not always directly comparable. This is due in part to simple differences in definition, but also because there are often differences in the importance of deprivations from one country or context to the next. Data availability issues also commonly discourage the use of multidimensional indexes in practice. The MPI indicators reported below add significant detail about the lived experience and the acuteness of poverty, but should be viewed as complimentary to monetary indicators, rather than a replacement for them.

CHAPTER 1

METHOD, DATA, AND MODELING

A. MONETARY IMPUTATION METHOD

1.1 Because numerous methods are available, selecting an appropriate method is a critical first step in deriving a poverty map. An SAE method developed by Elbers et al. (2003) has gained wide popularity among development practitioners, and is preferred within the World Bank when sufficient data are available.

1.2 The poverty map described in this report relies on the ELL approach on the basis of household-level data from the Population Census and the 2009 Tajikistan Living Standards Measurement Survey (TLSS). The ELL model utilizes detailed income/consumption information from a household survey, such as the TLSS, to estimate a model of monetary welfare, given a set of observable household characteristics. The parameter estimates from the model are then applied to the same set of characteristics in the population census to impute monetary welfare.

1.3 As a consequence of computing poverty incidence based on imputed consumption, SAE estimates of poverty are also subject to imputation error. One advantage of the ELL method over similar approaches is that it not only allows estimation of poverty incidence, but also the relevant standard errors. Elbers et al. (2003) analyze the properties of these errors in detail (the section below provides greater detail on the method). Experience to date suggests that poverty estimates are in most cases sufficiently precise for the purposes of informing policy choices (Bedi, Coudouel, and Simler, 2007; World Bank, 2012b).

1.4 Formally, the ELL model can be estimated as the (log) of per capita household consumption:

$$y_{ch} = X'_{ch}\beta + u_{ch}$$

where y_{ch} is the per capita consumption of household h residing in area c, X_{ch} are household and area/location characteristics, and $u_{ch} = \mu_c + \varepsilon_{ch}$, representing the residual, which is composed of the area component μ_c and the household component ε_{ch}. These two residual components have expected values of zero, and are independent of each other. It is assumed that $E(u_c^2) = \sigma_\mu^2 + \sigma_\varepsilon^2$. To estimate variance parameters, the following results rely on Henderson's method III, a commonly used estimator for the variance parameters of a nested error model (see Henderson, 1953; and Searle et al., 1992).

1.5 The variance of the remaining residual ε_{ch} is modeled via a logistic transformation as a function of household and area characteristics $ln\left[\frac{e_{ch}^2}{A-e_{ch}^2}\right] = Z'_{ch}\alpha + r_{ch}$ in order to obtain an estimate of the variance $\widehat{\sigma}_{\varepsilon,ch}^2$. Note that this approach allows for heteroscedasticity, such that the model is subsequently re-estimated to get a GLS estimate of β and of the variance-covariance matrix.

1.6 The small area estimates (and their standard errors) are obtained by means of simulation, which is ideally suited for estimating quantities that are non-linear functions of *y* (and thus non-linear function of

the errors and the model parameters), such as measures of poverty and inequality. Let *R* denote the number of simulations. The estimator then takes the form:

$$\widehat{H} = \frac{1}{R}\sum_{r=1}^{R} h(\tilde{y}^r)$$

where $h(y)$ is a function that converts the vector *y* with (log) incomes for all households into a poverty measure (such as the head-count rate), and where $\tilde{y}^r$ denotes the *r*-th simulated vector with elements:

$$\tilde{y}^r = X'\tilde{\beta}^r + \tilde{\mu}_c^r + \tilde{\varepsilon}_{ch}^r$$

1.7 With each simulation, both the model parameters $\tilde{\beta}^r$ and the errors $\tilde{\mu}_c^r$ and $\tilde{\varepsilon}_{ch}^r$ are drawn from their estimated distributions. The parameters $\tilde{\beta}^r$ are drawn by re-estimating the model parameters using the *r*-th bootstrap version of the survey sample. Alternatively, $\tilde{\beta}^r$ may be drawn from its estimated asymptotic distribution (called "parametric drawing"). The advantage of parametric drawing is that it is computationally fast. A potential disadvantage is that the true distribution of the estimator for the model parameter vector does not necessarily coincide with the asymptotic distribution. The use of bootstrapping, albeit more computationally intensive, provides a means of identifying the finite-sample distribution, and is thus expected to provide more accurate results when the sample size is small. The sample size of the TLSS used in this case is large enough for the asymptotic results to apply, and there is therefore little to no expected difference between estimates obtained with parametric drawing and bootstrapping.

1.8 A further alternative at this stage is to employ Empirical Best (EB) estimation. The idea of EB estimation is that the residuals for households sampled in area *c*, $e_{ch} = y_{ch} - X'_{ch}\beta$, are informative of the latent area error μ_c. This means that conditioning on the residuals observed for sampled households should enable tightening the distributions from which μ_c is simulated. It should be noted that EB only concerns the drawing of the area errors, and only areas that have been sampled in the TLSS benefit from the improvement offered by EB; for areas not sampled in the survey we still draw from the unconditional distribution, in which case EB we will refer to it as ELL-EB) coincides with standard ELL.

1.9 Any of these options yields R simulated poverty rates. The point estimates and their corresponding standard errors are obtained by computing respectively the average and the standard deviation over these simulated values. Box 1.1 below provides greater detail on this method.

Box 1.1: Step-by-step Summary of the Modelling Approach

1. Bootstrap the survey (unless parametric drawing of the model parameters is used).

2. Estimate β by means of Ordinary Least Squares (OLS), and extract the residuals.

3. Estimate the unconditional variance parameters of the nested error model (σ_μ^2 and σ_ε^2) by applying Henderson-method-III (see Henderson, 1953).

4. If heteroskedastic household errors are assumed, then: (a) derive estimates of the household errors by subtracting the area averages from the residuals (i.e. deviations from the area mean residual), (b) apply a logistic transformation to the errors derived under (a) to obtain the left-hand side (LFS) of the regression (also referred to as the "alpha-model") that will be used to predict the conditional variance of household component ε_{ch}, denoted by $\sigma_{\varepsilon,ch}^2$, (c) ensure that the unconditional variance is still equal to σ_ε^2, i.e. $E[\sigma_{\varepsilon,ch}^2] = \sigma_\varepsilon^2$

5. Given estimates of the unconditional variance σ_ε^2 and conditional variance $\sigma_{\varepsilon,ch}^2$, the covariance matrix $\Omega = E[\eta\eta^T + \varepsilon\varepsilon^T|x] = \sigma_\eta^2 I_\eta + diag(\sigma_{\varepsilon,ch}^2)$ can be constructed, which is used to obtain the GLS estimator for β.

6. At this stage, estimates for all the model parameters $\tilde{\beta}^r$, $\tilde{\sigma}_\eta^{2,r}$ and $\tilde{\sigma}_{\varepsilon,ch}^{2,r}$ are available. The next step is to draw the area errors and the household idiosyncratic errors: $\tilde{\eta}_c^r$ and $\tilde{\eta}_{ch}^r$ from their respective normal distributions with variances $\tilde{\sigma}_\eta^{2,r}$, $\tilde{\sigma}_{\varepsilon,ch}^{2,r}$.

7. From this basis, all that is needed to compute the round *r* simulated (log) household expenditure values for all households in the population census is available: $\tilde{y}_{ch}^r = x_{ch}^T \tilde{\beta}^r + \tilde{\eta}^r + \varepsilon_{ch}^r$

8. With the simulated household income data, the poverty and inequality measures can now be computed as if the population census came with household income data from the start.

9. This yields a simulated poverty and inequality measure for each of the *R* simulation rounds. The average and standard deviation give the poverty point estimate and the corresponding standard error respectively.

B. MULTIDIMENSIONAL POVERTY METHOD

1.10 A Multidimensional poverty index (MPI) is a common non-monetary compliment to monetary poverty estimates. In the case of Tajikistan, sufficient information is collected in the Census to derive such a measure without using any imputation approaches. For most such non-monetary measures, "deprivations" or "vulnerabilities" are identified, and summarized in the form of an index.

1.11 There are several strengths to this method:

- Firstly, it is easy to reproduce and to estimate, and does not require sophisticated econometrics or programming.

- A second benefit is that the measure does not require substantial data collection efforts. A relatively small module could be added to a survey for the purposes of estimating the index.

- Non-monetary approaches are also more straightforward to estimate when information on inflation is unavailable or unreliable

1.12 But there are also drawbacks:

- In Tajikistan, poverty is officially monitored using a monetary measure of consumption. This implies that a non-monetary measure would not necessarily coincide with official measures of poverty in the country.

- MPI indicators are not always comparable across regions or countries, due to the nature of the deprivations included. For instance, lacking access to heating is fundamentally incomparable between a county with a tropical climate and a country with a continental one.

1.13 The variables used to create the MPI reported below are grouped by three dimensions: i) demographic and labor, ii) education, and iii) services and infrastructure. Each dimension is equally weighted, and within each dimension, each indicator is also equally weighted. A household is defined as multi-dimensionally poor when the household is deprived on 33 percent or more of the weighted indicators in the index. In addition, severe poverty is defined as a household which is deprived on 50 percent or more of the weighted indicators in the index. A household is "vulnerable" for multidimensional poverty when deprived on at least 20 percent, but less than 33 percent of weighted indicators in the index.

1.14 For Tajikistan, the dimensions and indicators were informed by deprivation index analysis across countries and by Azevedo, Rajabov et al. (2015), and include:

- Education
    - Households with individuals (18+) who cannot read or write
    - At least one individual (20+) who has not completed secondary school
    - No household member has completed tertiary education

- Demographic and Labor
    - Dependency ratio>1
    - Both household heads are not employed

- Services and infrastructure
    - No access to sewage system
    - No access to piped water
    - Heating from oven, or heating is absent
    - No garbage disposal system
    - No toilet inside the house

C. DATA

1.15 The data for the monetary poverty map come from two sources: the Tajikistan Living Standard Measurement Survey 2009 (TLSS) collected by the State Statistical Agency of Tajikistan in collaboration with the World Bank, and the 2010 Census of Tajikistan.

1.16 An alternative data source, the household budget survey (HBS), was also available for estimating the poverty map. After thorough evaluation however, the HBS was not selected. Though the HBS has a number of advantages over the TLSS (including larger sample size, and the fact that it is currently the official source of poverty statistics for the country), the specific requirements of the poverty mapping method employed resulted in unstable results. More specifically, an HBS-based version of the model yielded an accurate prediction for the whole of Tajikistan when used for imputation, but the model could not capture the heterogeneity across oblasts reflected by poor oblast level predictions compared to direct estimates from TLSS. It was therefore decided that the TLSS was the preferred poverty data source for this undertaking, in light of the survey's timing and greater geographic coverage.

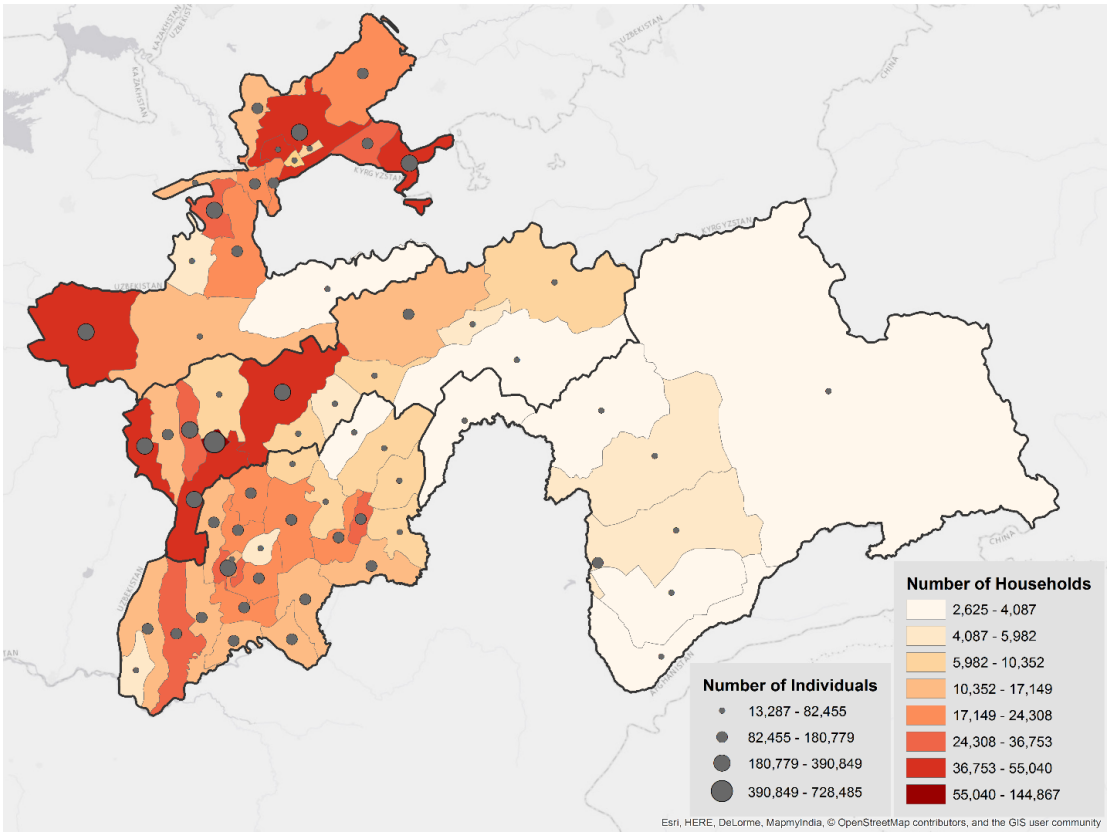
1.17 The TLSS provides information on food and non-food expenditure, labor activities, migration, agriculture, education, dwelling, utilities, and durable goods. The sample is representative at the national and regional level (Sugd, RRS, Khatlon, GBAO, plus Dushanbe) and for urban and rural strata. The survey was designed as a panel of 1,500 households interviewed during the Tajikistan 2007 Living Standards Survey (TLSS07). The households were revisited in November 2009, during the same time of year in which they were visited originally in 2007.

1.18 The original TLSS07 sampling design followed the enumeration areas defined for the census. The survey was stratified by region, and by urban and rural location of residence (9 strata: 4 rural, 5 urban). The sampling was designed in two stages. In the first stage, sampling units representing clusters were selected. In the second stage, a random sample of households was drawn from each clusters using the official clusters household book (a register maintained by officials in the enumeration area).

1.19 The Census of Tajikistan covers approximately 1.6 million households and 8 million individuals. The Republic of Tajikistan is administratively divided in 4 regions: Sogd oblast, Khatlon oblast, Gorno-Badagakashan (GBAO), Direct Rule District commonly known as the RRS (or the Regional Republics of Subordination, in which there are 13 autonomous districts) and Dushanbe. There are a total of 58 rayon (districts), 4 districts of Dushanbe, and 17 cities subordinated either to the Republic or to the oblast. There are 356 jamoats (rural administrative areas) and 13 towns of rural type. For the estimates that follow, the entire census database was available.

1.20 While most of the population in Tajikistan is located in the west of the country, districts in the east are generally less densely populated. Figure 1.1 described the population density of Tajikistan according to the 2010 Census.

Figure 1.1: Number of Households and Individuals, by district



Source: Census 2010.

D. MODELLING FOR MONETARY POVERTY

1.21 Since the ELL approach relies on estimating a welfare model on the TLSS data and applying it to the Population and Housing Census data, one of the key requirements of the model building stage is the similarity between the variables in the TLSS and the census. As part of building a welfare model, a two-stage process was undertaken:

a. **Step 1**: comparison of the TLSS and census questionnaires to identify "candidate variables" that exist both in the survey and the census and that are generated from identical or similar questions;

b. **Step 2**: comparison of the distributions of the "candidate variables" identified in step 1 in order to examine whether they capture the same underlying phenomena or whether, despite similar questions, their empirical distributions differ in any important ways.

1.22 The goal of model construction is to explain the variation in per capita household expenditure. The choice of candidate variables is typically constrained by the overlap between the survey and census questionnaires, and based on a heuristic model of household expenditure. Expenditure is often assumed to be a function of the demographic characteristics of the household (e.g. small children, working-age adults, or elderly), and individual education and occupation characteristics of the household and its members (e.g.

maximum level of education in the household, education level, the employment status of household members, and the type of employment for those who are employed).

1.23 In addition, other indicators such as the type of dwelling a household resides in, or the types of assets the household possesses (e.g. whether or not there is a bath or toilet in the dwelling), commonly proxy for variation in other welfare measurements. Accesses to basic services such as water and electricity are also assumed to reflect the income level and/or expenditure of the household. Household expenditure may also vary based on the location of the household (e.g. rural vs. urban; proximity to big cities; area with low or high employment rates etc.).

1.24 In Tajikistan, the pool of variables common to the two questionnaires included:

a. **Demographic characteristics**: Gender, age, marital status, household size, number of children, adults, and elderly in the household, dependency ratio
b. **Education**: Education level of the household head, highest level of education by any household member
c. **Occupation**: Employment status, occupation, sector of employment
d. **Housing characteristics**: Type of housing unit, main construction material of wall, total area of land and dwelling, ownership and occupancy status of dwelling, source of drinking water and electricity, type of sewage and toilet
e. **Productive and durable assets**: Ownership of cooler, refrigerator, freezer, electrical generator, cooker, television, washing machine, dishwasher, water heater, heater, electric fan, air conditioner, vacuum cleaner, motorcycle, car, and PC.

1.25 Some of the candidate variables were defined by taking the district-level average from the census, and including these indicators to generate more precise survey-based estimates. By construction, these variables are identical in the census and survey micro-data. Other spatial variables include a dummy variable for rural location and a dummy variable for the RRP oblast.[1]

1.26 The level at which regression models are run must be chosen carefully. If a single model is specified for the entire country, the implicit assumption is that the parameter estimates for the explanatory variables included in the model are the same for all regions of the country. In other words, a national model assumes that the relationship between household expenditure and household characteristics are uniform throughout the country. This may not be a tenable assumption in a country like Tajikistan, with wide spatial heterogeneity. For example, returns to education are likely higher in Dushanbe where formal job market is more robust than in the poorest areas with thin labor markets.

1.27 The approach employed for Tajikistan proceeded in a top-down fashion to decide the level at which to model the relationship. However, as the sample size must be no smaller than 300 for each regression to avoid the problem of over-fitting (Ahmed, Dorji, Takamatsu, & Yoshida, 2014), oblast level regressions were not feasible. The Beta model for Tajikistan thus used a national-level regression.

1.28 Assignment of candidate variables for matching proceeded by hand, comparing nationally-representative means in the two data sources. Those variables deemed acceptable were included in the model selection process. For those that were deemed to differ too greatly from one another – due, for instance, to slight differences in the wording of the question – the variable was excluded and not used in the model development process. Tables 1.1 and 1.2 provide comparisons of averages of a subset of variables

[1] The district level variables in the model were: "Total number 26 to 30 years old", "Total number 31 to 35 years old", "Total number 41 to 45 years old", and "District-average of working adults in Mining sector".

compared at this stage. Each was evaluated at the household level, including for questions that were gathered at the individual level in the questionnaire.

Table 1.1: **Comparison of Means between Survey and Census – Individual level data**

	Survey (Individual)				Census (Individual)			
	Share Missing	Mean of Sum	Mean of Mean	Mean of Max	Share Missing	Mean of Sum	Mean of Mean	Mean of Max
married	0.00	3.39	0.42	0.96	0.00	2.61	0.42	0.91
widow	0.00	0.24	0.04	0.22	0.00	0.20	0.05	0.19
age_0_6	0.00	1.15	0.13	0.61	0.00	0.92	0.13	0.52
age_1_14	0.00	2.76	0.33	0.89	0.00	2.25	0.33	0.81
age_15_24	0.00	1.90	0.24	0.78	0.00	1.41	0.22	0.67
age_25_64	0.00	3.04	0.39	0.99	0.00	2.44	0.41	0.96
age_65pl	0.00	0.30	0.04	0.24	0.00	0.21	0.04	0.17
preschool	0.00	0.04	0.01	0.03	0.00	0.04	0.01	0.03
educyn	0.00	6.48	0.83	1.00	0.00	5.48	0.88	1.00
educ_none	0.00	0.93	0.12	0.57	0.00	1.83	0.26	0.73
educ_prim	0.00	1.16	0.15	0.64	0.00	0.77	0.12	0.47
educ_basic	0.00	1.10	0.14	0.56	0.00	0.88	0.14	0.50
educ_secgen	0.00	2.66	0.34	0.87	0.00	2.22	0.36	0.85
educ_sectech	0.00	0.49	0.07	0.37	0.00	0.30	0.05	0.23
educ_higher	0.00	0.44	0.06	0.30	0.00	0.31	0.06	0.22
educ_grad	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: Authors calculation from Census 2010.

Table 1.2: **Comparison of Means between Survey and Census – Household level data**

	Survey (Household)		Census (Household)	
	Share Missing	Mean	Share Missing	Mean
work_share	0.00	0.39	0.00	0.58
pre_share	0.00	0.03	0.00	0.03
depmems	0.00	2.47	0.00	2.46
depratio	0.00	0.70	0.00	0.77
hhsize	0.00	6.67	0.00	6.31
hhsize2	0.00	53.49	0.00	50.47
hh_wi	0.00	0.17	0.00	0.14
hh_fem	0.00	0.18	0.00	0.26
hh_work	0.00	0.59	0.00	0.63
hh_mar	0.00	0.79	0.00	0.81
hh_ds	0.00	0.03	0.00	0.02
hh_absec	0.00	0.00	0.00	0.15
hh_abbasic	0.00	0.41	0.00	0.28
hh_abprim	0.00	0.78	0.00	0.80
rural	0.00	0.67	0.00	0.68
telephone	0.00	0.19	0.00	0.21

Source: World Bank calculations from Census 2010.

Poverty line

1.29 The poverty line was constructed for the 2007 TLSS survey results using the cost-of-basic-needs approach, and updated for use in 2009 when another round of the TLSS was conducted. The resulting poverty line depends on the cost of buying a diet of 2,250 calories per capita per day and an allowance for non-food consumption. The nominal poverty line was set at 4.56 Somoni a day per capita (2007 prices), of

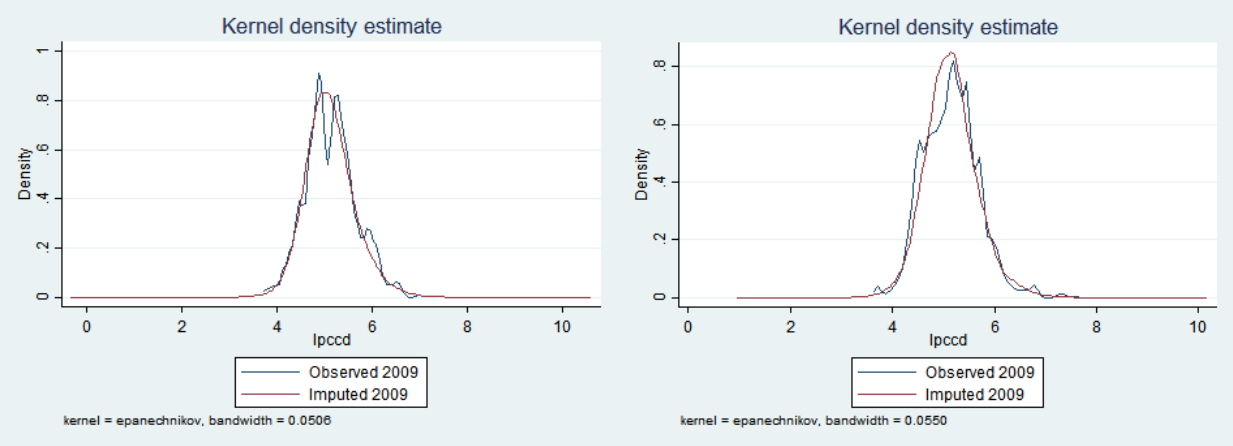
which 64 percent is food-consumption and 36 percent is non-food consumption.[2] After adjusting for different price levels across the country, the poverty line corresponds to a per capita monthly expenditure of 138.7 Somoni per month in 2007 and 162.1 Somoni per month in 2009.

Model selection

1.30 From the pool of variables not excluded due to comparability concerns, a variety of model selection techniques were employed and evaluated on the basis of several alternative criteria. Automated model selection techniques (lasso, forward stepwise, backward stepwise, etc.) were complimented by manually designed models and assessed in terms of out of sample performance. Thorough checks on the variance composition were also conducted. The final model was partially selected on the basis of the combination of a good adjusted R- squared and for a small ratio of location variance over total variance. For the model used in this exercise, the ratio is 3%, which is smaller than the recommended 5% level. The hierarchical error structure (province, psu, and household error) was also considered in the model selection process. In this case, the variance share of the location/psu is small: var(psu) = .0134, var(epsilon or residual) = .188, for a ratio of 6.6% of overall error variance.

1.31 Model validation (within the TLSS data) proceeded in several stages. First, a visual assessment was conducted to ensure the similarity between predicted and empirical consumption distributions. This was accomplished by withholding a subset of data, using the remainder as the "training" data, and subsequently imputing into the withheld data to ensure the robustness of the approach. The resulting distributions can be seen graphically in Figure 1.2. Poverty indices were then calculated to further validate the approach and confirm the consistency of poverty estimates.

Figure 1.2: **Distributions with Actual and Imputed Testing Sample**



Source: TLSS-2009, World Bank calculations.

1.32 Using both Stata and World Bank's PovMap software to build the mode with the above-mentioned validation procedures, the final model is presented as in Table 1.4[3].

[2] For more explanation, see the Basic Information Document of the 2007 TLSS, Poverty Assessment in 2009, and the update Poverty note with TLSS2009 in 2010/2011.

[3] The final model is based on the combination variables constructed from the survey and the district-area variables constructed from the census. The adjusted R-square is moderate at 33%. The ratio of variance of area-level and over mean squared error is 3%, which is low compared with other countries' studies. This means the prediction for the

Table 1.3: **Final Specification Using National Model**

Variable	Description	Coefficient	Std. Err.	|Prob|> t
Intercept	Intercept	5.011	0.130	0.000
activity13_sum	Total number of working adults in Public sector	-0.059	0.030	0.040
activity2_dist	District-average of working adults in Mining sector	13.750	3.930	0.000
activity6_mean	Total number of working adults in Trade sector	0.112	0.040	0.010
depmems	Number of dependency members (less than 15 and more than 65)	-0.031	0.010	0.000
educyn_mean	Average number of adults with some education level	0.316	0.090	0.000
educ_grad_max	Maximum number of adults with graduate level education	0.989	0.150	0.000
educ_higher_mean	Average number of adults with higher education level	0.475	0.100	0.000
educ_sectech_sum	Total number of adults with technical secondary education	0.051	0.020	0.010
hhsize	Household size	-0.118	0.020	0.000
hhsize2	Household size squared	0.004	0.000	0.000
hh_fem	Female headed household	-0.083	0.040	0.020
mainocc1_sum	Total number of adults working as managers and senior officials	0.277	0.060	0.000
mainocc2_mean	Average number of adults working as professional specialists	0.220	0.070	0.000
mainocc8_sum	Total number of adults working as operators, machine operators	0.141	0.040	0.000
mainocc9_mean	Average number of adults with unskilled work	-0.172	0.040	0.000
PROV_STR_4	Dummy for RRP oblast	0.309	0.040	0.000
RURAL_1	Dummy for rural	0.159	0.040	0.000
telephone	Household with telephone	0.147	0.040	0.000
tot26_30_dist	Total number 26 to 30 years old	0.0001	0.000	0.000
tot31_35_dist	Total number 31 to 35 years old	-0.0003	0.000	0.000
tot41_45_dist	Total number 41 to 45 years old	0.0002	0.000	0.000
work_share	Share of working adults in the household	0.113	0.060	0.050

Source: World Bank calculations from TLSS 2009 and Census 2010.

district enjoys much more benefits when aggregating households' welfare within a district, thus estimation becomes more precise.

Table 4: Individual-level Variable Comparisons between Survey and Census for Selected Model

	Survey				Census			
	Share Missing	Mean of Sum	Mean of Mean	Mean of Max	Share Missing	Mean of Sum	Mean of Mean	Mean of Max
activity13	0	0.26	0.14	0.22	0	0.27	0.05	0.22
activity6	0	0.22	0.12	0.18	0	0.18	0.03	0.14
educyn	0	6.48	0.83	1.00	0	5.48	0.88	1.00
educ_grad	0	0.00	0.00	0.00	0	0.00	0.00	0.00
educ_higher	0	0.44	0.06	0.30	0	0.31	0.06	0.22
educ_sectech	0	0.49	0.07	0.37	0	0.30	0.05	0.23
mainocc1	0	0.06	0.03	0.06	0	0.02	0.00	0.02
mainocc2	0	0.14	0.08	0.13	0	0.16	0.03	0.14
mainocc8	0	0.13	0.07	0.12	0	0.10	0.02	0.09
mainocc9	0	0.37	0.16	0.22	0	1.15	0.18	0.55

Table 5: Household-level Variable Comparisons between Survey and Census for Selected Model

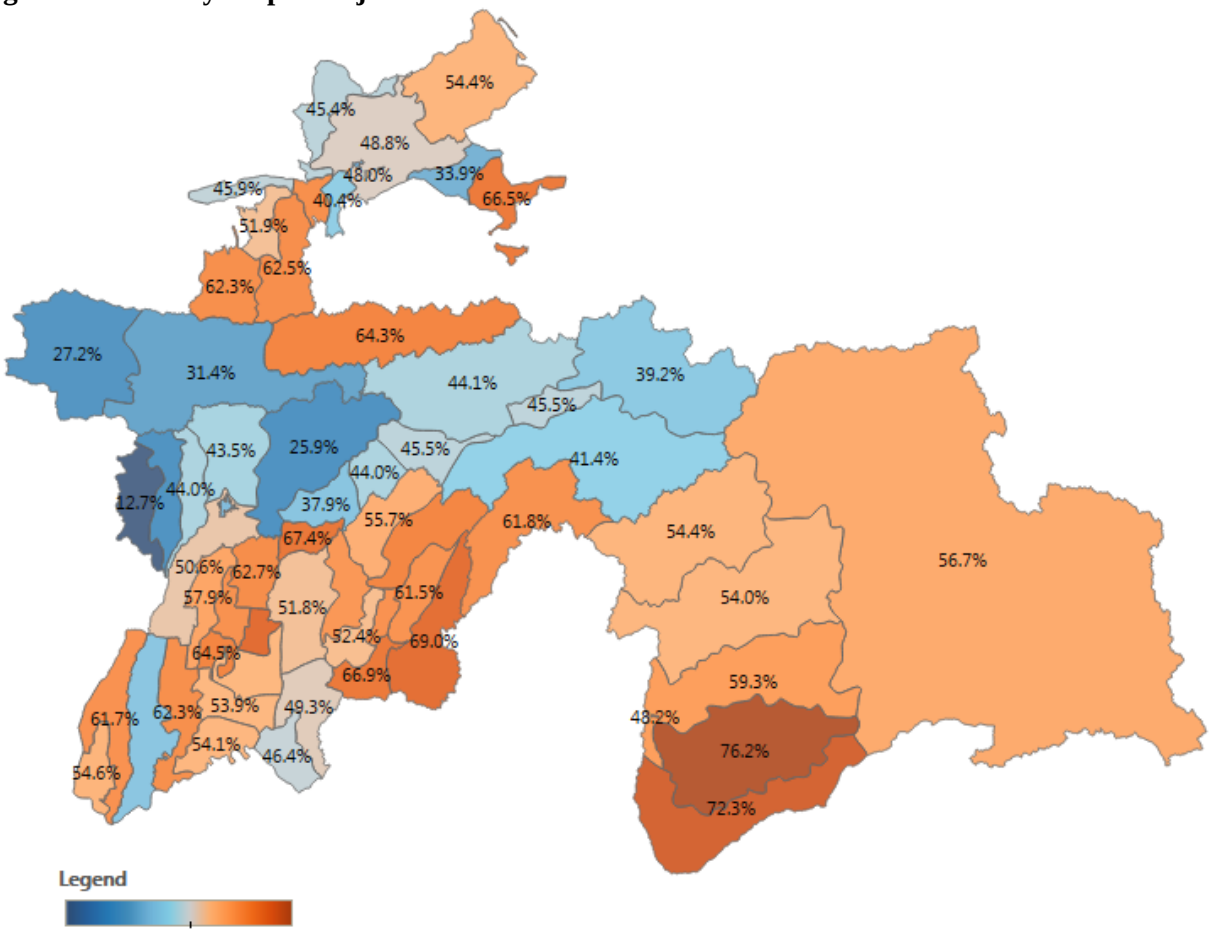
	Survey (Household)		Census (Household)	
	Share Missing	Mean	Share Missing	Mean
depmems	0	2.47	0	2.46
hhsize	0	6.67	0	6.31
hhsize2	0	53.49	0	50.47
hh_fem	0	0.18	0	0.26
rural	0	0.67	0	0.68
telephone	0	0.19	0	0.21
work_share	0	0.39	0	0.58

CHAPTER 2

POVERTY MAP

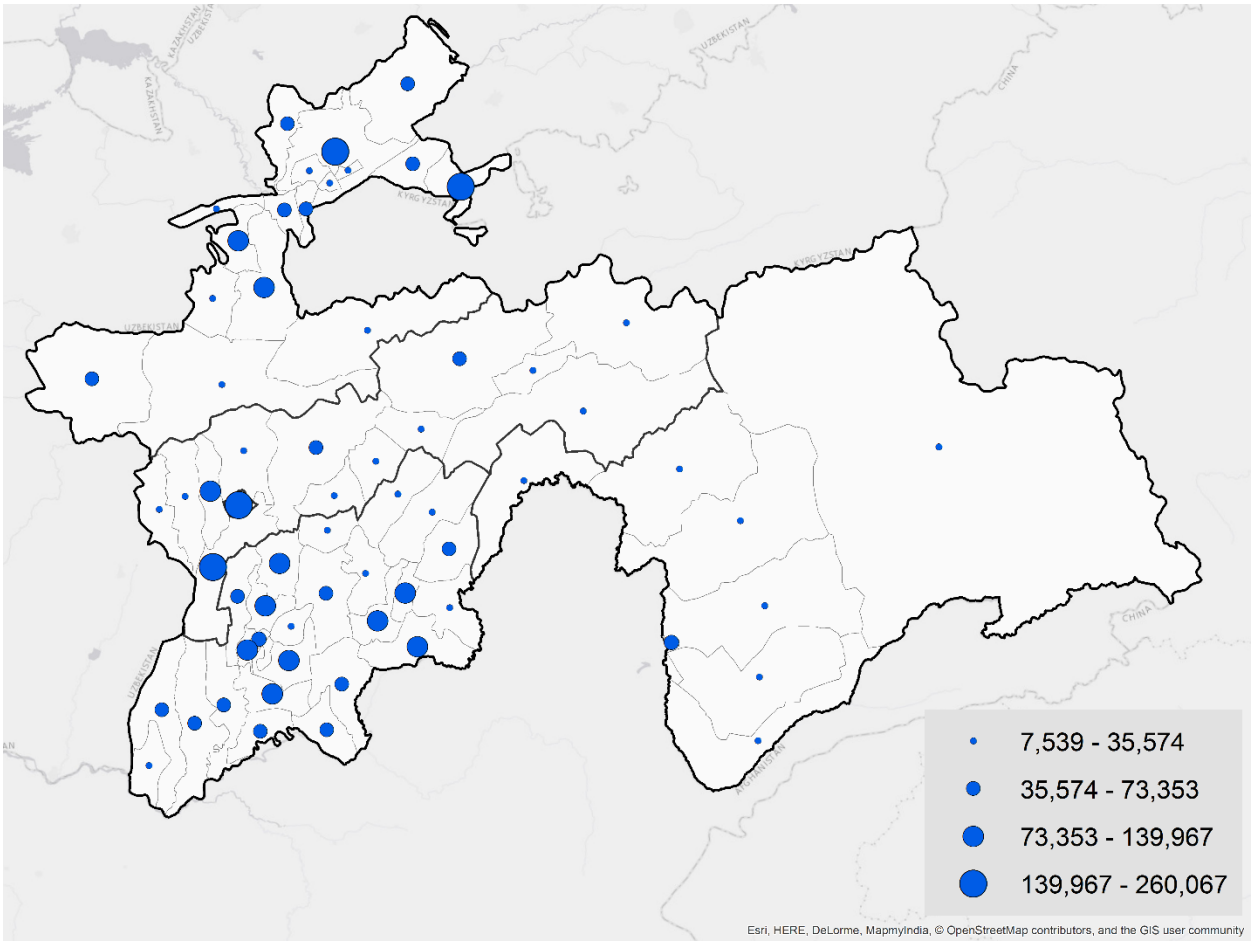
2.1 The final poverty map results for the method outlined above is included in Figure 2.1. Districts that had lower poverty rates than the national average are presented in blue, while those with a higher poverty rate than the national average are presented in orange. As expected, Dushanbe had the lowest poverty rate in 2010, while GBAO had the highest. Rural areas are poorer than urban areas on average, but low density areas represent a smaller share of the total poor in the country. As is clear from Figure 5, the majority of the country's poor live in the eastern districts, despite the mountainous GBAO region recording the highest rate.

Figure 2.1: **Poverty Map of Tajikistan**



Note: Poverty rates refer to the share of poor in the district.
Source: World Bank calculations based on TLSS2009 and Census 2010.

Figure 2.2: **Poor Population of Tajikistan**



Note: Blue dots refer to the population of poor in the districts. The bigger is the dot the bigger is the population of the poor.
Source: World Bank calculations based on TLSS2009 and Census 2010.

2.2 One approach to validate the results of the poverty map is to compare the poverty rates implied by the aggregated small area rates from the poverty map, with the regional poverty rates from the TLSS. This test succeeds in this case: the aggregated results from the poverty mapping exercise were very close to the estimates obtained from the TLSS (Table 2.1).

Table 2.1: **Poverty Estimates from the Census (using Povmap) and Survey (observed), in %**

	TLSS		PovMap	
	Poverty Rate	Standard error	Poverty Rate	Standard error
National	47.20	1.30	47.50	1.90
Dushanbe	33.90	2.90	35.60	2.30
Sogd	48.30	2.50	46.60	2.40
Khatlon	53.90	2.60	57.50	2.50
RRP	38.90	2.80	36.80	3.80
GBAO	61.90	4.10	60.40	4.20

Source: World Bank calculations based on TLSS2009 and Census 2010.

2.3 For rural areas, the survey poverty rate estimate was 49.2%, while the estimate using aggregated poverty map results stood at 51.0%. For urban areas, the survey estimate was 41.8%, while the aggregated poverty map estimate stood at 39.0%. The standard errors were of similar magnitude in the survey estimates and the poverty map aggregated estimates. This is not ideal, as the standard errors are often smaller for poverty map estimates in comparison to direct survey estimates. However, previous modeling exercises suffered from even greater imprecision. The results reported here are consistent between the small area estimates and the aggregated regional results.

CHAPTER 3

MULTIDIMENSIONAL POVERTY INDEX (MPI) MAPS

3.1 There are several complimentary ways to present results from the MPI analysis. Figure 3.1 provides the headline result: The national rate is 64 percent and the rates for the regions vary substantially. Driving a considerable portion of these results are high levels of deprivation relating to education, and for those districts outside of Dushanbe and other urban areas, access to infrastructure. In multidimensional terms, Dushanbe is clearly the least poor out of the regions.

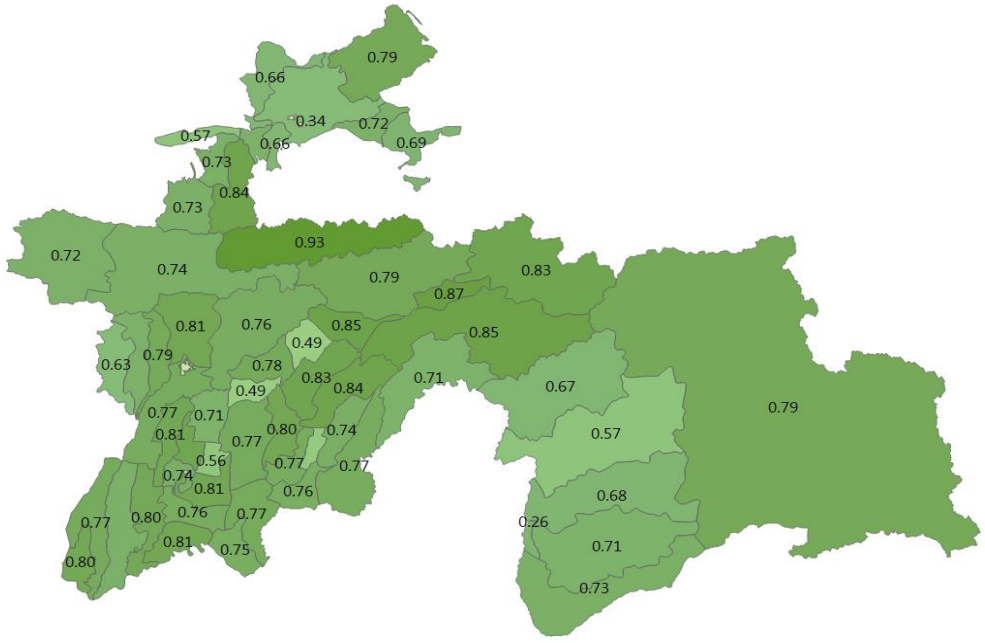
3.2 As Table 3.1 reports however, in contrast to estimates for monetary poverty, in the case the MPI, RRP fares worst in terms of both multidimensional poverty and in terms of severe multidimensional poverty. It is therefore not very surprising that there is only a weak correlation between the MPI measure of poverty and the monetary measure, as shown in Figure 3.2.

Table 3.1: **MPI Indicators by Region, in %**

	National	Dushanbe	Sogd	Khatlon	RRP	GBAO
Multidimensional Poverty	64	22	63	72	75	61
Multidimensional Vulnerability	22	24	24	21	19	30
Severe Multidimensional Poverty	33	5	31	38	44	29
Households with adults 18+ cannot read or write	39	1	1	1	1	1
Age dependency>1	22	17	19	27	26	16
Household member (+20) does not have complete secondary education	41	32	37	41	53	29
No household member (+25) has tertiary education	79	58	81	84	83	65
Both heads are unemployed Yes=deprived	13	16	12	13	16	16
No access to sewage	73	19	76	80	85	88
No access to piped water	67	8	70	80	72	89
Heating from oven, or heating is absent	70	9	77	78	80	73
No garbage disposable system	63	4	64	73	76	76
No toilet inside the house	78	21	82	88	89	90

Source: Census 2010.

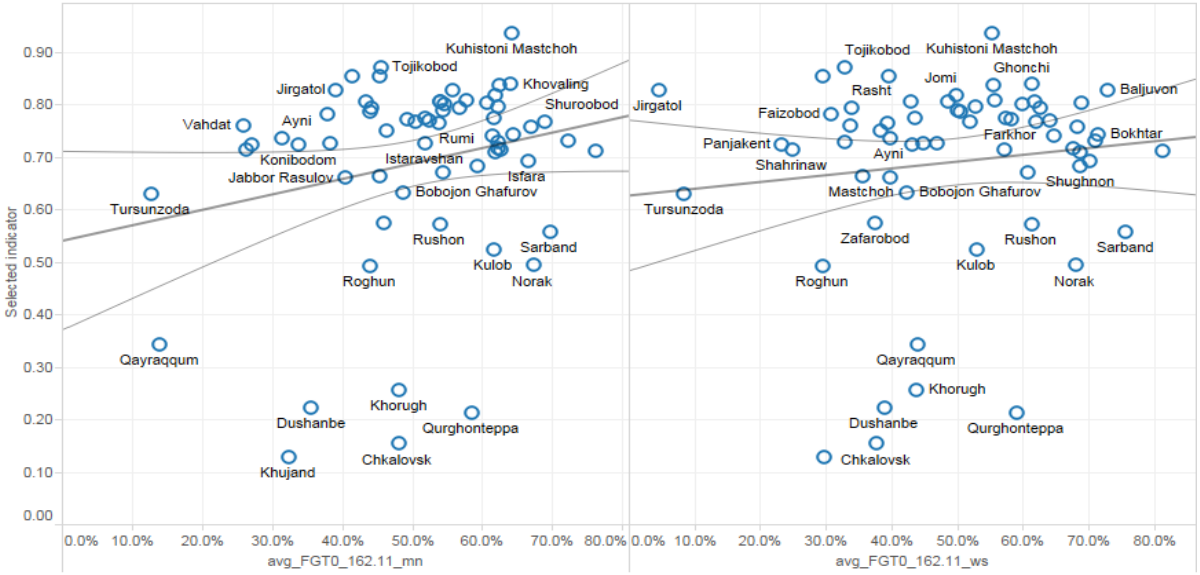
Figure 3.1: **Multidimensional Poverty Index Map of Tajikistan using Census 2010**



Source: World Bank calculations using Census 2010.

3.3 It should be noted that although one might anticipate a strong correlation between each deprivation and monetary measures of poverty (or consumption), it is not always the case that monetary poor households are also multi-dimensionally poor, or vice versa. This is due to the fact that weighting in the deprivation index introduces dissimilarities in the measure, as does the overlapping nature of deprivations. Indeed, deprivation index approaches were developed because monetary poverty measures often miss important attributes of poverty which are better captured in multidimensional measures.

Figure 3.2: MPI Maps vs. Monetary Poverty



Source: World Bank calculations using Census 2010 and TLSS 2009.

ANNEX A – POVERTY RATES BY DISTRICTS[4]

Dushanbe and Districts of Republican Subordination/ Душанбе и Районы Республиканского Подчинения

District		Poverty,%	Standard Error	Number of Poor
Dushanbe	Душанбе	35.6	0.02	260,066
Faizobod	Файзабад	37.9	0.10	31,259
Hisor	Гиссар	44.0	0.08	107,287
Jirgatol	Джиргиталь	39.2	0.09	21,629
Nurobod	Нурабад	45.5	0.07	29,941
Rasht	Рашт	44.1	0.07	45,237
Roghun	Рогун	44.0	0.08	15,870
Rudaki	Рудаки	50.6	0.07	197,700
Shahrinaw	Шахринав	26.2	0.07	25,317
Tavildara	Тавилдара	41.4	0.09	7,956
Tojikobod	Таджикобод	45.5	0.10	17,053
Tursunzoda	Турсунзаде	12.7	0.04	30,405
Vahdat	Вахдат	25.9	0.08	72,476
Varzob	Варзоб	43.5	0.08	28,370

Source: World Bank calculations using Census 2010 and TLSS 2009.

Gorno-Badakhshan Autonomous Province/Горно-Бадахшанская Автономная область

District		Poverty,%	Standard Error	Number of Poor
Darvoz	Дарвоз	61.8	0.07	12,384
Ishkoshim	Ишкашим	72.3	0.09	21,053
Khorugh	Хорог	48.2	0.08	13,070
Murghob	Мургаб	56.7	0.09	7,539
Roshtqala	Рошткала	76.2	0.06	18,590
Rushon	Рушан	54.0	0.09	12,880
Shughnon	Шугнан	59.3	0.10	20,429
Vanj	Ванч	54.4	0.08	16,695

Source: World Bank calculations using Census 2010 and TLSS 2009.

[4] Please note that for many individual districts, the standard errors are substantial. For instance, 9 percent standard error means the 95% confidence interval will be almost +/-20 percent. Individual district level results should be considered bearing in mind the imprecision of specific estimates, and particularly in those cases with small populations.

Khatlon / Хатлонская область

District		Poverty,%	Standard Error	Number of Poor
Baljuvon	Бальджувон	55.7	0.09	13,639
Bokhtar	Бохтар	64.5	0.07	139,967
Danghara	Дангара	51.8	0.09	63,475
Farkhor	Фархор	49.3	0.08	67,774
Hamadoni	Хамадони	66.9	0.08	82,270
Jilikul	Джиликуль	62.3	0.08	56,104
Jomi	А. Джоми	61.8	0.07	83,576
Khovaling	Ховалинг	64.1	0.06	31,384
Khuroson	Хуросон	57.9	0.08	53,103
Kulob	Куляб	61.7	0.07	111,940
Muminobod	Муминобод	61.5	0.08	47,729
Norak	Нурек	67.4	0.07	32,957
Nosiri Khisrav	Носири Хисрав	54.6	0.08	16,556
Panj	Пяндж	46.4	0.09	43,146
Qabodiyon	Кабодиён	38.3	0.09	56,698
Qumsangir	Кумсангир	54.1	0.10	59,733
Qurghonteppa	Курган-Тюбе	58.6	0.08	43,719
Rumi	Джалолиддин Руми	53.9	0.08	84,869
Sarband	Сарбанд	69.7	0.09	27,092
Shahrtuz	Шаартуз	61.7	0.08	62313
Shuroobod	Шурообод	69.0	0.09	30,995
Temurmalik	Темурмалик	60.6	0.07	35,574
Vakhsh	Вахш	54.0	0.08	85,998
Vose	Восе	52.4	0.07	92,845
Yovon	Яван	62.7	0.09	111,729

Source: World Bank calculations using Census 2010 and TLSS 2009.

Sughd/ Согдийская область

District		Poverty,%	Standard Error	Number of Poor
Asht	Ашт	54.4	0.08	73,352
Ayni	Айни	31.4	0.08	22,644
Bobojon Ghafurov	Б. Гафуров	48.8	0.07	160,139
Chkalovsk	Чкаловск	48.0	0.10	13,272
Ghonchi	Ганчинский	62.5	0.06	88,513
Isfara	Исфара	66.5	0.06	153,076
Istaravshan	Истаравшан	51.9	0.06	115,137
Jabbor Rasulov	Дж. Расулов	40.4	0.07	45,638
Khujand	Худжанд	32.4	0.06	52,015
Konibodom	Канибадам	33.9	0.07	61,230
Kuhistoni Mastchoh	Кух. Мастчохский	64.3	0.08	13,543
Mastchoh	Матчинский	45.4	0.07	45,924
Panjakent	Пенджикент	27.2	0.06	66,648
Qayraqqum	Кайраккум	14.0	0.06	5,603
Shahriston	Шахристан	62.3	0.08	21,371
Spitamen	Спитамен	62.4	0.08	73,294
Zafarobod	Зафаробод	45.9	0.10	27,488

Source: World Bank calculations using Census 2010 and TLSS 2009.

ANNEX B
MULTIDIMENSIONAL POVERTY INDICATOR BY DISTRICT, in %

		District		Dep Demo1	Dep Demo2	Dep Educ1	Dep Educ2	Dep Emp1	Dep Infra1	Dep Infra2	Dep_Infra3	Dep_Infra4	Dep_Infra5	MPI Poor	MPI Severe	MPI Vulnerable
Dushanbe and Districts of Republican Subordination	Душанбе и Районы Республиканского Подчинения	Dushanbe	Душанбе	1	17	32	58	16	19	8	9	4	21	22	5	24
		Faizobod	Файзабад	2	26	45	75	21	90	81	90	92	94	78	49	17
		Hisor	Гиссар	1	25	57	82	11	89	80	87	81	92	79	46	18
		Jirgatol	Джиргиталь	1	34	29	88	13	95	96	93	84	99	83	45	17
		Nurobod	Нурабад	1	32	62	91	16	86	88	80	83	99	85	54	14
		Rasht	Рашт	1	29	54	88	20	86	72	83	82	96	79	49	19
		Roghun	Рогун	1	28	39	84	14	51	33	50	47	53	49	28	21
		Rudaki	Рудаки	1	27	60	83	15	87	69	80	77	93	77	44	19
		Shahrinaw	Шахринав	1	22	49	78	15	89	81	86	67	93	71	40	24
		Tavildara	Тавилдара	1	42	53	79	11	93	91	92	89	99	85	56	13
		Tojikobod	Таджикобод	1	27	44	88	19	95	92	93	93	98	87	53	12
		Tursunzoda	Турсунзаде	1	22	42	84	13	74	53	72	65	76	63	34	21
		Vahdat	Вахдат	1	23	59	83	18	82	77	76	72	84	76	45	17
		Varzob	Варзоб	1	26	62	72	24	90	77	80	90	98	81	49	18

Source: World Bank calculations using Census 2010.

		District		Dep Demo1	Dep Demo2	Dep Educ1	Dep Educ2	Dep Emp1	Dep Infra1	Dep Infra2	Dep_Infra3	Dep_Infra4	Dep_Infra5	MPI Poor	MPI Severe	MPI Vulnerable
Dushanbe and Districts of Republican Subordination	Душанбе и Районы Республиканского Подчинения	Dushanbe	Душанбе	1	17	32	58	16	19	8	9	4	21	22	5	24
		Faizobod	Файзабад	2	26	45	75	21	90	81	90	92	94	78	49	17
		Hisor	Гиссар	1	25	57	82	11	89	80	87	81	92	79	46	18
		Jirgatol	Джиргиталь	1	34	29	88	13	95	96	93	84	99	83	45	17
		Nurobod	Нурабад	1	32	62	91	16	86	88	80	83	99	85	54	14
		Rasht	Рашт	1	29	54	88	20	86	72	83	82	96	79	49	19
		Roghun	Рогун	1	28	39	84	14	51	33	50	47	53	49	28	21
		Rudaki	Рудаки	1	27	60	83	15	87	69	80	77	93	77	44	19
		Shahrinaw	Шахринав	1	22	49	78	15	89	81	86	67	93	71	40	24
		Tavildara	Тавилдара	1	42	53	79	11	93	91	92	89	99	85	56	13
		Tojikobod	Таджикобод	1	27	44	88	19	95	92	93	93	98	87	53	12
		Tursunzoda	Турсунзаде	1	22	42	84	13	74	53	72	65	76	63	34	21
		Vahdat	Вахдат	1	23	59	83	18	82	77	76	72	84	76	45	17
		Varzob	Варзоб	1	26	62	72	24	90	77	80	90	98	81	49	18

Source: World Bank calculations using Census 2010.

		District		Dep Demo1	Dep Demo2	Dep Educ1	Dep Educ2	Dep Emp1	Dep Infra1	Dep Infra2	Dep_Infra3	Dep_Infra4	Dep_Infra5	MPI Poor	MPI Severe	MPI Vulnerable
Gorno-Badakhshan Autonomous Province	Горно-Бадахшанская Автономная область	Darvoz	Дарвоз	1	24	45	68	12	98	98	71	91	99	71	39	28
		Ishkoshim	Ишкашим	1	17	43	75	14	89	93	80	84	94	73	38	22
		Khorugh	Хорог	1	9	19	44	15	54	55	32	29	56	26	9	33
		Murghob	Мургаб	1	21	22	84	36	93	97	86	84	95	79	50	19
		Roshtqala	Рошткала	0	13	28	68	19	97	97	83	91	99	71	34	28
		Rushon	Рушан	0	13	25	65	11	97	95	71	80	99	57	21	40
		Shughnon	Шугнан	0	11	26	60	19	99	97	89	92	99	68	33	31
		Vanj	Ванч	1	23	28	71	9	88	94	88	81	96	67	29	31

Source: World Bank calculations using Census 2010.

Dushanbe and Districts of Republican Subordination	Душанбе и Районы Республиканского Подчинения	District		Dep Demo1	Dep Demo2	Dep Educ1	Dep Educ2	Dep Emp1	Dep Infra1	Dep Infra2	Dep_Infra3	Dep_Infra4	Dep_Infra5	MPI Poor	MPI Severe	MPI Vulnerable
		Dushanbe	Душанбе	1	17	32	58	16	19	8	9	4	21	22	5	24
		Faizobod	Файзабад	2	26	45	75	21	90	81	90	92	94	78	49	17
		Hisor	Гиссар	1	25	57	82	11	89	80	87	81	92	79	46	18
		Jirgatol	Джиргиталь	1	34	29	88	13	95	96	93	84	99	83	45	17
		Nurobod	Нурабад	1	32	62	91	16	86	88	80	83	99	85	54	14
		Rasht	Рашт	1	29	54	88	20	86	72	83	82	96	79	49	19
		Roghun	Рогун	1	28	39	84	14	51	33	50	47	53	49	28	21
		Rudaki	Рудаки	1	27	60	83	15	87	69	80	77	93	77	44	19
		Shahrinaw	Шахринав	1	22	49	78	15	89	81	86	67	93	71	40	24
		Tavildara	Тавилдара	1	42	53	79	11	93	91	92	89	99	85	56	13
		Tojikobod	Таджикобод	1	27	44	88	19	95	92	93	93	98	87	53	12
		Tursunzoda	Турсунзаде	1	22	42	84	13	74	53	72	65	76	63	34	21
		Vahdat	Вахдат	1	23	59	83	18	82	77	76	72	84	76	45	17
		Varzob	Варзоб	1	26	62	72	24	90	77	80	90	98	81	49	18

Source: World Bank calculations using Census 2010.

		District		Dep Demo1	Dep Demo2	Dep Educ1	Dep Educ2	Dep Emp1	Dep Infra1	Dep Infra2	Dep_Infra3	Dep_Infra4	Dep_Infra5	MPI Poor	MPI Severe	MPI Vulnerable
		Baljuvon	Бальджувон	1	37	62	86	7	83	89	90	77	97	83	49	16
		Bokhtar	Бохтар	1	26	44	84	12	83	83	81	80	96	74	39	23
		Danghara	Дангара	1	30	52	82	20	85	82	80	75	94	77	46	20
		Farkhor	Фархор	1	28	39	78	15	88	86	87	85	96	77	42	21
		Hamadoni	Хамадони	1	26	34	78	14	92	85	88	87	95	76	39	21
		Jilikul	Джиликуль	1	28	46	88	11	84	93	84	78	91	80	43	18
		Jomi	А. Джоми	1	27	44	89	12	92	91	84	86	95	82	47	15
		Khovaling	Ховалинг	1	34	60	84	16	86	88	89	83	96	84	54	15
		Khuroson	Хуросон	1	28	53	90	18	81	84	83	76	94	81	48	17
		Kulob	Куляб	1	24	34	68	17	68	53	63	46	75	52	24	29
		Muminobod	Муминобод	1	29	50	79	13	73	78	87	76	94	74	38	23
		Norak	Нурек	1	25	49	81	13	50	44	37	43	50	49	24	25
		Nosiri Khisrav	Носири Хисрав	1	26	35	92	7	88	93	85	92	97	80	38	19
		Panj	Пяндж	1	26	39	89	8	88	88	81	77	93	75	36	22
		Qabodiyon	Кабодиён	1	22	30	95	8	77	91	86	71	96	73	30	26
		Qumsangir	Кумсангир	2	28	55	91	11	84	88	82	78	91	81	46	17
		Qurghonteppa	Курган-Тюбе	1	21	26	69	11	26	11	22	4	26	21	6	28
		Rumi	Джалолиддин Руми	2	27	42	87	11	85	82	81	81	89	76	43	18
		Sarband	Сарбанд	1	24	50	80	23	54	50	53	38	57	56	29	24
		Shahrtuz	Шаартуз	1	26	22	90	9	93	88	87	83	94	77	34	19
		Shuroobod	Шурообод	1	31	36	76	11	96	92	81	93	98	77	40	22
		Temurmalik	Темурмалик	1	28	49	84	17	87	87	86	87	96	80	48	18
		Vakhsh	Вахш	1	29	45	89	10	92	91	77	86	96	81	44	18
		Vose	Восе	1	29	42	80	12	88	88	86	83	95	77	41	21
Khatlon	Хатлонская область	Yovon	Яван	1	30	45	86	14	75	73	75	72	78	71	42	18

Source: World Bank calculations using Census 2010.

		District		Dep Demo1	Dep Demo2	Dep Educ1	Dep Educ2	Dep Emp1	Dep Infra1	Dep Infra2	Dep_Infra3	Dep_Infra4	Dep_Infra5	MPI Poor	MPI Severe	MPI Vulnerable
Dushanbe and Districts of Republican Subordination	Душанбе и Районы Республиканского Подчинения	Dushanbe	Душанбе	1	17	32	58	16	19	8	9	4	21	22	5	24
		Faizobod	Файзабад	2	26	45	75	21	90	81	90	92	94	78	49	17
		Hisor	Гиссар	1	25	57	82	11	89	80	87	81	92	79	46	18
		Jirgatol	Джиргиталь	1	34	29	88	13	95	96	93	84	99	83	45	17
		Nurobod	Нурабад	1	32	62	91	16	86	88	80	83	99	85	54	14
		Rasht	Рашт	1	29	54	88	20	86	72	83	82	96	79	49	19
		Roghun	Рогун	1	28	39	84	14	51	33	50	47	53	49	28	21
		Rudaki	Рудаки	1	27	60	83	15	87	69	80	77	93	77	44	19
		Shahrinaw	Шахринав	1	22	49	78	15	89	81	86	67	93	71	40	24
		Tavildara	Тавилдара	1	42	53	79	11	93	91	92	89	99	85	56	13
		Tojikobod	Таджикобод	1	27	44	88	19	95	92	93	93	98	87	53	12
		Tursunzoda	Турсунзаде	1	22	42	84	13	74	53	72	65	76	63	34	21
		Vahdat	Вахдат	1	23	59	83	18	82	77	76	72	84	76	45	17
		Varzob	Варзоб	1	26	62	72	24	90	77	80	90	98	81	49	18

Source: World Bank calculations using Census 2010.

		District		Dep Demo1	Dep Demo2	Dep Educ1	Dep Educ2	Dep Emp1	Dep Infra1	Dep Infra2	Dep_Infra3	Dep_Infra4	Dep_Infra5	MPI Poor	MPI Severe	MPI Vulnerable
Sughd	Согдийская область	Asht	Аште	1	21	31	81	12	93	88	96	92	98	79	40	19
		Ayni	Айни	1	23	30	79	8	88	90	89	86	93	74	34	21
		Bobojon Ghafurov	Б. Гафуров	1	16	40	79	12	84	74	85	63	91	63	30	29
		Chkalovsk	Чкаловск	0	15	26	60	9	17	7	22	12	18	15	4	26
		Ghonchi	Ганчинский	1	24	43	84	9	96	95	92	91	99	84	47	15
		Isfara	Исфара	1	18	33	84	15	86	78	86	73	90	69	33	25
		Istaravshan	Истаравшан	1	22	43	86	9	86	78	87	70	89	73	35	22
		Jabbor Rasulov	Дж. Расулов	1	16	29	83	12	80	86	83	79	88	66	28	29
		Khujand	Худжанд	0	11	23	62	9	14	3	15	2	24	13	2	21
		Konibodom	Канибадам	1	15	39	84	16	91	86	84	74	92	72	37	23
		Kuhistoni Mastchoh	Кух. Мастчохский	2	35	85	89	5	95	95	95	73	99	93	66	6
		Mastchoh	Матчинский	2	21	45	84	10	84	71	87	60	90	66	30	28
		Panjakent	Пенджикент	1	22	50	86	11	83	76	82	70	88	72	38	22
		Qayraqqum	Кайраккум	1	16	32	80	16	36	19	47	24	32	34	15	26
		Shahriston	Шахристан	1	28	31	77	11	86	91	93	94	88	73	35	26
		Spitamen	Спитамен	1	15	38	84	15	88	79	87	79	91	72	37	23
		Zafarobod	Зафаробод	1	20	39	87	10	50	77	74	57	79	57	24	31

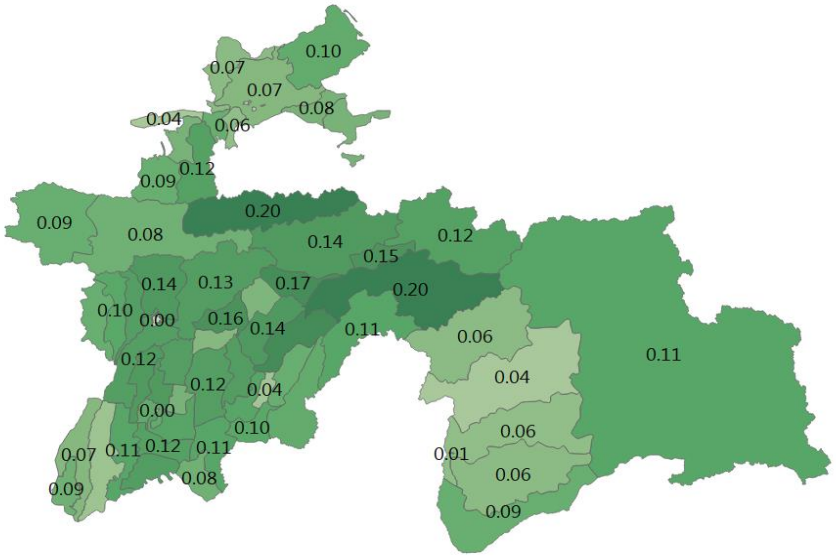
Source: World Bank calculations using Census 2010.

		District		Dep Demo1	Dep Demo2	Dep Educ1	Dep Educ2	Dep Emp1	Dep Infra1	Dep Infra2	Dep_Infra3	Dep_Infra4	Dep_Infra5	MPI Poor	MPI Severe	MPI Vulnerable
Dushanbe and Districts of Republican Subordination	Душанбе и Районы Республиканского Подчинения	Dushanbe	Душанбе	1	17	32	58	16	19	8	9	4	21	22	5	24
		Faizobod	Файзабад	2	26	45	75	21	90	81	90	92	94	78	49	17
		Hisor	Гиссар	1	25	57	82	11	89	80	87	81	92	79	46	18
		Jirgatol	Джиргиталь	1	34	29	88	13	95	96	93	84	99	83	45	17
		Nurobod	Нурабад	1	32	62	91	16	86	88	80	83	99	85	54	14
		Rasht	Рашт	1	29	54	88	20	86	72	83	82	96	79	49	19
		Roghun	Рогун	1	28	39	84	14	51	33	50	47	53	49	28	21
		Rudaki	Рудаки	1	27	60	83	15	87	69	80	77	93	77	44	19
		Shahrinaw	Шахринав	1	22	49	78	15	89	81	86	67	93	71	40	24
		Tavildara	Тавилдара	1	42	53	79	11	93	91	92	89	99	85	56	13
		Tojikobod	Таджикобод	1	27	44	88	19	95	92	93	93	98	87	53	12
		Tursunzoda	Турсунзаде	1	22	42	84	13	74	53	72	65	76	63	34	21
		Vahdat	Вахдат	1	23	59	83	18	82	77	76	72	84	76	45	17
		Varzob	Варзоб	1	26	62	72	24	90	77	80	90	98	81	49	18

Source: World Bank calculations using Census 2010.

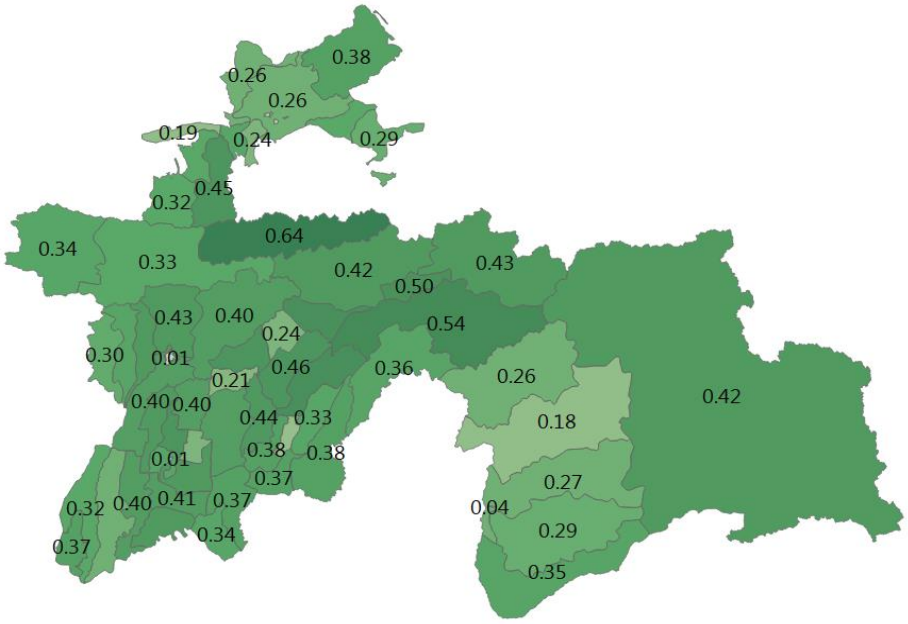
ANNEX C – MPI INDICATOR MAPS

Figure C1: MPI Map with 8 Indicators



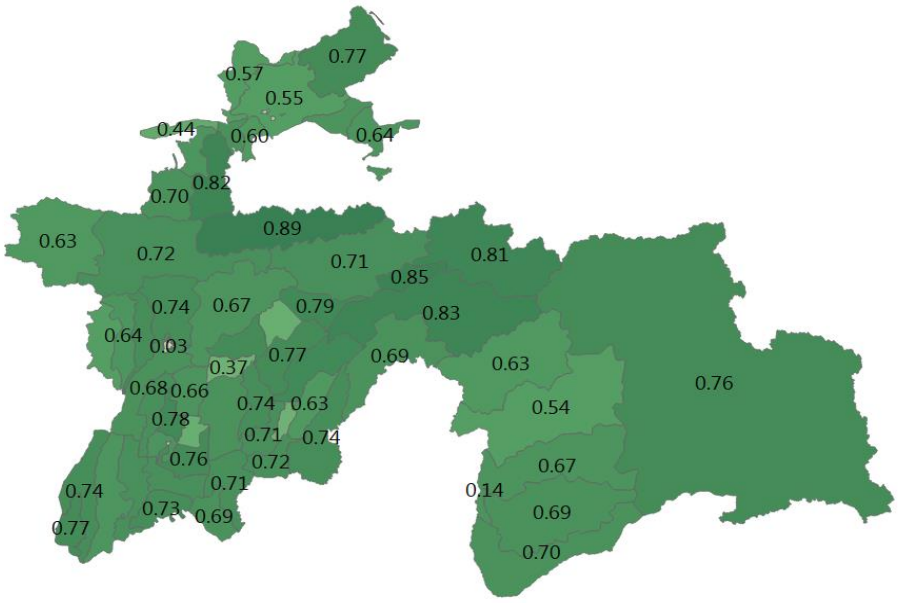
Note: Poverty rates refer to the share of poor in the district.
Source: World Bank calculations using Census 2010.

Figure C2: MPI Map with 7 Indicators



Note: Poverty rates refer to the share of poor in the district.
Source: World Bank calculations using Census 2010.

Figure C3: MPI Map with 6 Indicators



Note: Poverty rates refer to the share of poor in the district.
Source: World Bank calculations using Census 2010.