



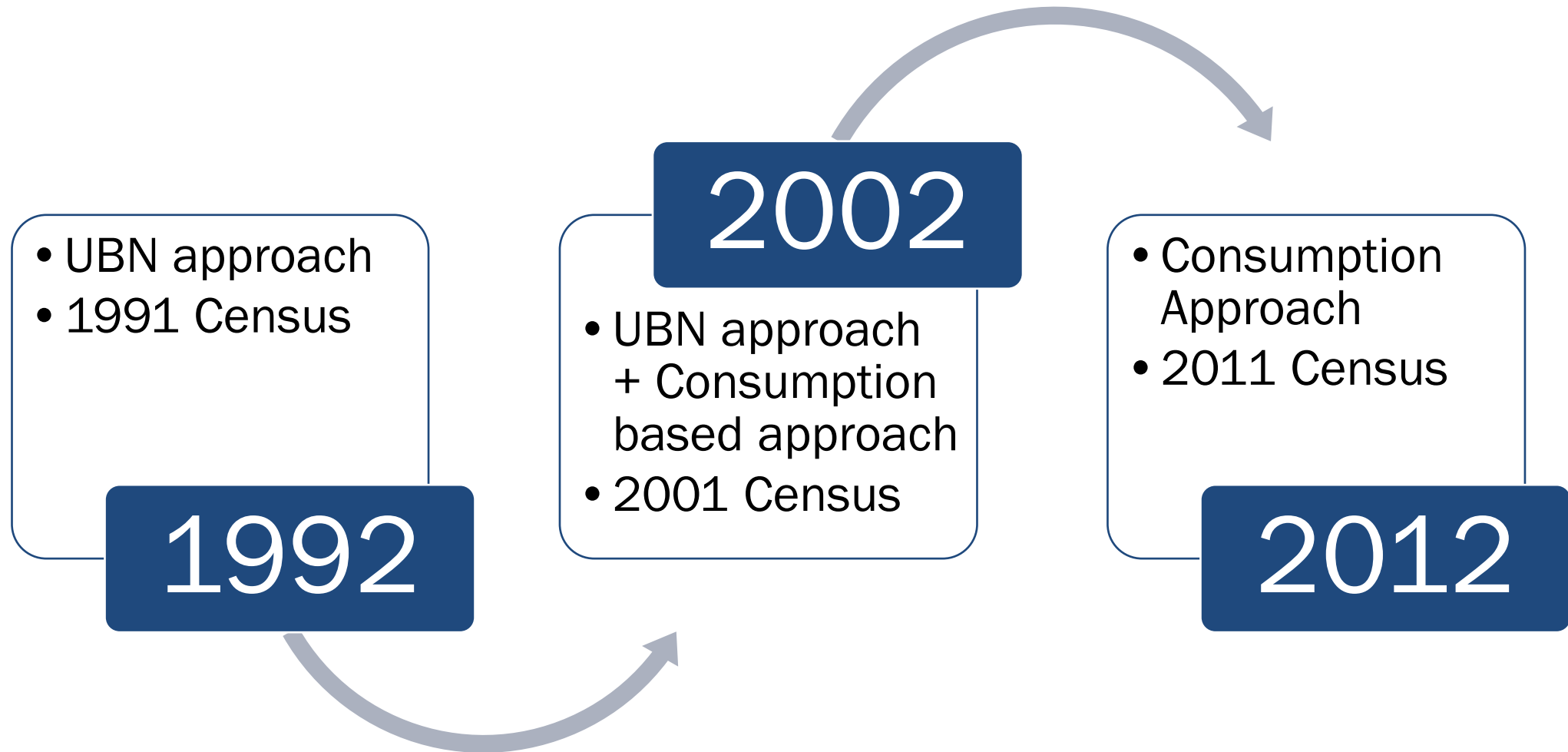
POVERTY MAPPING USING SMALL AREA ESTIMATION TECHNIQUES

THE JAMAICAN EXPERIENCE

Presented by:
Miss Leesha Delatie-Budair, M.Sc.
Deputy Director General
Statistical Institute of Jamaica



POVERTY MAPS IN JAMAICA





WHAT IS POVERTY MAPPING ?

- "Poverty mapping" is a method to estimate the welfare level and the degree of inequality at lower aggregation levels such as EDs or communities.
- It uses a model of household expenditure from a survey dataset to estimate household welfare and apply it to a census dataset which does not include household expenditure or income information.
- Poverty indicators at the community level are then estimated as aggregates.



THE APPROACH (2012)

Workshop with key stakeholders to define model parameters

Modelling

Workshop with key stakeholders to validate results



STAGES OF POVERTY MAPPING

Stage 1 The census and survey data are examined for compatibility.
Only the variables with same definition and distribution are allowed to be used in the second stage or the modelling stage.

Stage 2 A series of regressions are run to model the expenditure and decompose the random unexplained components.
Once a believable welfare estimation model is obtained, the poverty mapper will then apply it to the third stage known as the simulation stage.

Stage 3 Uses the model parameters and performs repeated drawings on different random components to bootstrap the household expenditure.
The estimated household welfare is then aggregated at different levels.
Model evaluation



STAGE 1: COMPARISON



JSLC (LSMS)

- Parish level data (14)

Census

- ED Level data

Poverty Maps

- Parish level data (14)
- Community level data (767)



STAGE 1: COMPARISON (CONT'D)

Identified variables collected in both Census and JSLC

- Collected variables e.g. sex of household head
- Derived variables e.g. dependency ratio

Assessed averages and design-adjusted confidence intervals

- At $\alpha = 0.05$
- Variable statistically equal if census estimate within 95% C.I.



STAGE 1: COMPARISON (CONT'D)

JSLC

Households (6,579)

Individual (20,532)

Variables

- demographics
- education
- Employment
- consumption
- housing characteristics

Census

Households (881,037)

Individual (2,682,512)

Variables

- basic services
- information and communication technology (ICT) equipment
- Housing characteristics

• demographic

• education



STAGE 2: MODELLING

Determine consumption models

- Geographic regions believed to have similar consumption patterns

Determine variables to include in each model

- Significant linear correlation with consumption (Pearsons)



STAGE 2: MODELLING (CONT'D)

Conceptually, a total of 77 identical variables, including derived variables, between both sources were identified at the household level.

Statistically, all of the 77 variables in each of the seven geographic groups were tested for equality.

household
size

household
composition

age

sex

occupation

education

materials of
the dwelling

access to
basic
services

household
assets.



STAGE 2: MODELLING (CONT'D)

Control Variables

Number

- 46 variables aggregated at the level of parish and community were included in the modelling stage

Purpose

- To control for differences between communities in terms of population, climate, housing characteristics, public transfers and public services.

Sources of the Control Variables:

Population and Housing Census

Administrative Records



STAGE 2: MODELLING (CONT'D)

- For each of the seven groups, the relationship between the logarithm of household consumption per adult equivalent, with the statistically equal and aggregated variables identified in the first stage, was estimated using a GLS regression approach.

$$\log(Y_{hl}) = X_{hl}\beta + Z_l\gamma + \mu_{hl}$$

- The X_{hl} and Z_l sets include, respectively, the household characteristics and the characteristics of the geographical unit that allow for the prediction of household consumption on the census.
- μ_{hl} represents the error term that includes two components:
 - the error that is common for all the households in the same geographical unit,
 - the error that is specific to each household.



STAGE 2: MODELLING (CONT'D)

- The error term μ_{hl}

$$\mu_{hl} = \eta_l + \varepsilon_{hl}$$

- η_l is the error that is common for all the households in the same geographical unit,
- ε_{hl} the error that is specific to each household.



STAGE 2: MODELLING (CONT'D)

The objective of this process was to analyse the power of each model to predict consumption, based on two conditions:

all the variables included in the model were statistically significant

that the adjusted coefficient of determination, (R^2), was around 0.50, but no less than 0.30



STAGE 3: SIMULATION

200 imputations of adult equivalent consumption were simulated for each ED

Imputed consumption was then compared with the survey results



STAGE 3: MODEL EVALUATION

- Each model was evaluated in terms of the magnitude of the estimation error that is common to all households living in the same geographical unit (η_l).
- This assessment calculates the ratio of the variance of η_l relative to the total variance of errors (μ_{hl}), and indicates what proportion of the variance of errors that is due to unexplained differences at the community level.
- As this ratio moves away from zero, the reliability of the estimations decreases as it reduces the accuracy of capturing the fact that households living in the same community are more similar among each other than their peers living in other communities.
- As a condition, the value of the ratio should be less than 10%, which is satisfied in all seven groups.



SUMMARY OF THE MODEL RESULTS

Groups	Observations	R2	Ratio of variance	Statistically equal variables
Kingston Metropolitan Area	1,110	0.624	6.4%	48/77
Other Parish Capitals	813	0.514	9.6%	55/77
Other Urban Areas	650	0.522	5.6%	52/77
Rural North - Portland	293	0.447	0.5%	55/77
Rural North - St. Mary	272	0.442	8.2%	46/77
Rural North - St. Ann, Trelawny, St. James and Hanover	947	0.422	8.1%	49/77
Rural South	1,984	0.478	8.9%	44/77
Spanish Town & Portmore	510	0.494	6.2%	50/77
Total	6,579			



COMPARISON BETWEEN IMPUTATION AND JSLC FIGURES





PARAMETERS ESTIMATED AT THE COMMUNITY LEVEL

Per capita consumption

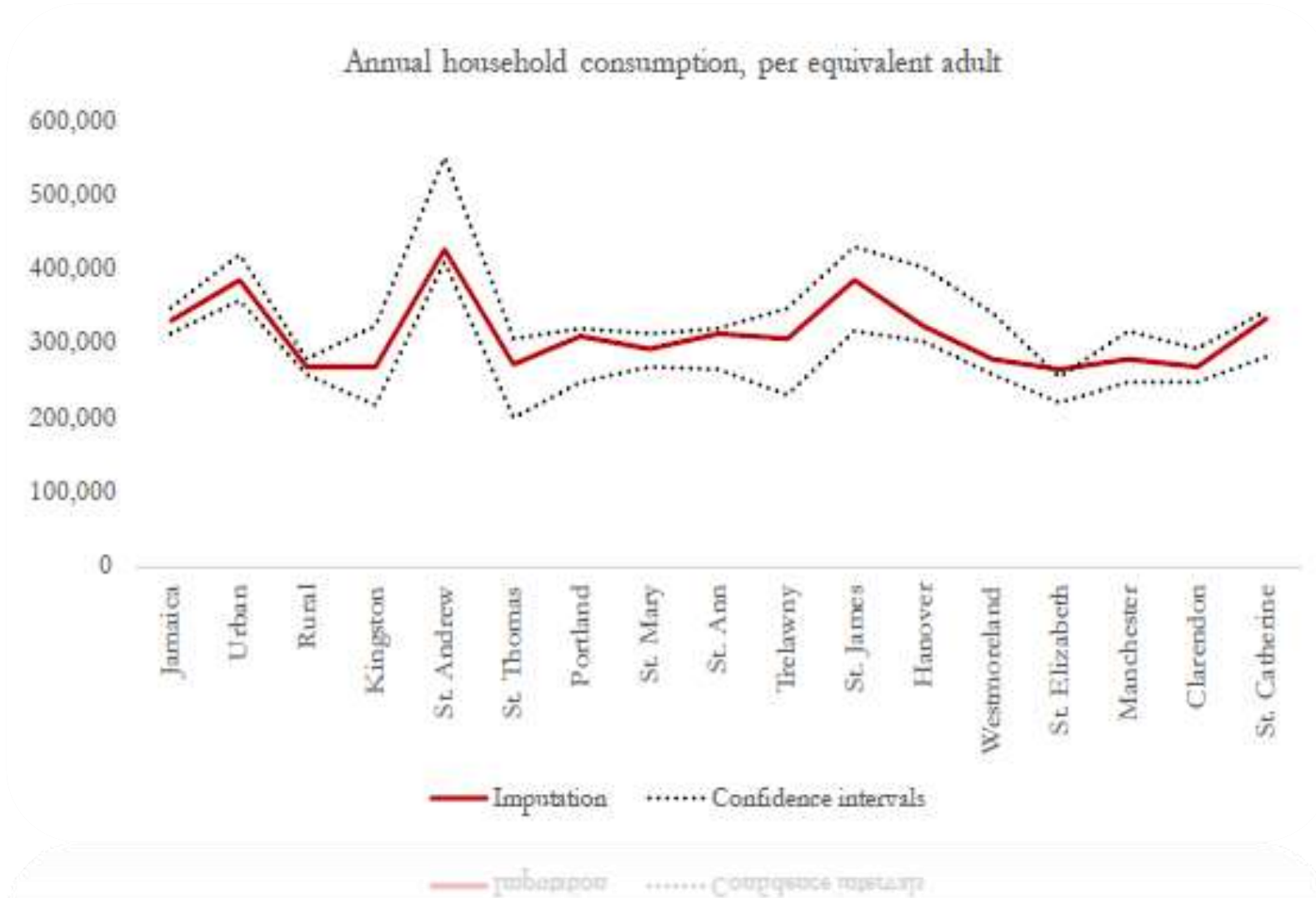
Total poverty

Food poverty

- Evaluation Criteria
 - 95% Confidence Interval
 - the CVs for predicted consumption, and the standard errors of poverty estimates at the community level



EQUIVALIZED PER CAPITA CONSUMPTION



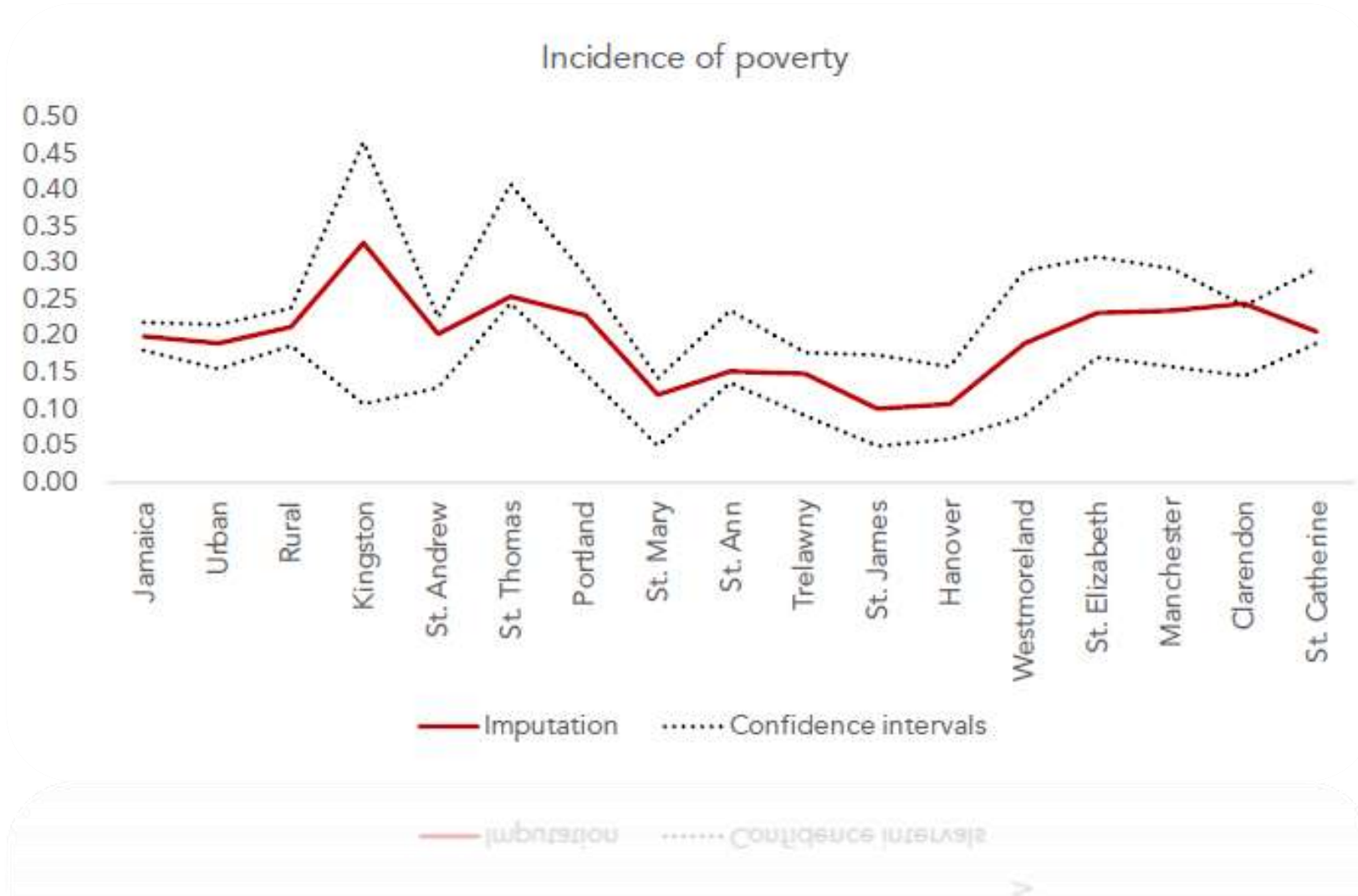


EQUIVALIZED PER CAPITA CONSUMPTION

Equivalized per capita consumption							
	Imputation		JSLC			Result	
	Average	S.E.	Average	S.E.	Conf. Interval 95%		
National							
Jamaica	330714.2	3195.0	329123.5	8856.9	311717.5	346529.5	In
Urban	384732.9	4811.5	388463.0	15446.2	358107.3	418818.7	In
Rural	269180.9	3195.5	267726.6	5614.9	256691.9	278761.2	In
Parish							
Kingston	267673.7	6934.1	269150.4	26544.4	216984.1	321316.7	In
St. Andrew	425754.8	7778.7	479083.4	35691.7	408940.3	549226.5	In
St. Thomas	271573.8	6690.3	251157.9	27197.8	197707.6	304608.3	In
Portland	308710.5	4757.4	282964.0	17787.9	248006.2	317921.7	In
St. Mary	291937.3	8905.0	288909.4	11415.2	266475.8	311343.1	In
St. Ann	313900.0	6133.3	291338.7	14320.7	263195.1	319482.4	In
Trelawny	307196.3	6497.8	288791.1	30253.7	229335.0	348247.2	In
St. James	384252.5	10249.3	371982.3	29007.8	314974.8	428989.8	In
Hanover	321658.8	7568.6	352159.2	24774.5	303471.1	400847.3	In
Westmoreland	278505.6	5588.5	299205.5	20417.2	259080.7	339330.3	In
St. Elizabeth	263951.7	5677.9	236395.5	8619.7	219455.8	253335.3	Out
Manchester	277489.3	5194.8	280643.1	17663.0	245931.0	315355.2	In
Clarendon	269589.8	5281.0	269878.2	12056.1	246185.0	293571.4	In
St. Catherine	332352.3	5590.5	312678.9	15369.2	282474.5	342883.2	In



TOTAL POVERTY



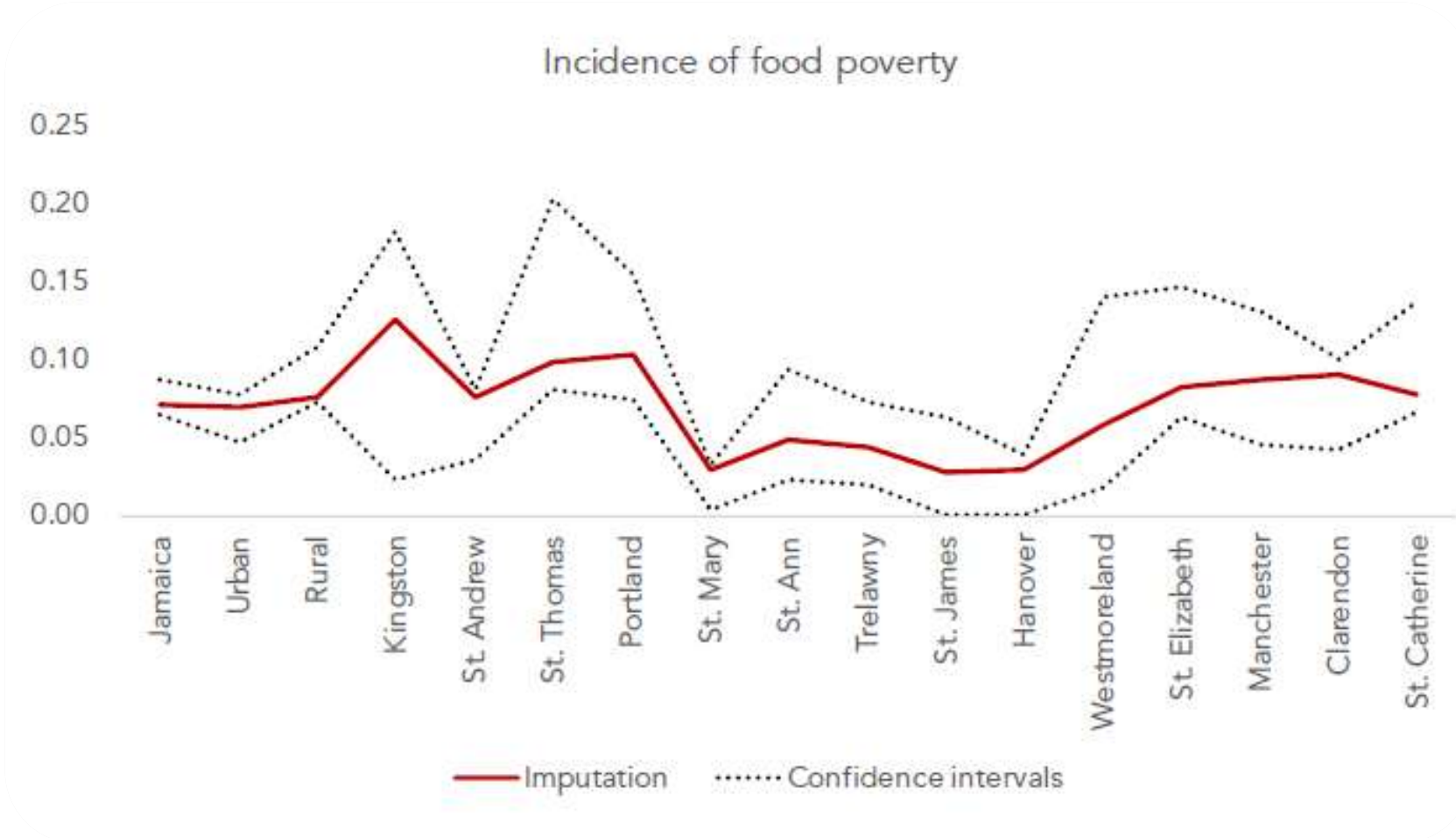


TOTAL POVERTY

Total poverty							
	Imputation		JSLC			Result	
	Poverty	S.E.	Poverty	S.E.	Conf. Interval 95%		
National							
Jamaica	0.198	0.004	0.198	0.010	0.178	0.219	In
Urban	0.188	0.005	0.185	0.015	0.154	0.215	In
Rural	0.210	0.006	0.213	0.013	0.187	0.238	In
Parish							
Kingston	0.325	0.015	0.286	0.091	0.106	0.466	In
St. Andrew	0.203	0.007	0.177	0.024	0.129	0.225	In
St. Thomas	0.253	0.013	0.325	0.042	0.244	0.407	In
Portland	0.228	0.008	0.215	0.035	0.146	0.283	In
St. Mary	0.120	0.014	0.094	0.024	0.048	0.141	In
St. Ann	0.152	0.008	0.184	0.026	0.134	0.235	In
Trelawny	0.147	0.011	0.132	0.022	0.090	0.175	In
St. James	0.098	0.009	0.111	0.032	0.049	0.174	In
Hanover	0.107	0.011	0.107	0.025	0.059	0.156	In
Westmoreland	0.188	0.011	0.189	0.050	0.090	0.287	In
St. Elizabeth	0.230	0.012	0.238	0.035	0.169	0.306	In
Manchester	0.235	0.011	0.224	0.035	0.156	0.293	In
Clarendon	0.243	0.012	0.193	0.025	0.145	0.242	Out
St. Catherine	0.204	0.007	0.240	0.026	0.190	0.291	In



FOOD POVERTY





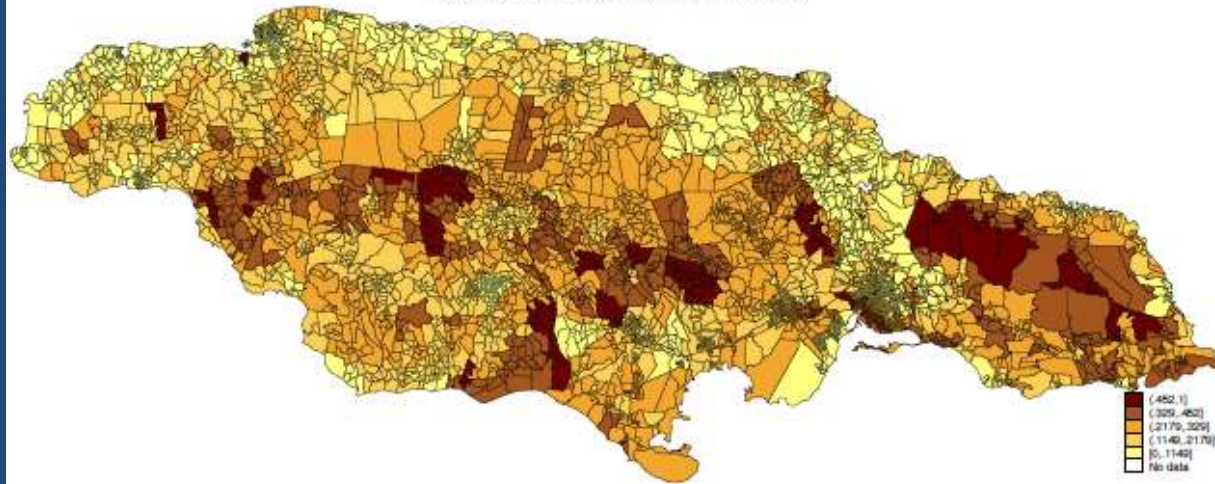
FOOD POVERTY

Food poverty							
	Imputation		JSLC			Result	
	Poverty	S.E.	Poverty	S.E.	Conf. Interval 95%		
National							
Jamaica	0.071	0.003	0.075	0.006	0.064	0.086	In
Urban	0.068	0.004	0.061	0.008	0.046	0.076	In
Rural	0.075	0.004	0.089	0.009	0.072	0.107	In
Parish							
Kingston	0.125	0.012	0.102	0.040	0.023	0.182	In
St. Andrew	0.076	0.006	0.058	0.011	0.036	0.080	In
St. Thomas	0.097	0.009	0.140	0.031	0.079	0.202	In
Portland	0.103	0.006	0.114	0.021	0.073	0.154	In
St. Mary	0.029	0.004	0.018	0.007	0.004	0.033	In
St. Ann	0.048	0.005	0.057	0.018	0.022	0.093	In
Trelawny	0.044	0.005	0.045	0.014	0.019	0.072	In
St. James	0.028	0.004	0.031	0.016	0.000	0.062	In
Hanover	0.028	0.005	0.017	0.011	0.000	0.039	In
Westmoreland	0.058	0.006	0.078	0.031	0.017	0.139	In
St. Elizabeth	0.081	0.007	0.104	0.021	0.063	0.146	In
Manchester	0.086	0.007	0.087	0.021	0.045	0.129	In
Clarendon	0.089	0.008	0.070	0.015	0.041	0.099	In
St. Catherine	0.077	0.004	0.101	0.018	0.066	0.136	In



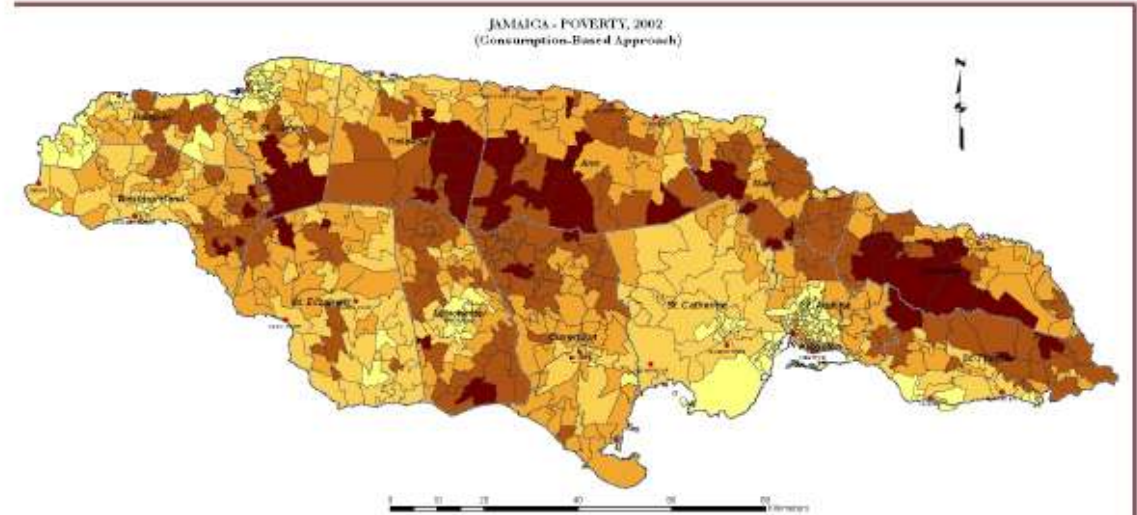
POVERTY MAPS 2012 AND 2002

Incidence of poverty in Jamaica
Percentage of population by communities



2012
19.9%

JAMAICA - POVERTY, 2002
(Consumption-Based Approach)



2002
19.7%

Prepared by: The Planning Institute of Jamaica
University of Technology, Jamaica (IIT/JCUI)
Date: July 2008
Source: Population Census 2001
Survey of Living Conditions 2002



Next Poverty Maps





STATISTICAL INSTITUTE OF JAMAICA

(STATIN)

7 CECELIO AVENUE

KINGSTON 10

JAMAICA W.I.

(876) 630-1600

 INFO@STATINJA.GOV.JM |  WWW.STATINJA.GOV.JM

    @STATINJA



**Thank You for Your
Attention**