USING POVERTY MAPPING TO INFORM POLICY DESIGN, MONITORING AND EVALUATION: POSSIBILITIES FOR THE LATVIA POVERTY MAPPING

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POVERTY AND EQUITY GLOBAL PRACTICE

WORLD BANK GROUP

MAIN TAKEAWAYS

- A poverty map is not an end in itself
- Augmented with administrative records it can become an extremely valuable tool to help inform identification, selectivity and prioritization of public investment
- The methods used in this work can find applications well beyond the mapping of poverty and deprivations

OUTLINE

1. The European Commission / World Bank Poverty Mapping Project
2. Using Poverty Mapping to Inform Policy Design
3. Using Poverty Mapping to Inform Policy Monitoring
4. Using Poverty Mapping to Inform Policy Evaluations
5. Linking administrative records and big data to Poverty mapping
6. Using small area estimation methods to estimate other indicators
7. How often spatial patterns of poverty change?

POVERTY AND SOCIAL EXCLUSION IN THE EUROPEAN UNION

- **Nearly 25% of the EU population** is at risk of poverty or social exclusion. This represents **124.2 million people**.

- Significant policy and budgetary commitment to reducing poverty and social exclusion (e.g., approximately EUR 350 billion in Regional Development, Social, and Cohesion Funds).
  - Large variation in poverty & social exclusion across EU Member States.
    - Around 15% in Czech Republic, Netherlands, and Sweden.
    - More than 40% in Bulgaria and Romania.

- Also large variation in poverty & exclusion *within* Member States.

EUROPEAN COMMISSION / WORLD BANK POVERTY MAPPING PROJECT

Objective: identify the small areas (e.g., municipalities) most likely to have the highest risk of poverty rates. That is, show the regional disparities within EU Member States.

Purposes:

Inform European Commission negotiations with Member States for 2014-2020 budget cycle, using high-resolution poverty statistics

Inform national and sub-national policies and programs

Collaboration among EC (DG Employment, DG Regional Policy, Eurostat), World Bank, and the national authorities in Member States

MAIN FEATURES OF THE PROJECT

Construct poverty maps for all EU Member States (NUTS 3 or lower)

- World Bank responsible for ten new Member States
- Consortium of Nordic research centers covering the other 17 Member States

Two phases to the project:

- Pilot in Denmark and Slovenia to compare poverty mapping methodologies
  - peer reviewed by Steering Committee that includes Eurostat and other European technical experts
- Produce maps for remaining member states using agreed methodology

Within member states, the main partners are national statistical institutes (NSIs).

- Working with data before it is sent to Eurostat ➔ getting national buy-in, working collaboratively on-site in NSIs, strengthening NSI capacity
- Full census microdata not available in time in most countries ➔ using aggregate data in some countries, and possible refinements as census microdata becomes available.

THE CHALLENGE: OBTAINING POVERTY INDICATORS FOR SMALL SUB-NATIONAL AREAS

Household surveys such as EU-SILC are the main source of indicators of living conditions, poverty, and social exclusion.

- Detailed information on multiple indicators
- Sample sizes are too small to be representative for disaggregated sub-national units.

Population censuses

- 100% coverage permits assessment for small areas
- Typically do not have much information on the usual poverty and social exclusion indicators

The Solution: Poverty mapping Combines the Census and the Survey

Survey:

- Welfare measure
- Not representative at lower level

+

Census:

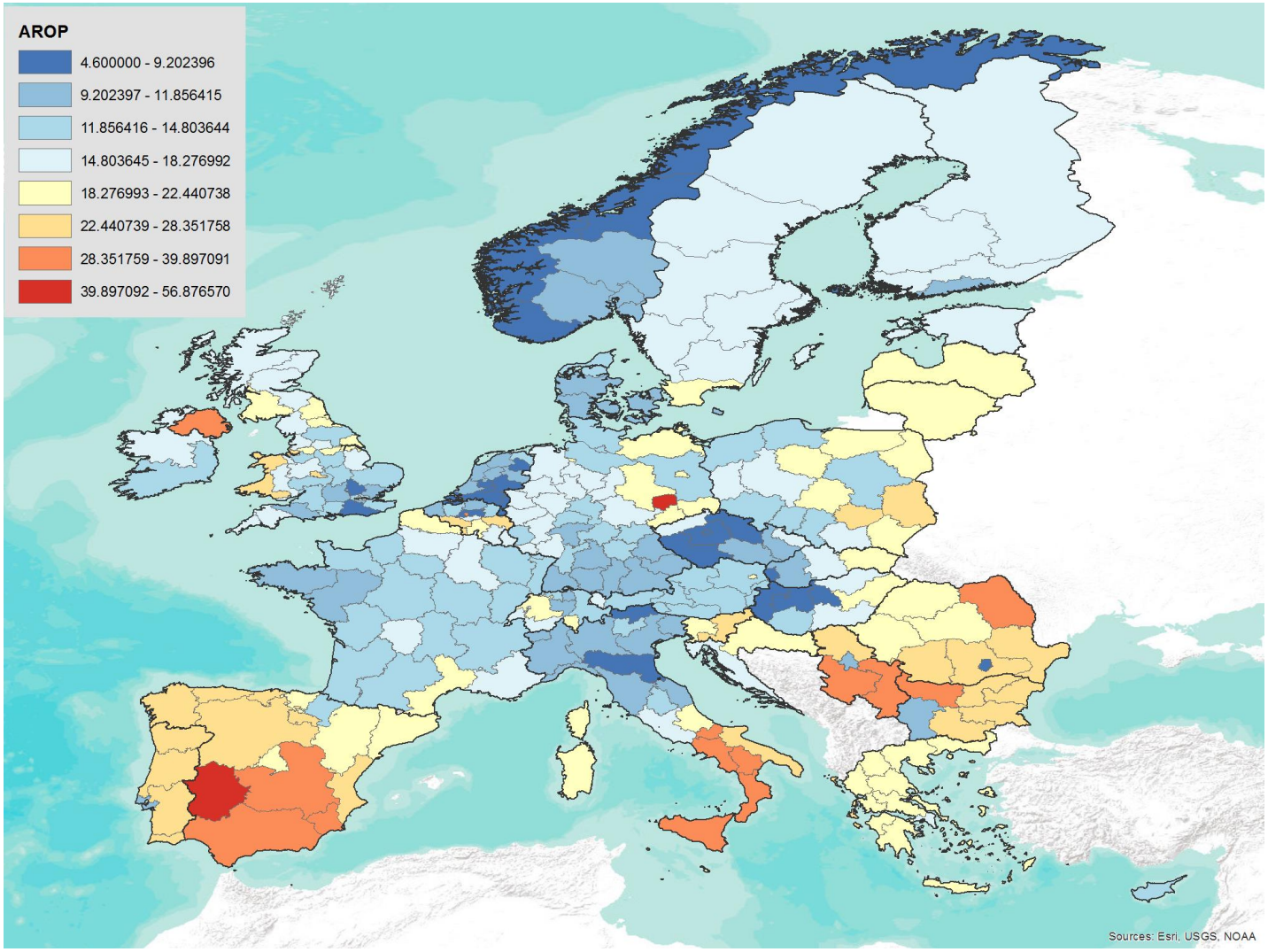
- Full coverage
- No monetary welfare measure

→

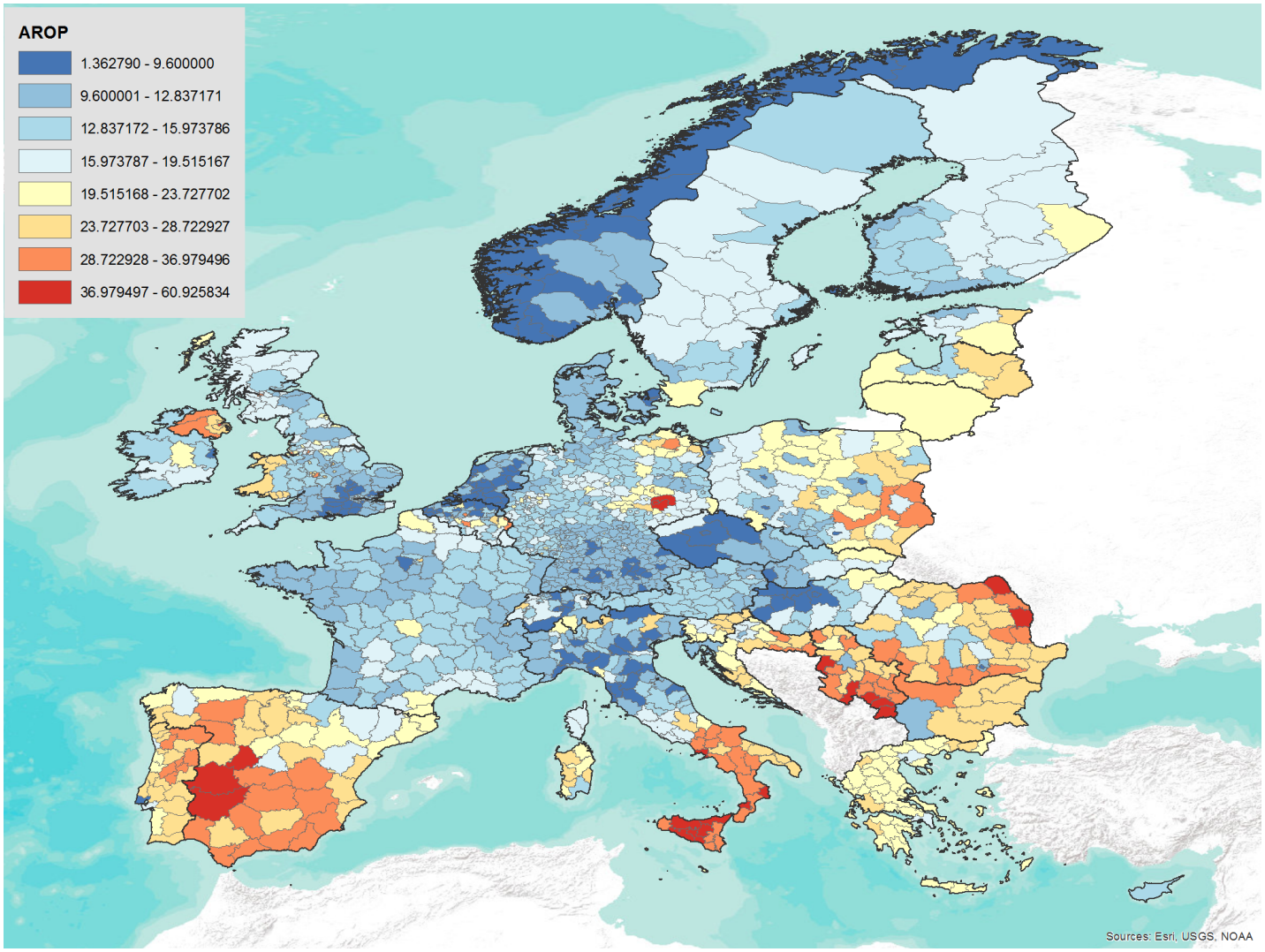
Poverty Mapping:

- Geographically disaggregated estimates of: poverty, number of poor, average income/consumption, inequality
- Simulating a measure of welfare from household survey into census, using statistical methods
- Considerable data requirements

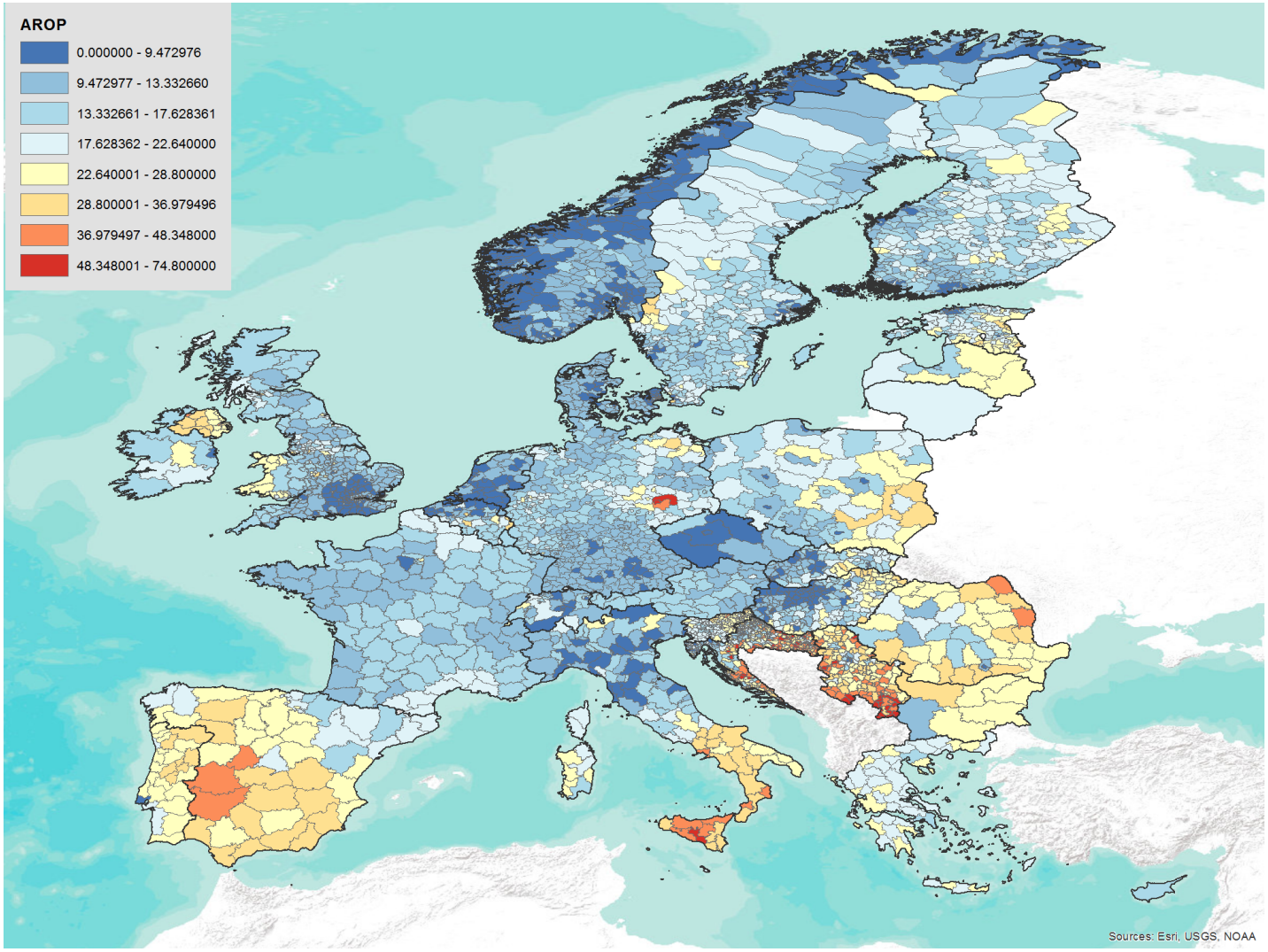
WHAT IS OUR CURRENT TERRITORIAL UNDERSTANDING OF POVERTY IN THE EU AT NUTS2?



WITH THIS COLLABORATION WE WERE ABLE TO BUILD A EU MAP AT NUTS3…



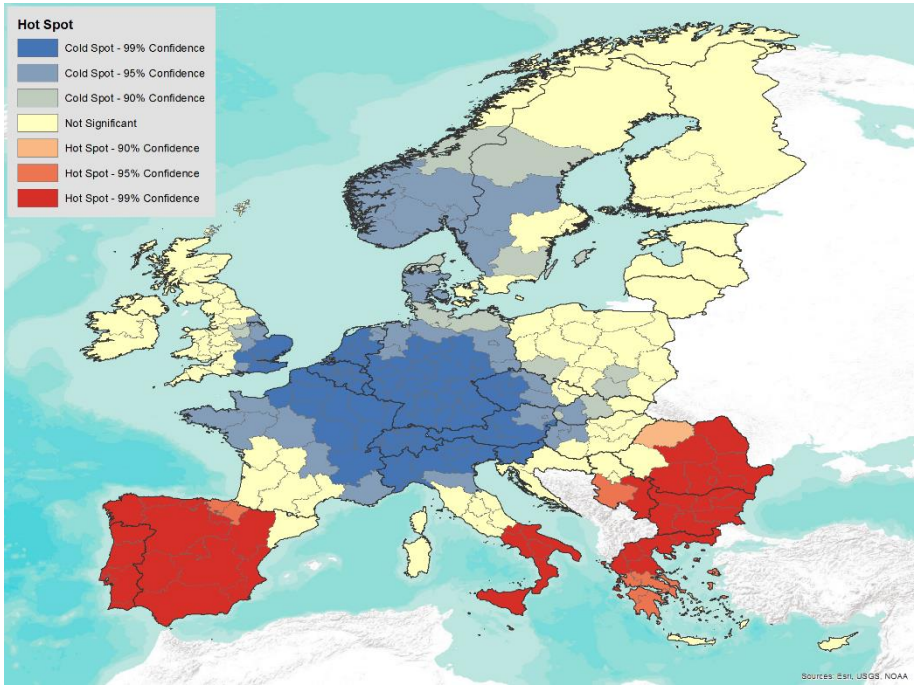
AND IN SOME CONTRIVES WERE EVEN ABLE TO GO AT A LOWER LEVEL, AS LAU.



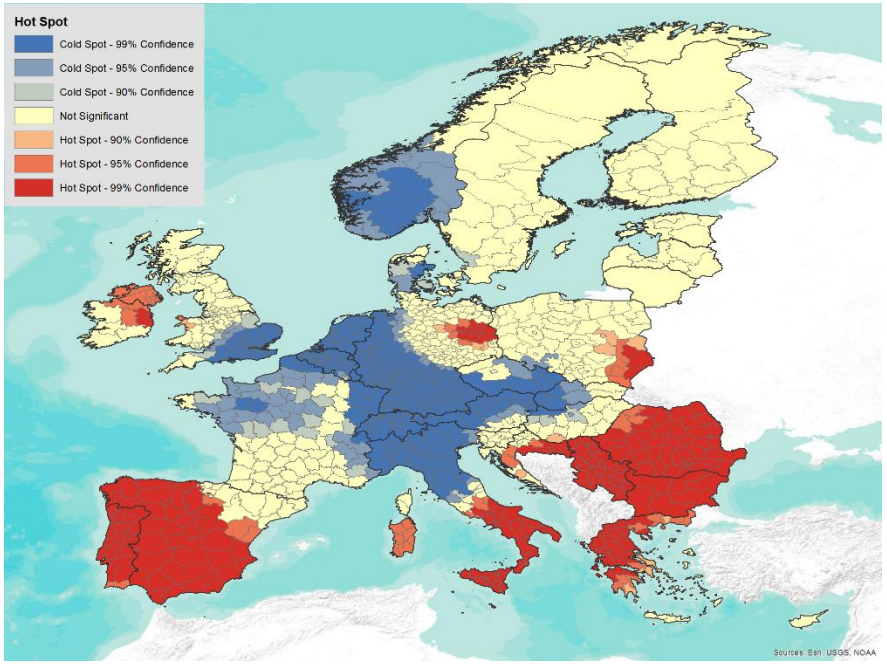
AND THE LEVEL OF TERRITORIAL ANALYSIS CAN AFFECT OF OUR UNDERSTANDING OF SPATIAL PATTERNS OF POVERTY AMONG MEMBER STATES.

Poverty Hot and Cold Spots

AT NUTS2



AT NUTS3



USING POVERTY MAPPING TO INFORM POLICY DESIGN

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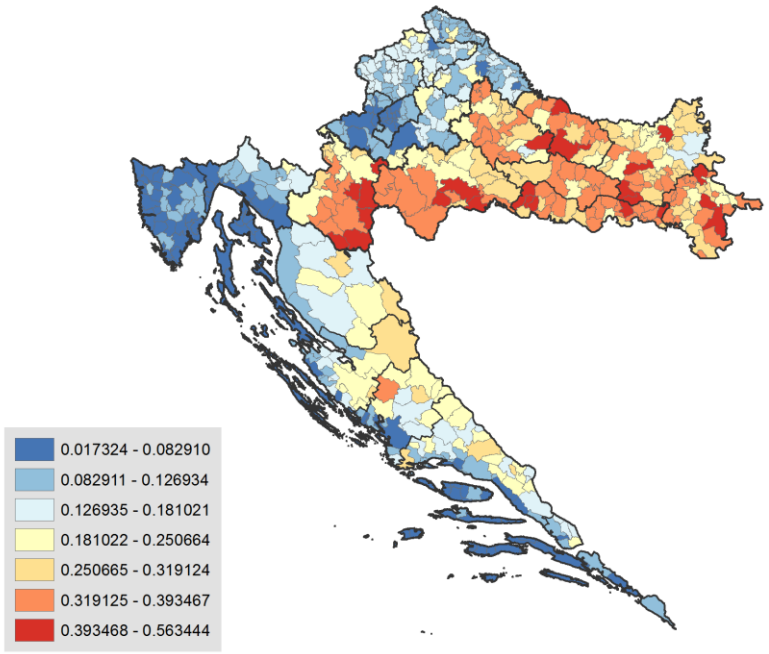
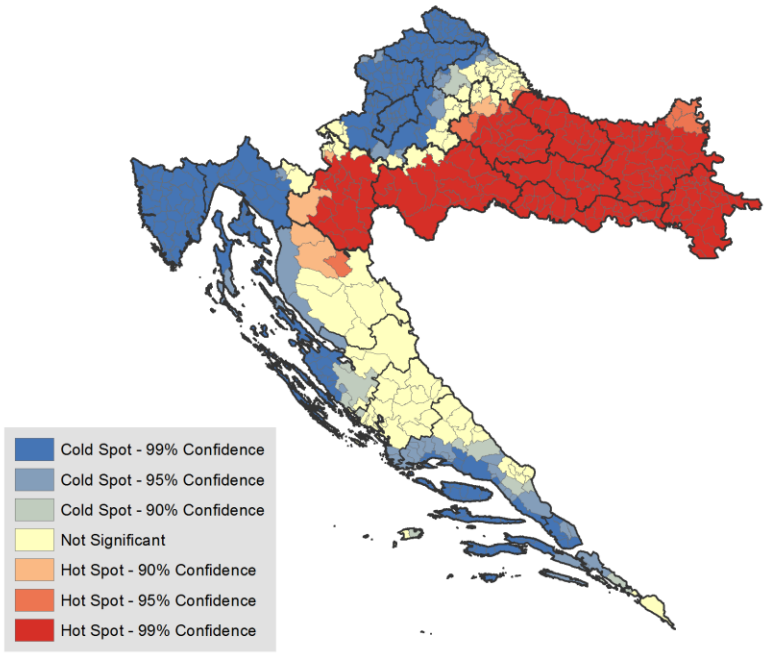
Policy Design: Identifying spatial patterns of poverty

Identifying Hot and Cold Spots of Poverty

Croatia Poverty Rate (HBS)



Croatia Poverty Rate Hot Spot Analysis



***Red indicates a cluster of high values (Hot spot)**
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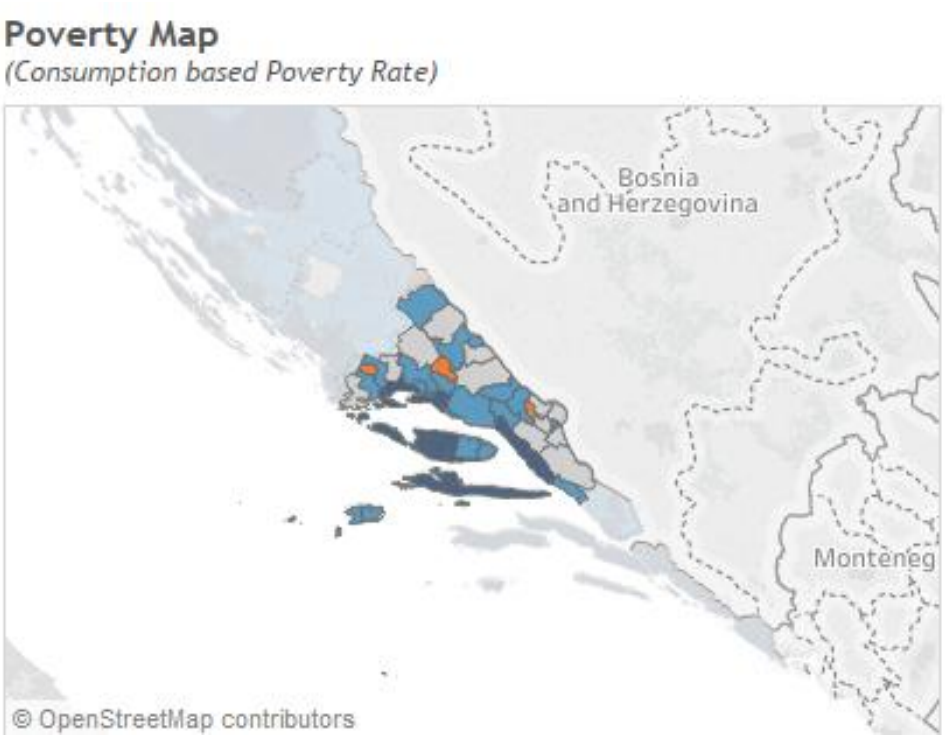
Policy Design: Visualizing the heterogeneity of Poverty

Consumption based Poverty Rate and for Croatia (LAU2, by NUTS 2)



Small area estimates

Policy Design : Using Poverty Maps to Improve the Efficiency of Transfers

Targeting simulation in Croatia

- Poverty maps are more than a pretty picture, and can provide actionable information on the **heterogeneity of poverty**
- The most common motivation for poverty mapping is to improve targeting of interventions

Improved targeting simulation in Croatia

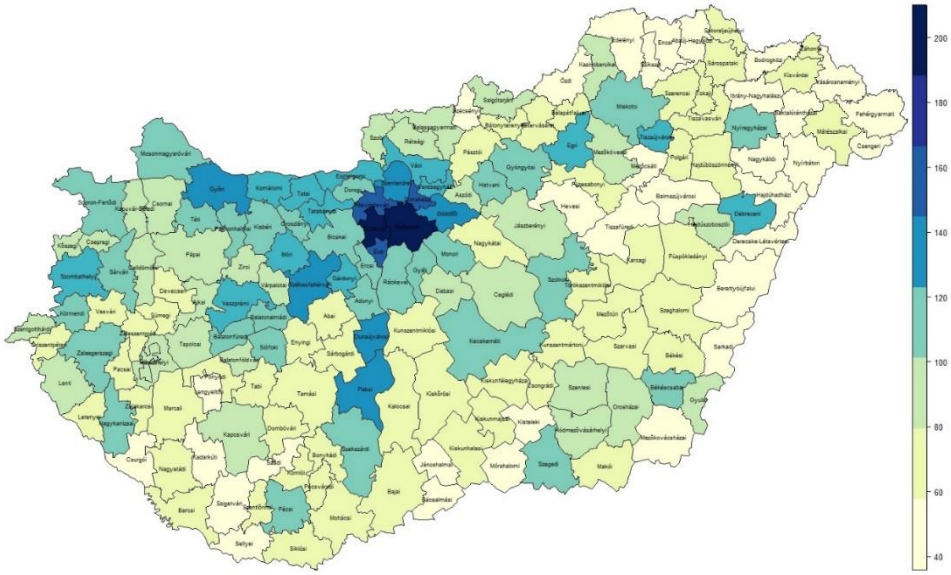
Transfer level	Headcount	Gap	Severity
NUTS-1 (baseline)	1.00	1.00	1.00
NUTS-2	1.05	1.10	1.14
NUTS-3	1.50	1.66	1.70
Municipalities, cities, and districts of Zagreb	1.59	1.89	2.03

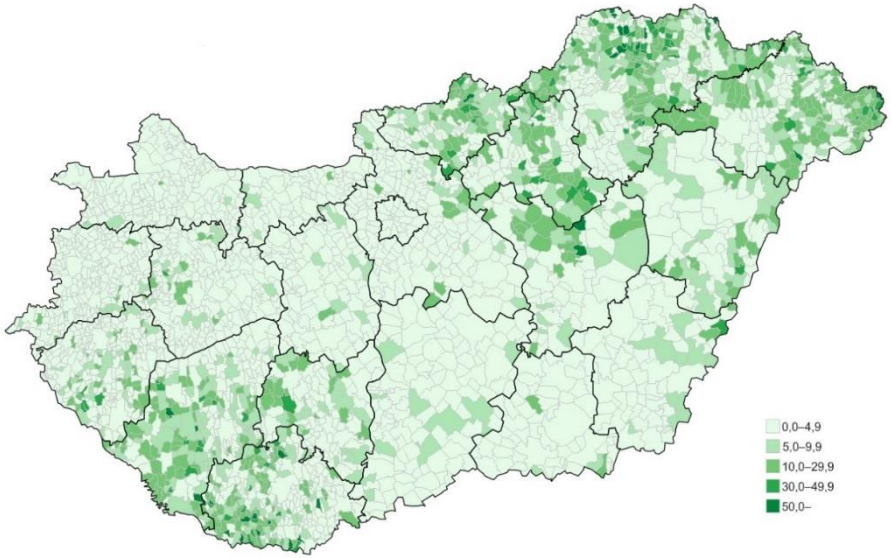
Note: Transfer is 1.64 billion HRK (0.5% of GDP)

Small area estimates

Policy Design: Visualizing the heterogeneity of Poverty

Hungary LAU 1 tax income & Roma population



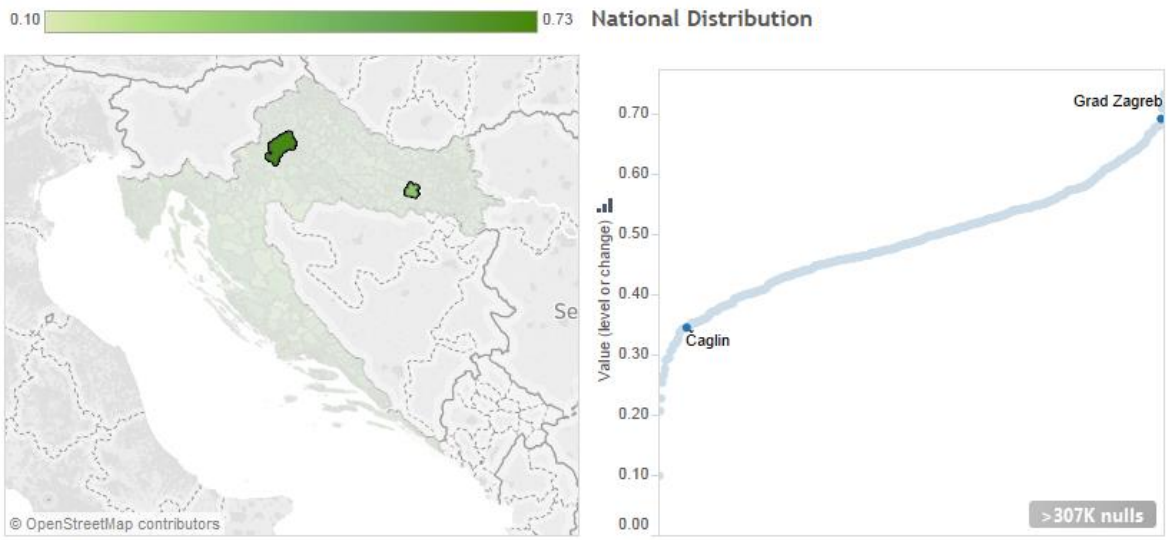


Policy Design: Ex-ante evaluation of policy options

Internet expansion in Croatia

- According to the **2011 Population Census**, the share of households with internet access per municipality ranges from 19% to over 70%.
- This information can be used to implement a policy simulation of increasing the internet access by 10 percentage points.
- Two scenarios of an increase in household internet access were explored:
- In Zagreb an increase from 70% to 80%
- Čaglin increase from 35% to 45%

Share of households with internet access

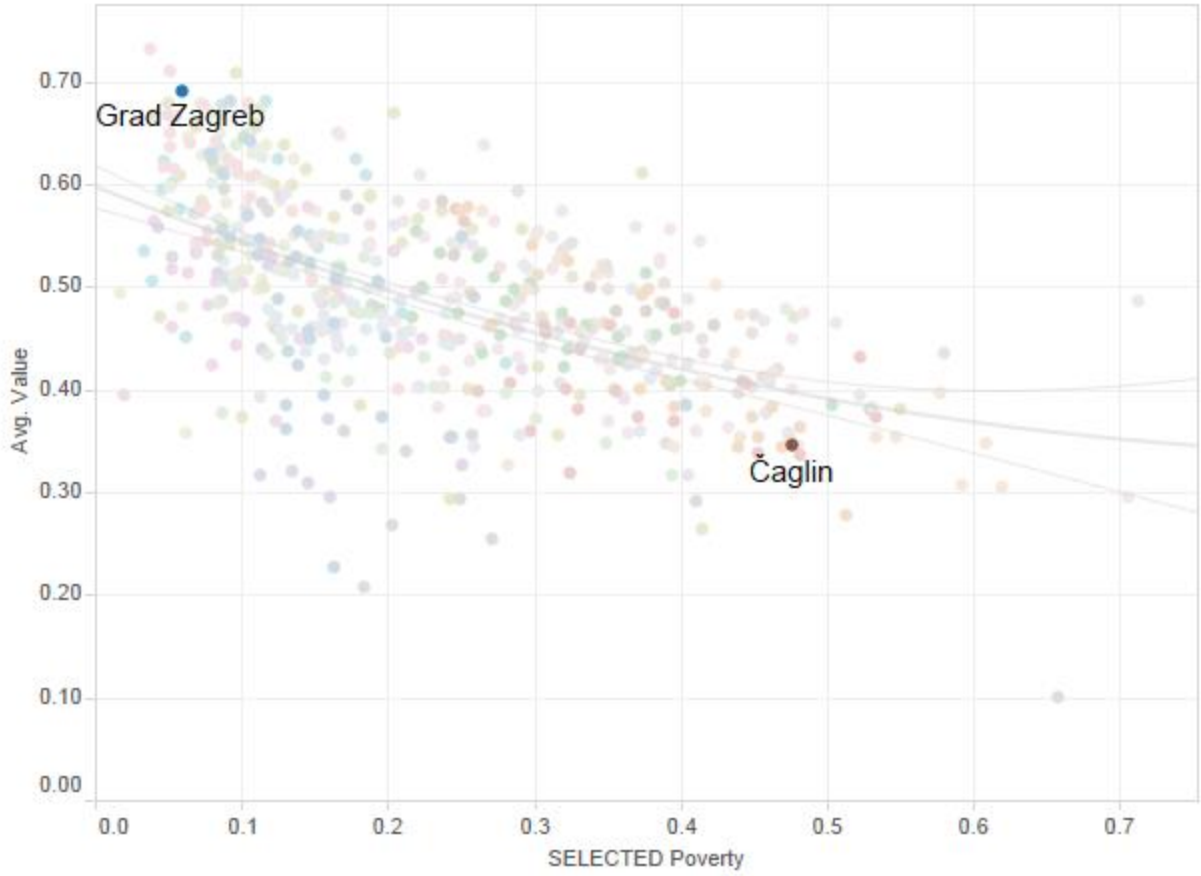


Exercises of this nature can help policy makers think through the expected and un-expected consequences of certain policy choices, and through that improve the log frame of the interventions being designed.

Policy Design: Ex-ante evaluation of policy options

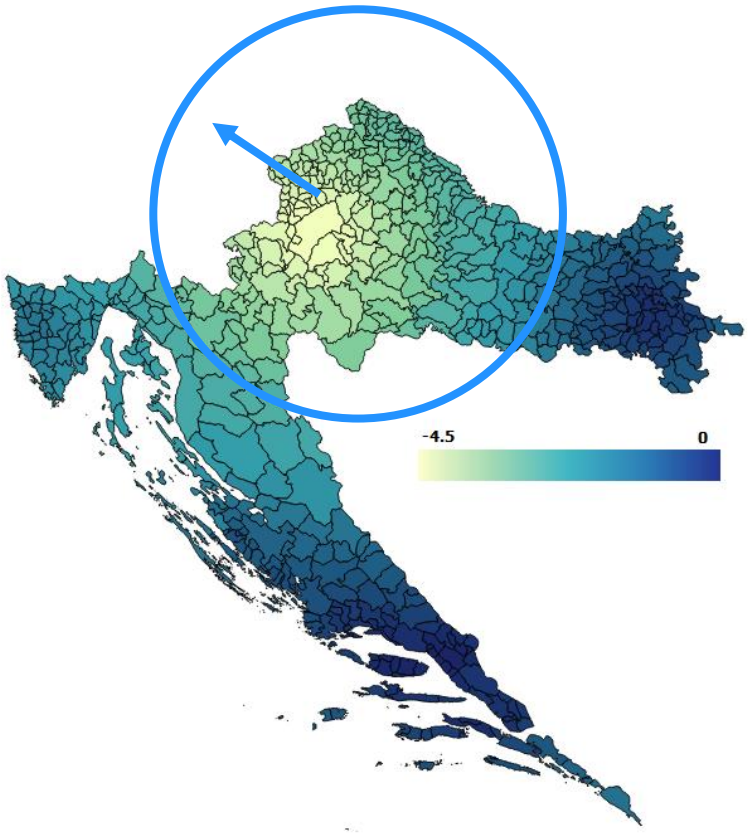
Internet expansion in Croatia

- The following step of this simulation consists in exploring the relationship between the output of interest. In this case, share of household internet access, and the poverty measure chosen to be the outcome.
- The figure on the right shows a negative relationship between poverty rates and the share of households with internet access at the municipal level.



Policy Design: Ex-ante evaluation of policy options

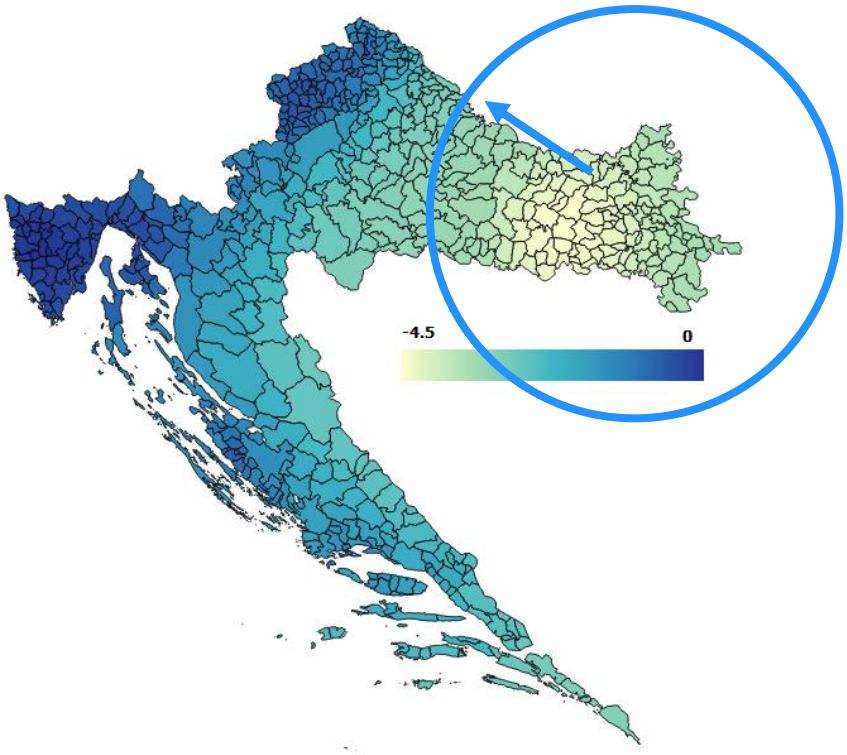
Internet expansion in Croatia



- There are spatial spillovers from policy interventions
- A spatial regression model is run in order to see how correlates and space relate to poverty
- There is a presence of spatial correlation even when controlling for several municipal level characteristics
- An increase in the population who has access to the internet is simulated for Zagreb
- The effect for Zagreb is 3.2 percentage points
- The potential beneficial spillovers from such an intervention have an impact well beyond the epicenter
- Poverty falls to a greater degree in Zagreb, but also spills over to the rest of Croatia

Policy Design: Ex-ante evaluation of policy options

Internet expansion in Croatia



- A similar intervention in an area that has considerably lower access to internet for example: Čaglin could possibly yield a larger effect and larger spatial spillovers
- The effect in Čaglin is a decrease in poverty of 4.4 percentage points
- The farther away from the epicenter, the lower the effect

USING POVERTY MAPPING TO INFORM POLICY MONITORING

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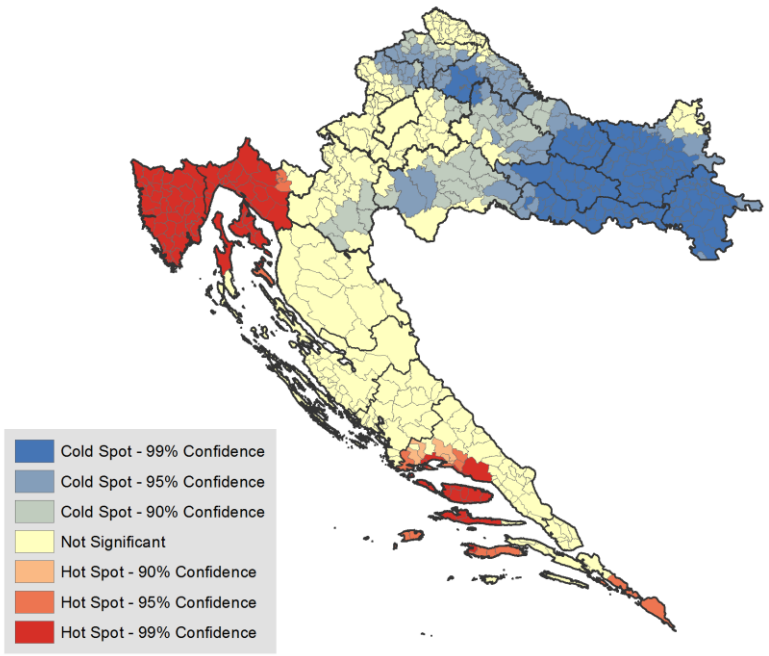
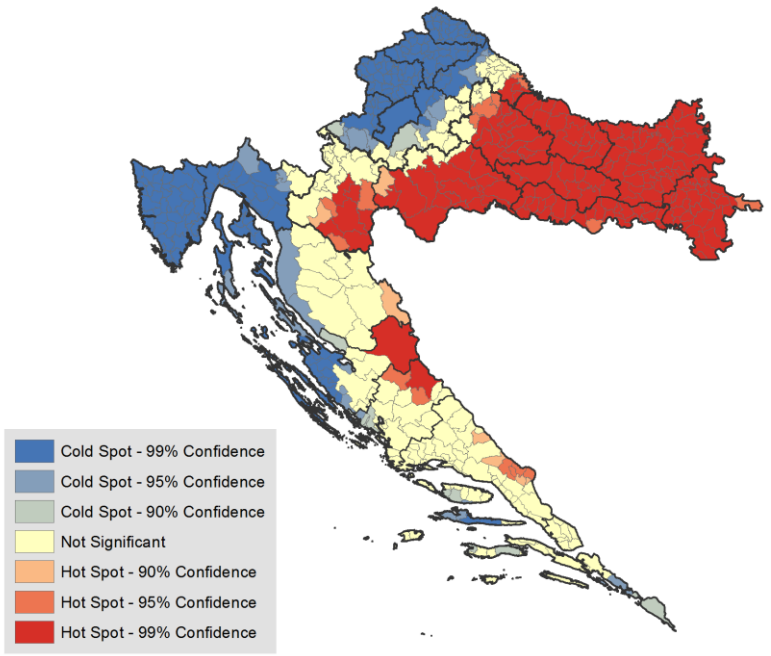
Using administrative records to improve policy monitoring
Hot Spot Analysis of Business Environment & Employment in Croatia

Number of active business entities per capita



Unemployment Rate



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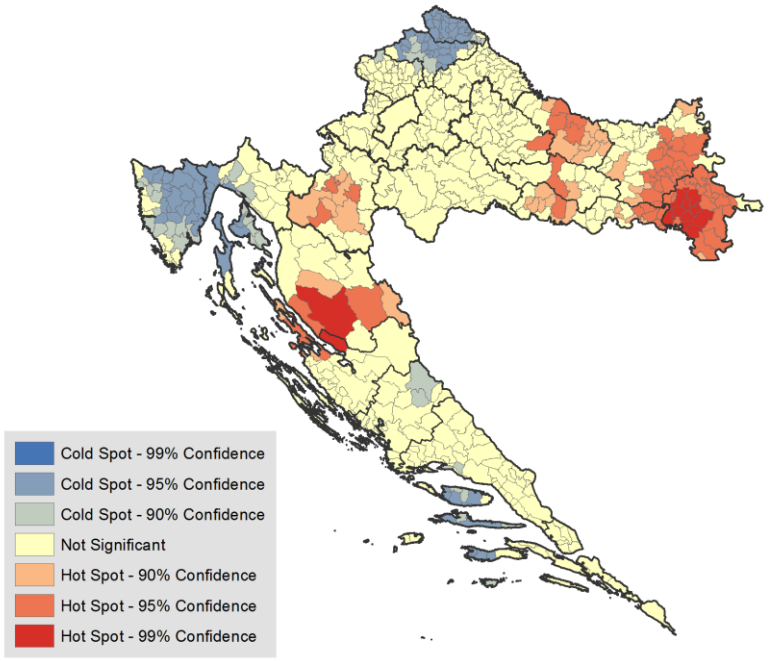
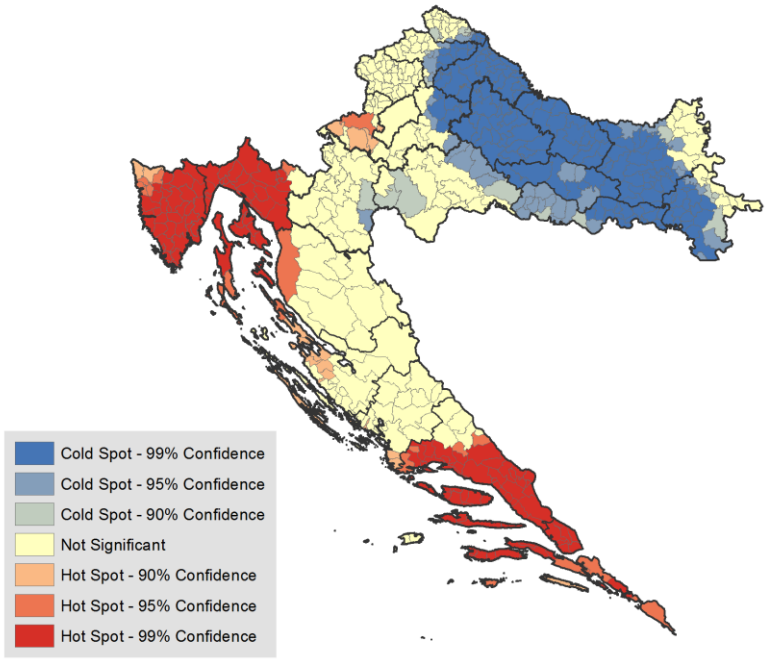
Using administrative records to improve policy monitoring

Hot Spot Analysis of Education in Croatia

Proportion of student failing Matura exams



Share of people with secondary education or more



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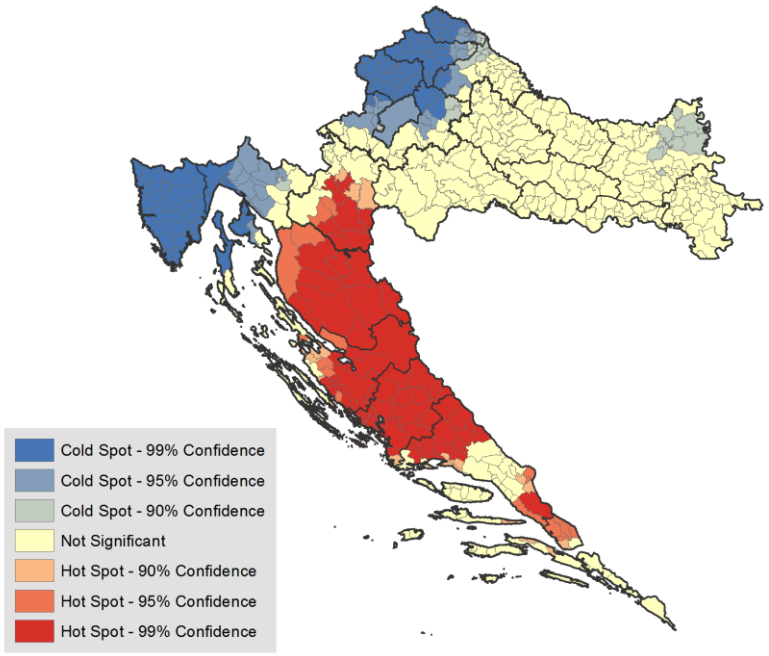
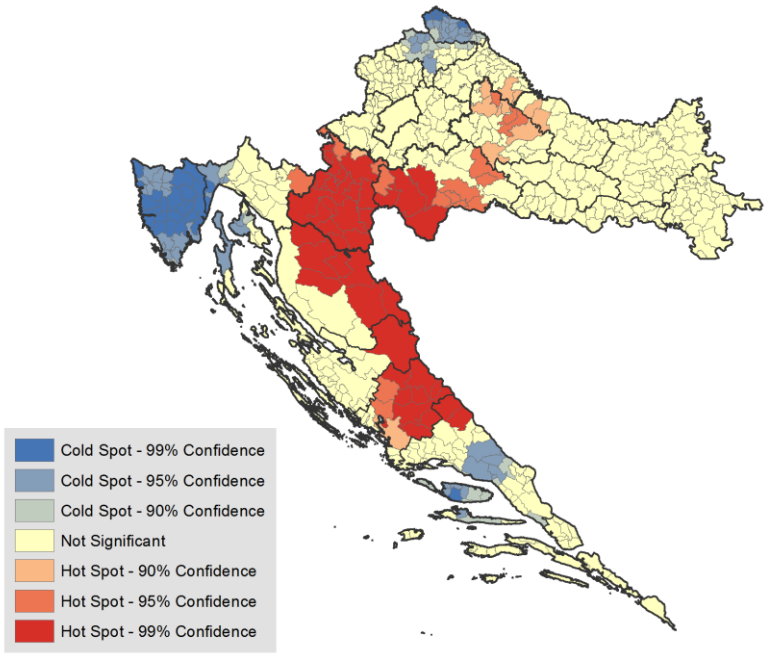
Using administrative records to improve policy monitoring
Hot Spot Analysis of Demographics in Croatia

Dependency Ratio



Mortality Rate



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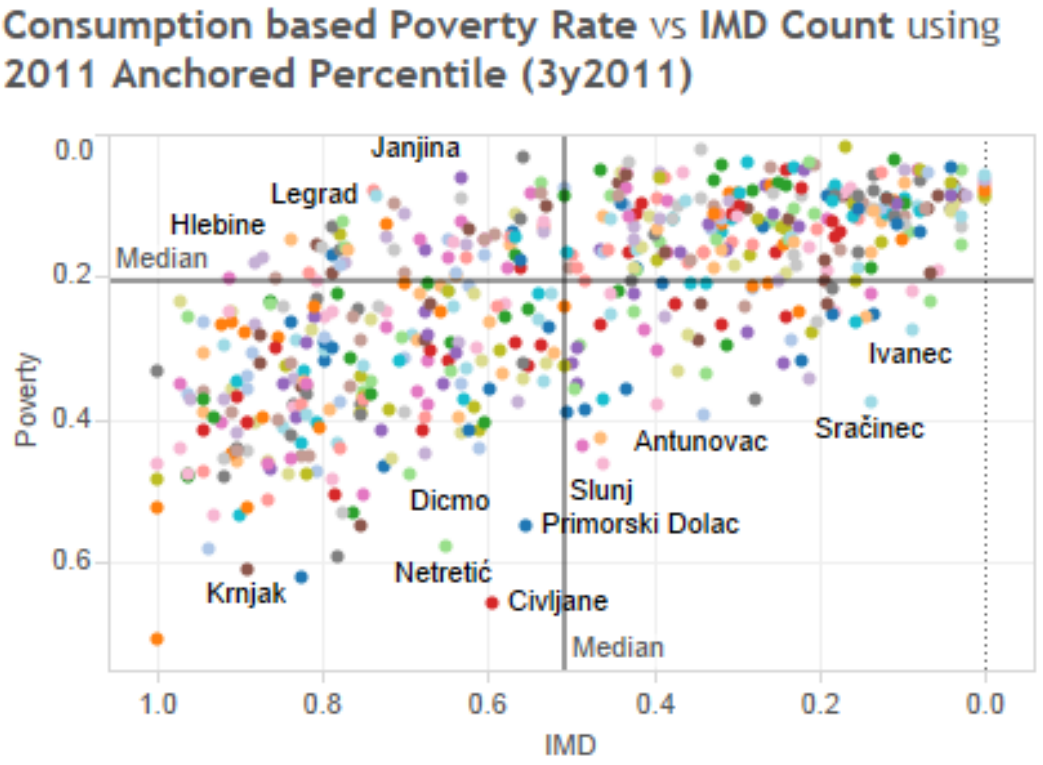
Combining Poverty Maps and Administrative Records to identify lagging regions

Croatian Index of Multiple Deprivation

IMD Dashboards

Guiding Principles

1. **Municipalities** as the main unit of analysis (LAU2)
2. Regional Deprivation as a **multidimensional concept**
3. **Ownership** (consultations with multiple stakeholders and approval from steering committee)
4. Support from a **conceptual framework** (3 domains; 8 subdomains; 31 indicators)
5. **Policy relevance** (actionable indicators)
6. Timeliness (most indicators produced from existing **administrative records**)
7. Indicators selected based on an objective relationship with **subnational monetary poverty**



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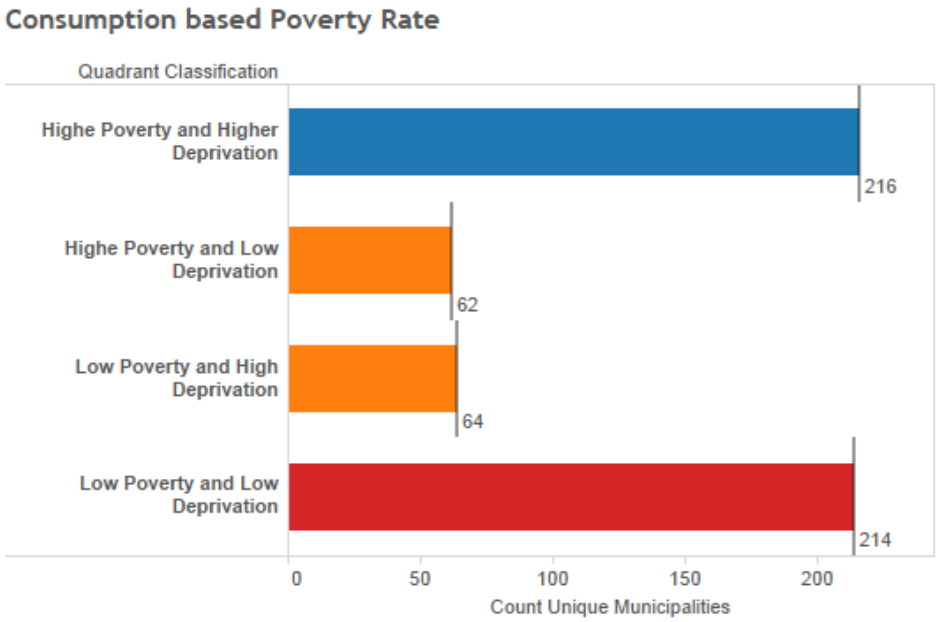
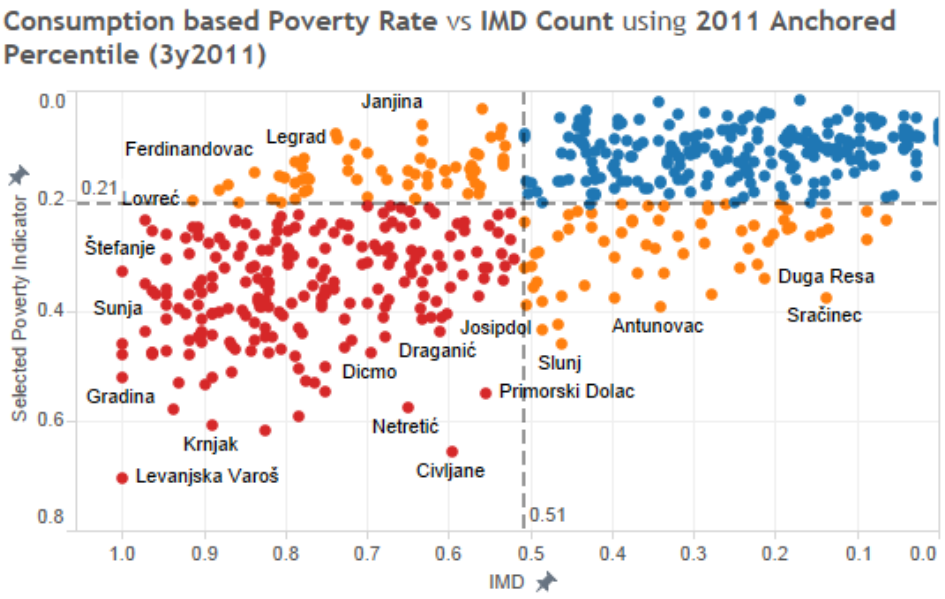
Croatian Index of Multiple Deprivation

IMD Dashboards



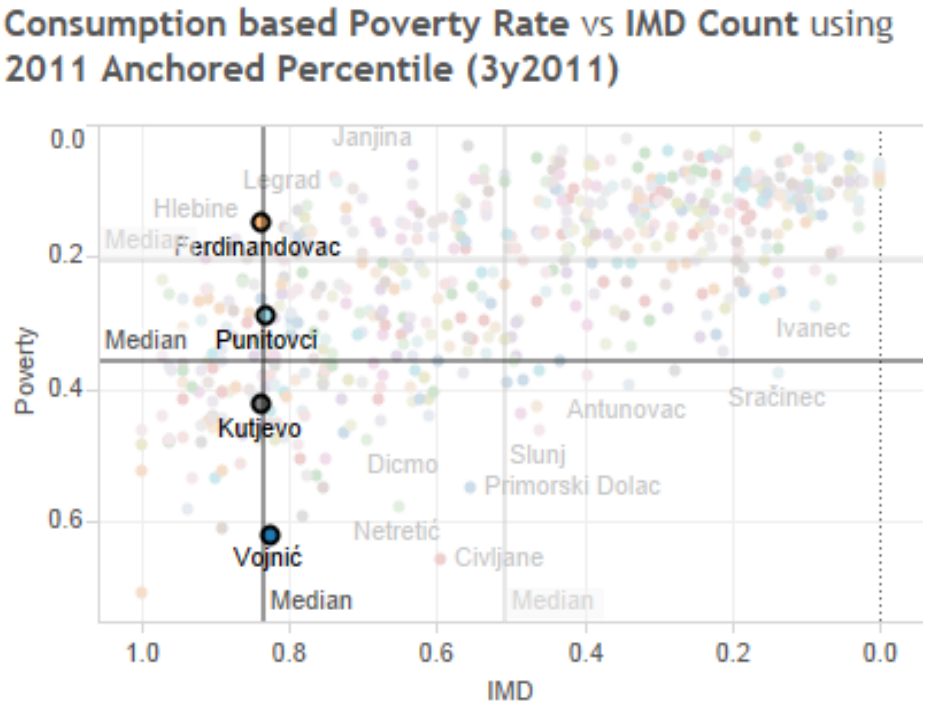


Combining Poverty Maps and Administrative Records to identify lagging regions

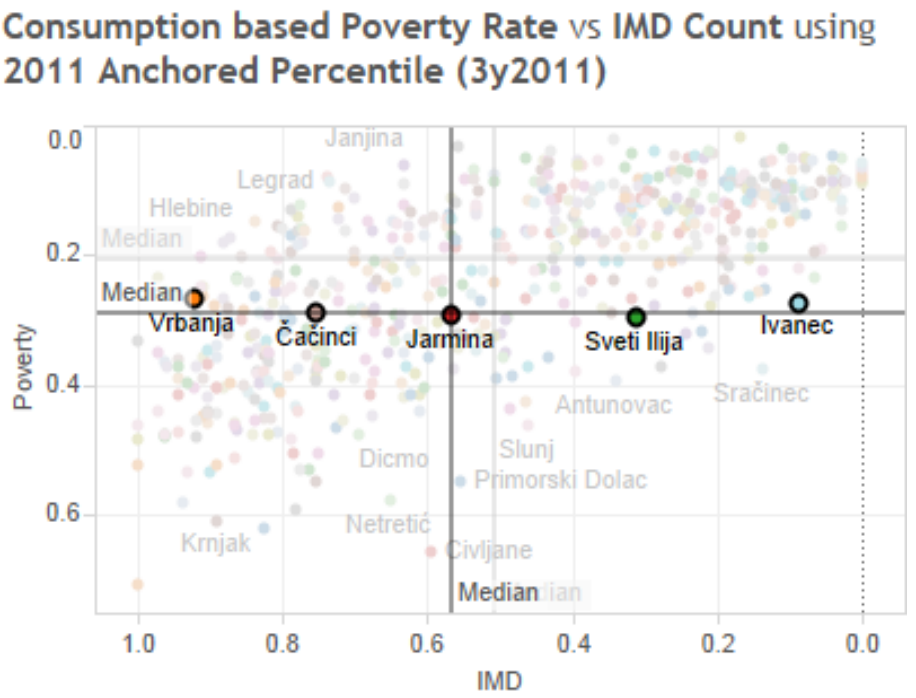
Croatian Index of Multiple Deprivation

IMD Dashboards

Municipalities at the same IMD can have very different monetary poverty levels….



Municipalities at the Poverty level can have very different IMD.



Combining Poverty Maps and Administrative Records to identify lagging regions

Croatian Index of Multiple Deprivation

IMD Dashboards

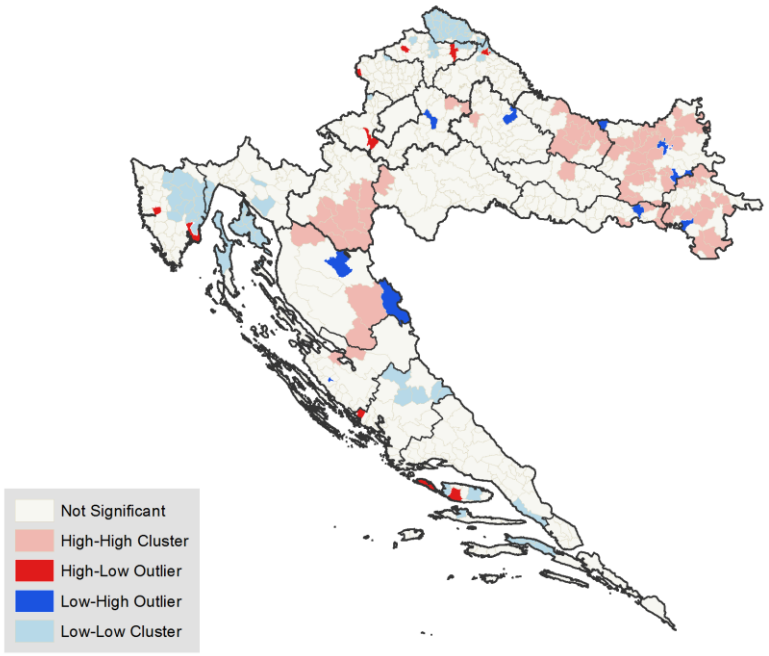
IMD municipal Score Card

IMD Input Standard: 2011 Anchored Percentile (3y2011)

Domain	Subdomain	Indlabel	Levanjska Varoš	Vladislavci	Koprivnički Bregi	Kalnik	Rovinj - Rovigno
Economic	Economic development	Net income of the population ..	0.98	0.73	0.53	0.85	0.01
		Number of active business ent..	0.72	0.79	0.87	0.45	0.01
		Number of active crafts per ca..	0.98	0.98	0.83	0.96	0.05
		Number of registered personal..	0.98	0.85	0.56	0.49	0.10
		Share of employed in agricultu..	0.81	0.58	0.66	0.97	0.15
	Fiscal capacity	Average taxable income per c..	0.98	0.76	0.54	0.86	0.02
		Budget revenues (w/o grants, ..	0.69	0.88	0.72	0.78	0.05
		Share of taxpayers in populati..	0.91	0.58	0.48	0.61	0.00
		Total budget expenditure (incl...	0.81	0.41	0.87	0.66	0.06
	Labor Market	Employment rate	0.98	0.72	0.45	0.87	0.01
		Participation rate	0.95	0.54	0.43	0.96	0.04
		Pension system dependency r..	0.94	0.66	0.57	0.85	0.15
		Unemployment rate	0.97	0.84	0.55	0.53	0.07
Physical	Physical infrastructure	Share of HHs with Internet co..	0.97	0.77	0.36	0.89	0.03
		Share of HHs with access to p..	0.99	0.99	0.25	0.99	0.06
		Share of HHs with access to p..	0.89	0.99	0.75	0.29	0.03
		Share of HHs without central ..	0.91	0.79	0.27	0.17	0.34
	Social services	Distance to primary health cen..	0.87	0.93	0.27	0.68	0.01
		Enrollment rate in kindergarte..	0.62	0.66	0.25	0.55	0.03
		Transparency of local govern..	0.99	0.47	0.33	0.47	0.70
Social	Demography	Dependency ratio	0.76	0.25	0.30	0.28	0.05
		Mortality rate	0.70	0.70	0.31	0.81	0.12
		Population change (year-on-y..	0.69	0.64	0.83	0.77	0.28
		Population density	0.95	0.41	0.34	0.47	0.09
	Health and education	Proportion of student failing M..	0.81	0.37	0.64	0.29	0.32
		Share of people with secondar..	0.98	0.90	0.80	0.96	0.09
		Share of persons using the as..	0.96	0.81	0.38	0.46	0.04
	Social protection	Child allowance benefit per ca..	0.92	0.84	0.59	0.81	0.11
		GMB per capita per month	0.99	0.79	0.69	0.10	0.20
		Share of GMB beneficiaries in..	0.84	0.53	0.57	0.39	0.09

Using administrative records to improve policy monitoring
Learning from outliers

Proportion of student failing Matura exams



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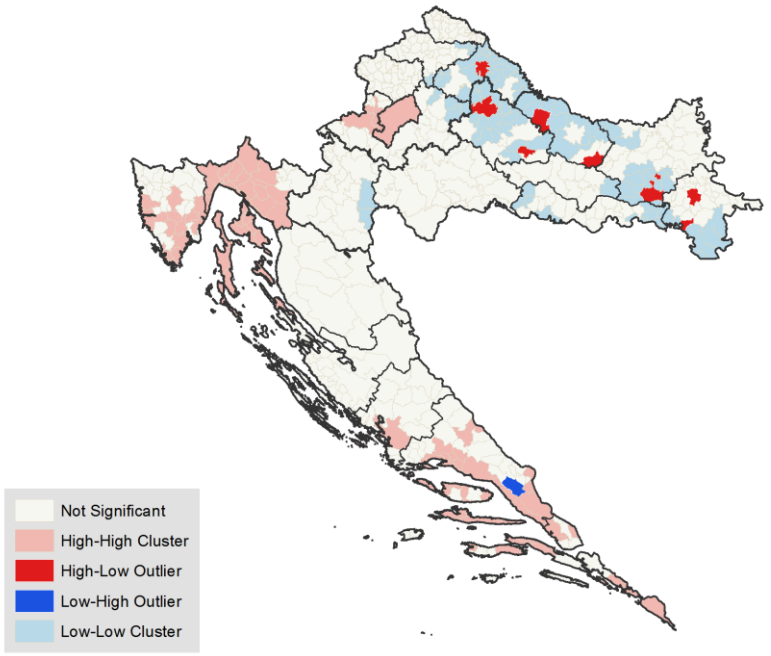

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USING POVERTY MAPPING TO INFORM POLICY EVALUATIONS

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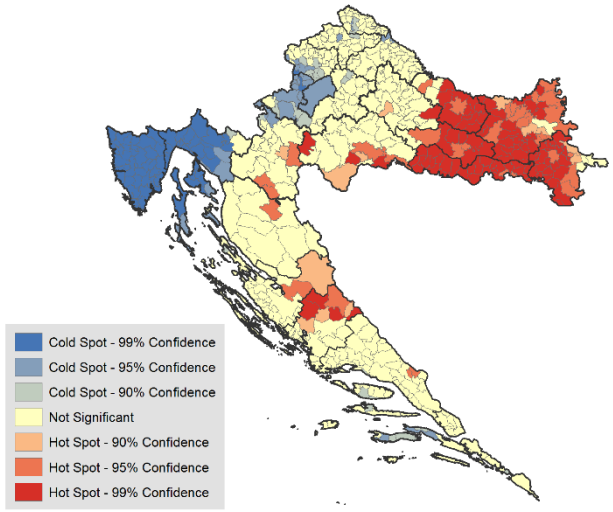
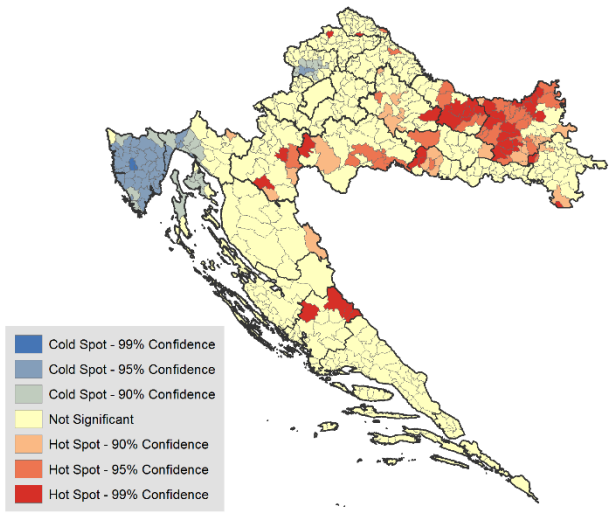
Ex-Post Evaluation: Using Poverty Maps to Improve the Efficiency of Transfers

Hot Spot and Quadrant Analysis for Poverty Rate Before Transfers and Proportion of the Municipality Covered by the GMB

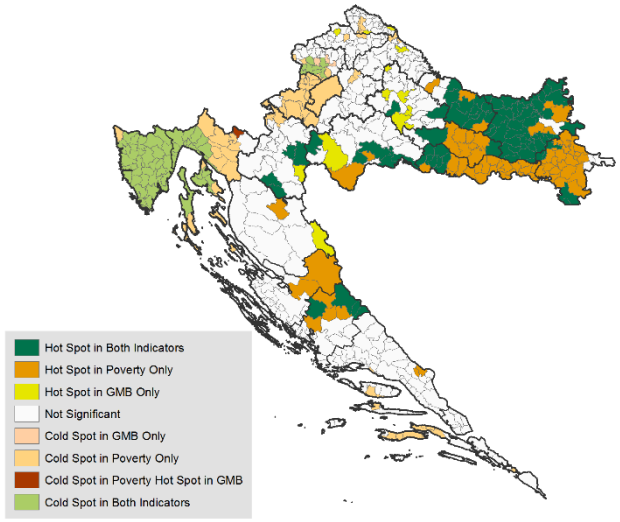
A. Poverty Rate Before Transfers Hot Spot



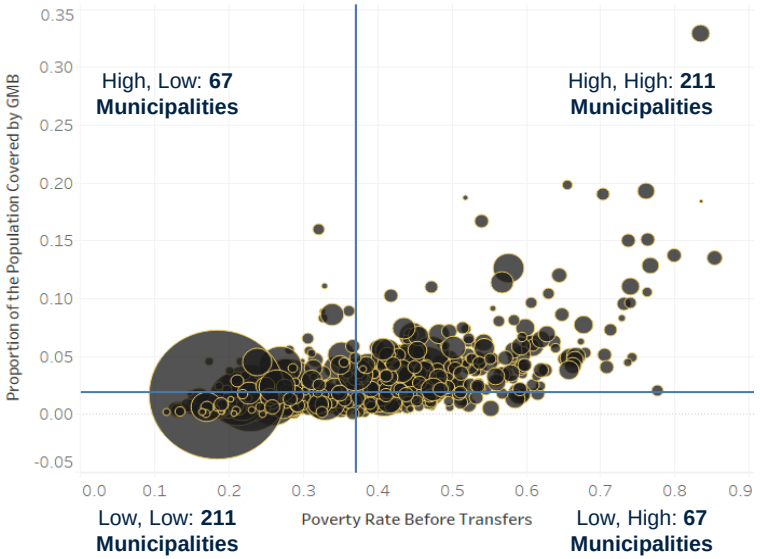
B. Proportion of Municipality Covered by the GMB



C. Joined Hot Spot of A & B



D. Quadrant of Poverty Rate and Proportion Covered by GMB

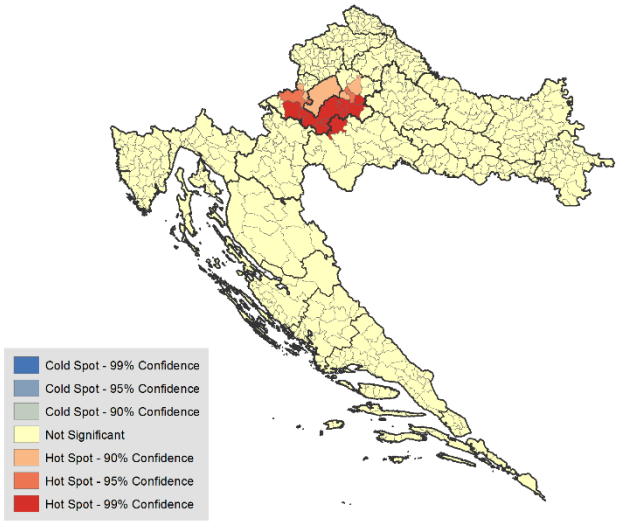


*Circles are sized by estimated Number of Poor

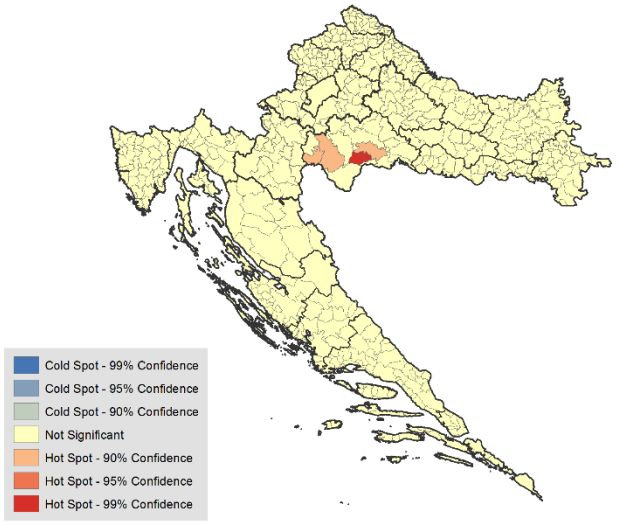
Ex-Post Evaluation: Using Poverty Maps to Improve the Efficiency of Transfers

Hot Spot and Quadrant Analysis for Number of Poor Before Transfers and Number of GMB Beneficiaries

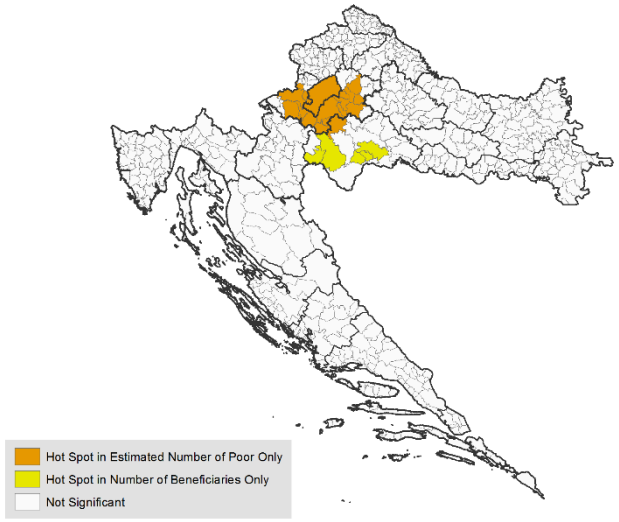
A. Estimated Number of Poor Hot Spot (Before transfers)



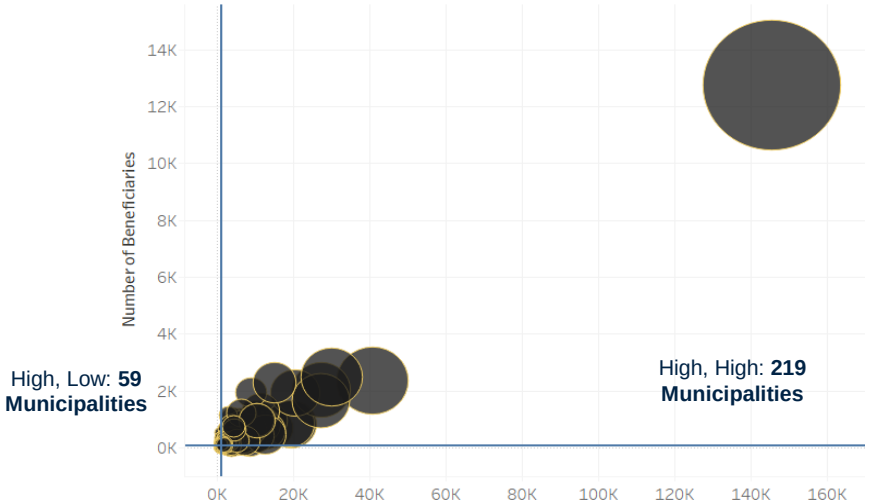
B. Number of GMB Beneficiaries



C. Joined Hot Spot of A & B



D. Quadrant of Number of Poor and Number of Beneficiaries

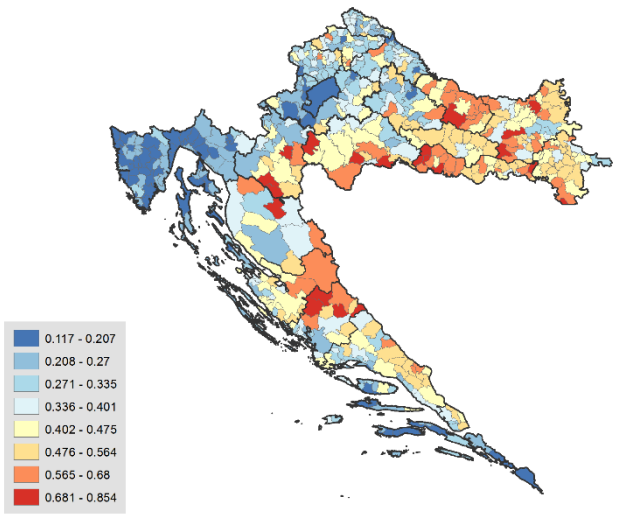


*Circles are sized by estimated Number of Poor

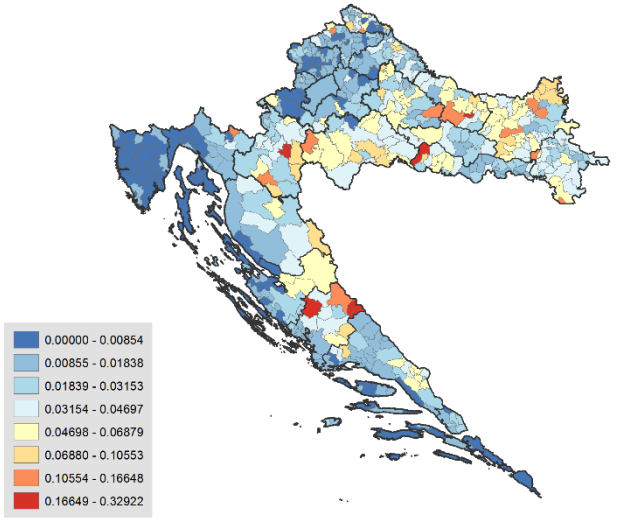
Ex-Post Evaluation: Using Poverty Maps to Improve the Efficiency of Transfers

Geographically Weighted Regression (GWR) for and Poverty Rate Before Transfers and Proportion of the Municipality Covered by the GMB

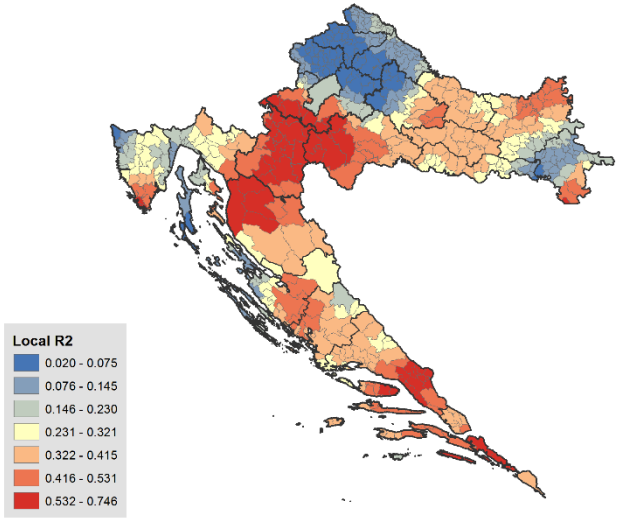
A. Poverty Rate Before Transfers (Independent Variable)



B. Proportion of Municipality Covered by the GMB (Dependent Variable)



C. GWR of Poverty Rate and Proportion Covered

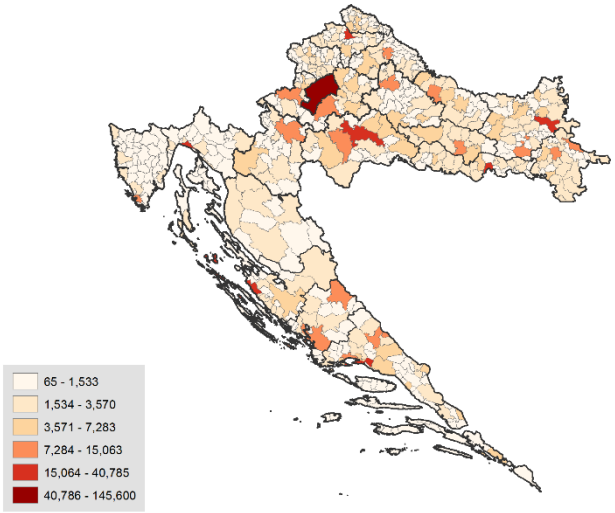


OLS R2: 0.391
OLS Adjusted R2: 0.39
GWR R2: 0.59
GWR Adjusted R2: 0.53

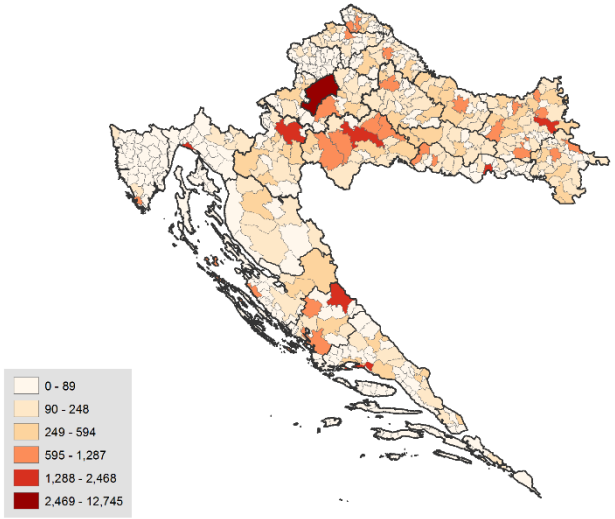
Ex-Post Evaluation: Using Poverty Maps to Improve the Efficiency of Transfers

Geographically Weighted Regression (GWR) for and Number of Poor Before Transfers and Number of Beneficiaries Covered by the GMB

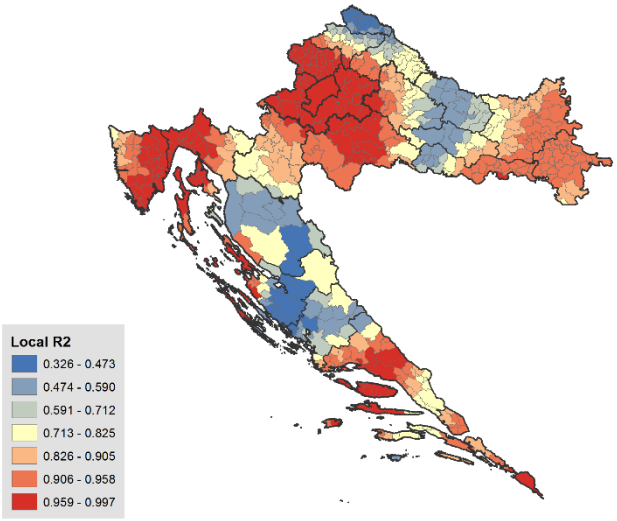
A. Number of Poor Before Transfers (Independent Variable)



B. Number of Beneficiaries (Independent Variable)



C. GWR of Number of Poor and Number of Beneficiaries



OLS R2: 0.93
OLS Adjusted R2: 0.931
GWR R2: 0.97
GWR Adjusted R2: 0.96

LINKING ADMINISTRATIVE RECORDS AND BIG DATA TO POVERTY MAPPING

WORLD BANK GROUP

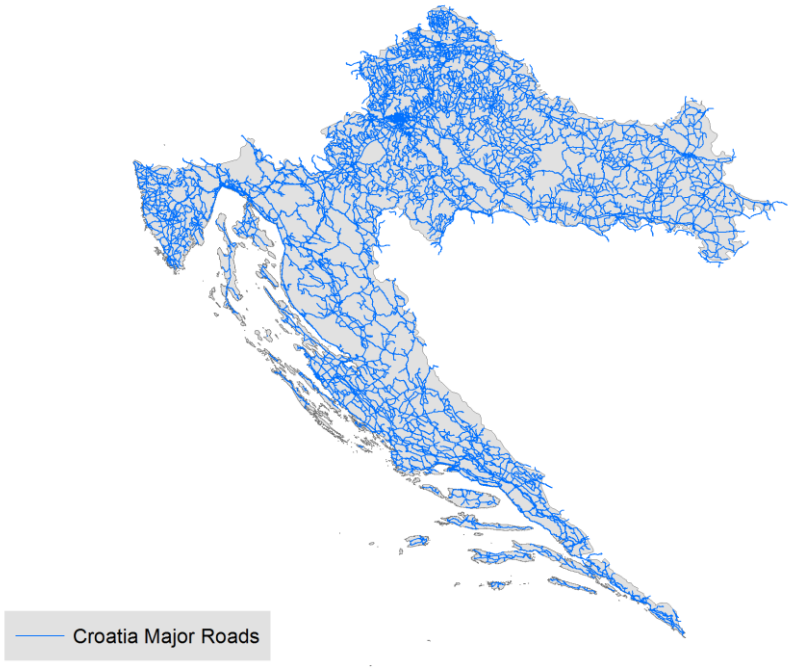
POVERTY MAPPING AND BIG DATA

Can poverty mapping be combined with Bid Data on satellite and other publicly available spatial data?

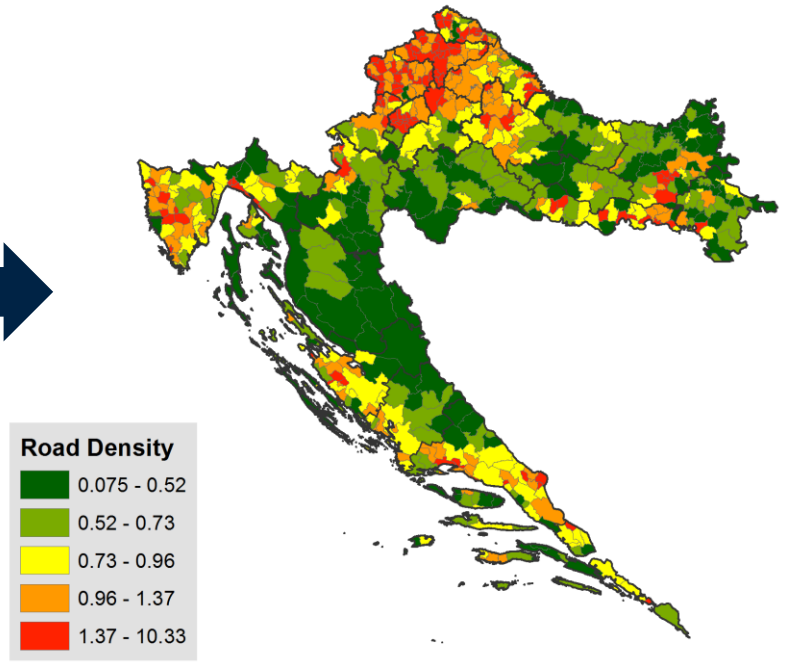
- There is an increasing quantity of geospatial information provided at extremely high resolution and frequency
- This new databases offer the possibility for policy makes and analysts to improve their understanding of poverty dynamics at the subnational level
- High resolution satellite imagery can also be a valuable component of this work going forward.

Line Density (Road density): This tool is used to calculate the density of line segments in each area (municipality). The density tool can be applied to any line data including rivers, railroads etc

Major Roads in Croatia



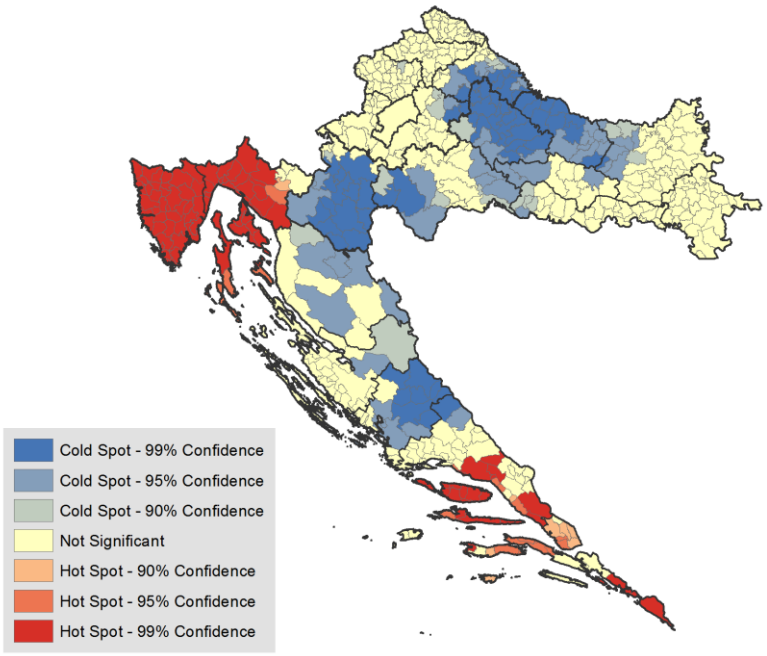
Road Density in each Municipality



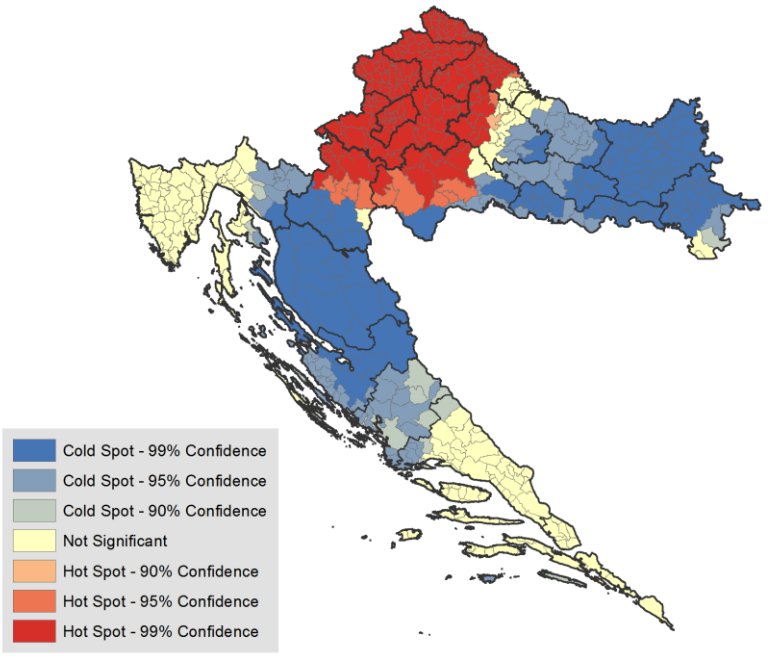
* Road Density = Road Length (km) / Area of Municipality (km^2)

Hot Spot Analysis of Infrastructure & Connectivity in Croatia

Share of HHs with Internet connection



Density of Road Network



***Red indicates a cluster of high values (Hot spot)**
Blue indicates a cluster of low values (Cold spot)

USING SMALL AREA ESTIMATION METHODS TO ESTIMATE OTHER INDICATORS

WORLD BANK GROUP

COST OF LIVING AND POLICY MAKING

Why does it matter?

- A price index is useful in separating real income from nominal income
- Cost of living indexes allow for interpersonal welfare comparisons when the costs of living vary over time and space

Using the HBS we create a Paasche index, in order to adjust for price differences across regions

- It represents how much better or worse off would an individual be if she moved to the base region (Equivalent Variation)

Two versions:

1. For municipalities not in the HBS, a distance weighted average of all the other municipalities' index is obtained
2. For municipalities not in the HBS, the NUTS 3 index is used

COST OF LIVING AND POLICY MAKING

The Household Budget Survey for 2011 (HBS) is used to estimate a Paasche index for each locality (LAU2 in Croatia, Judet in Romania)

Croatia:

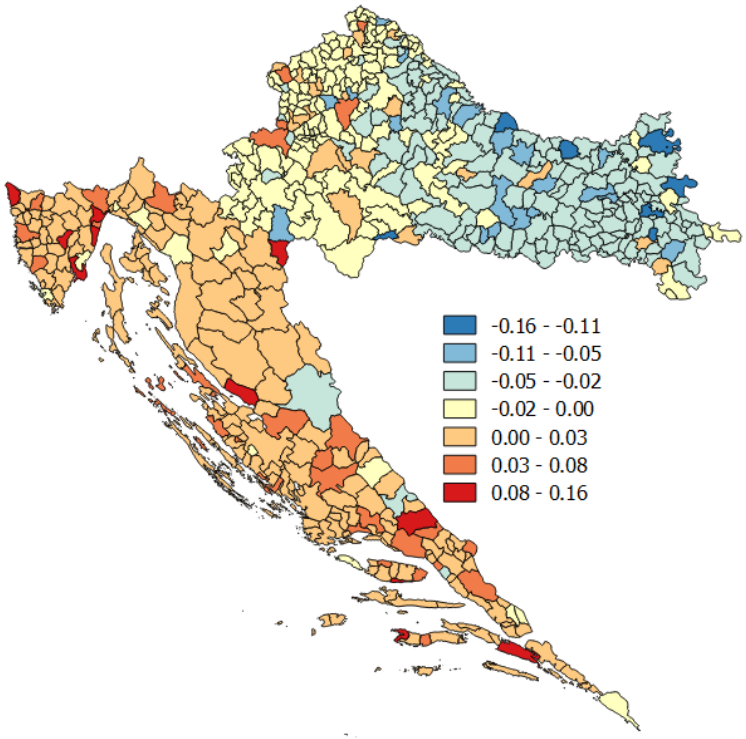
- Since not all municipalities are included in the HBS, the values for those not in the HBS must be imputed
- A spatial weighted average of the spatial deflators is obtained
- The deflator for those municipalities not included in the HBS is replaced by the spatial weighted average Paasche index

Romania:

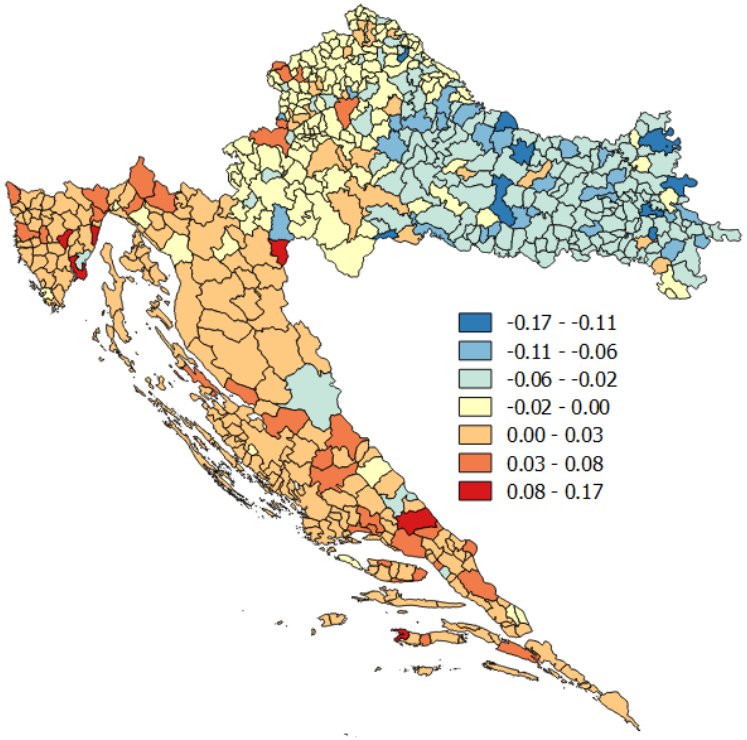
- Obtain Paasche indexes for all Judets from the HBS
- Assign to the most populous LAU2 by Judet the observed Paasche index
- For all other LAU2 use the spatial weighted average Paasche index

Poverty Map Difference When Deflating Spatially

Difference for income poverty

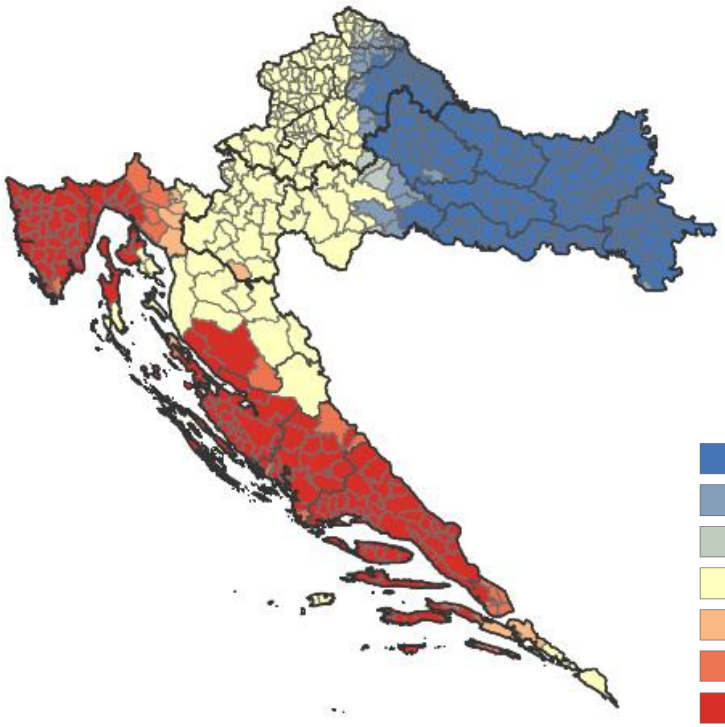


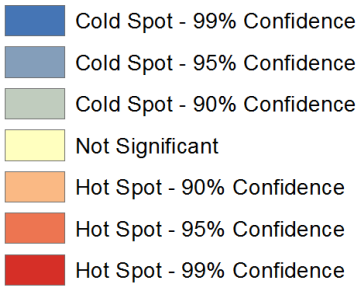
Difference for consumption poverty



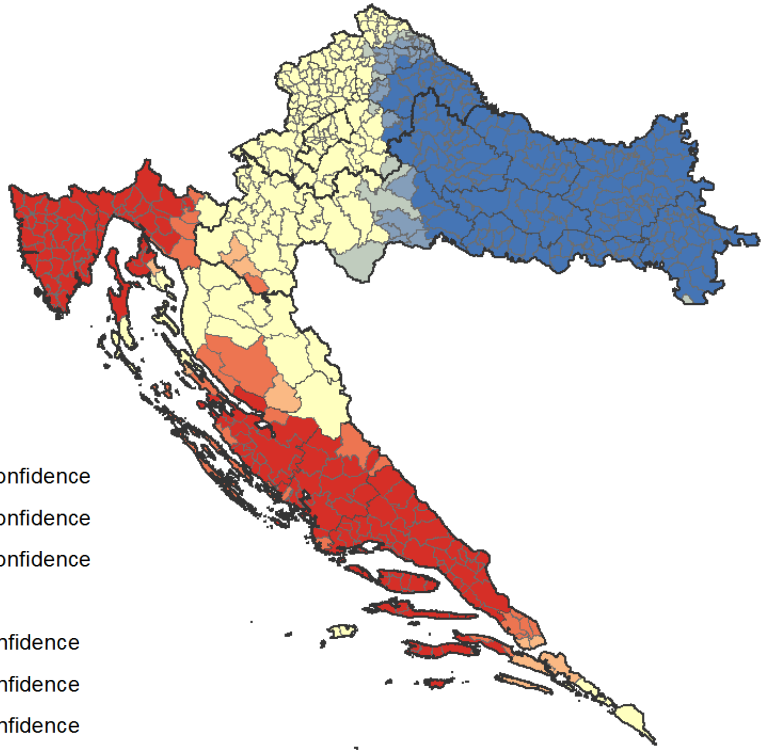
Hot Spot Analysis of the Difference on FGT0

Difference for income poverty



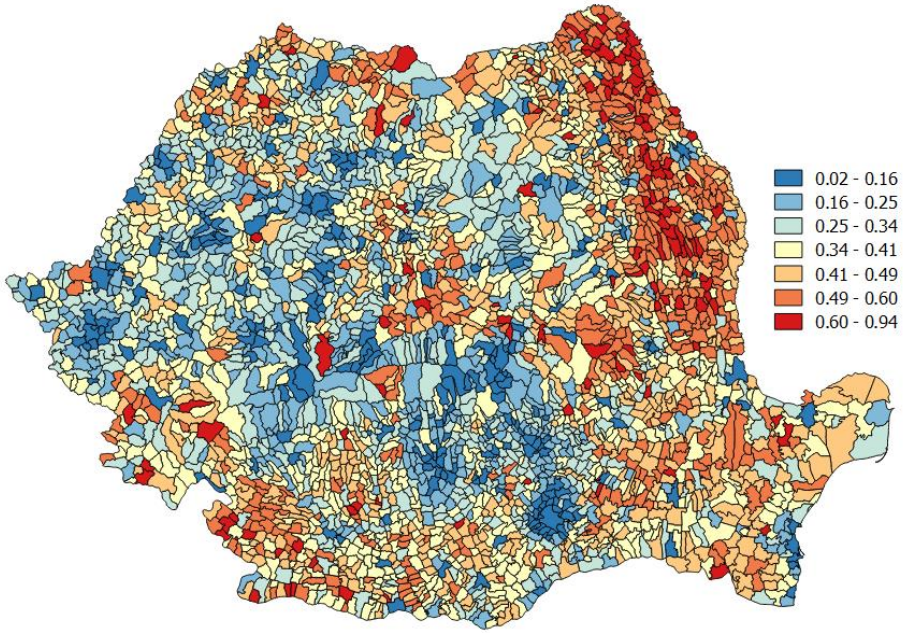


Difference for consumption poverty

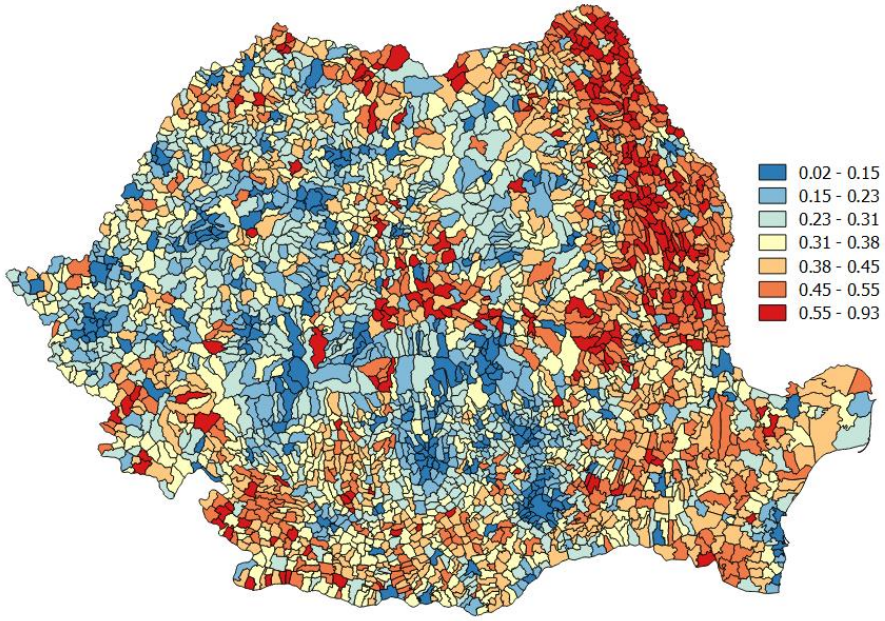


Poverty Map Difference When Deflating Spatially

Income poverty **before** spatial deflation



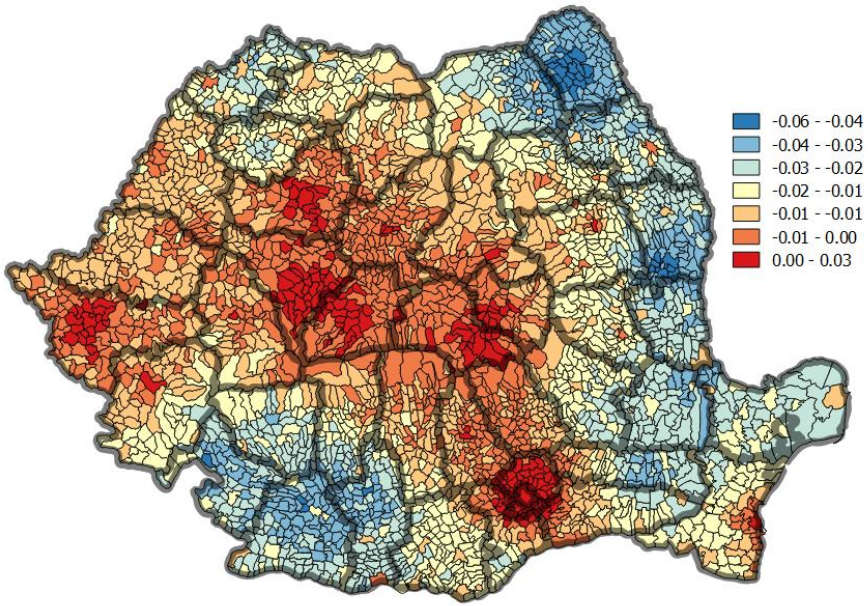
Income poverty **after** spatial deflation



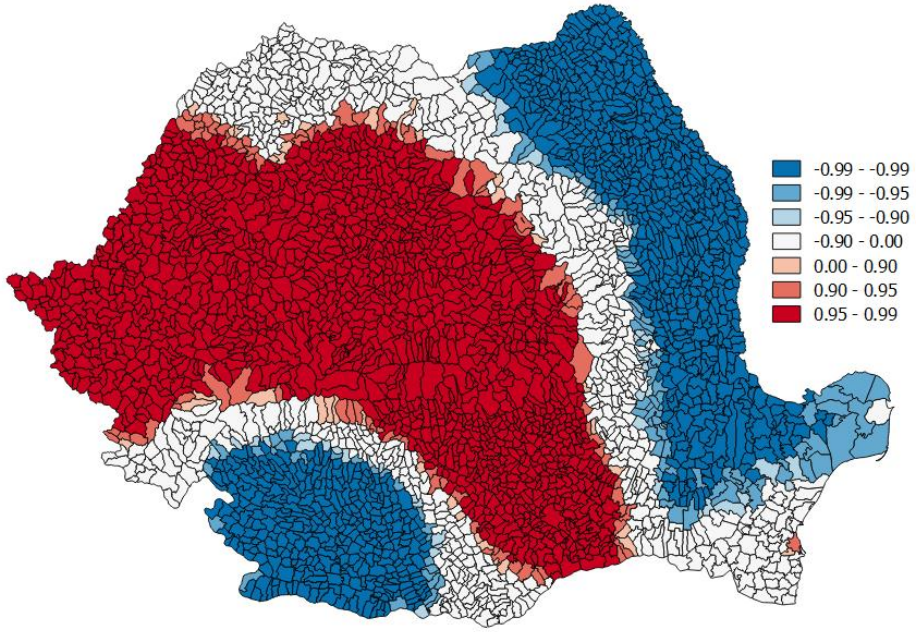
Poverty Map Difference When Deflating Spatially

Differences in the Poverty Rate

Value



Spatial Correlation



USING SAME METHODS TO ESTIMATE OTHER INDICATORS FOR SMALL AREAS

Small area estimation techniques allow us to impute a measure of income (or expenditures) for every household in the Population Census

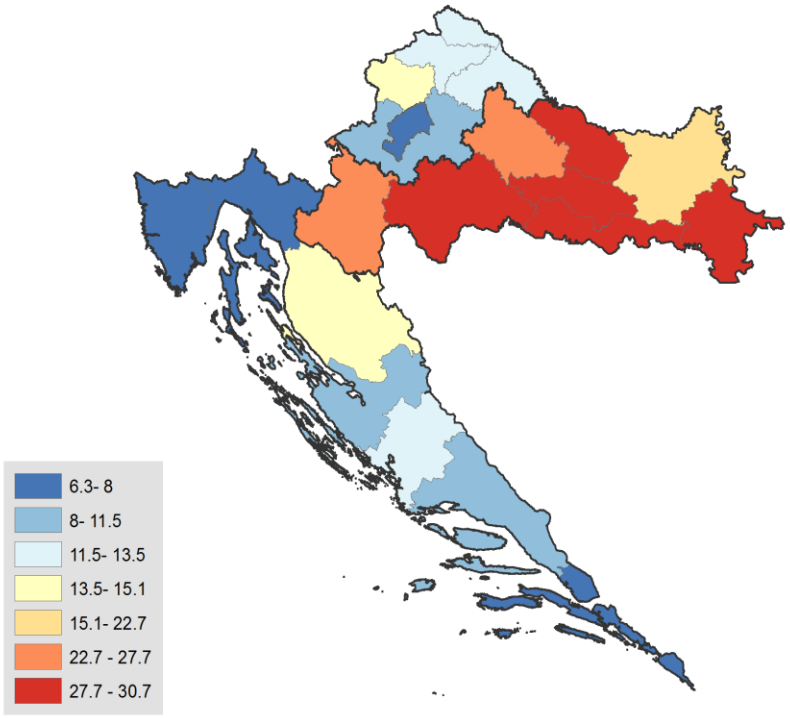
This enables us to compute the poverty rate for given administrative units, but also other measures such as depth of poverty (poverty gap), or severity of poverty (squared poverty gap), or anchored poverty

It can allows for measures of poverty for population subgroups

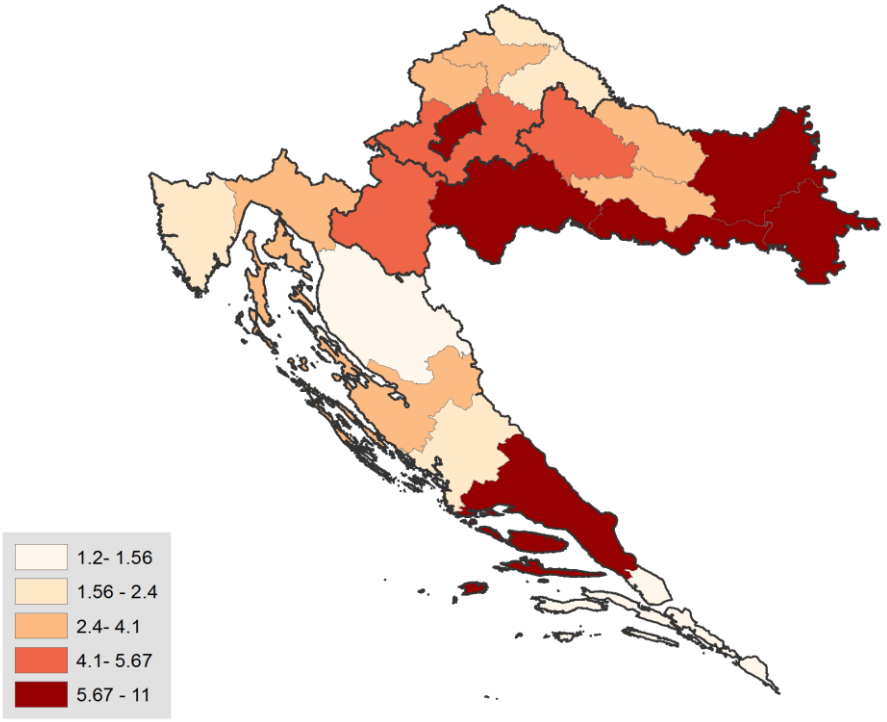
- In-work poverty
- Poverty among other socio-demographic groups

HBS: Poverty Rate and Proportion of the Poor (NUTS3)

Consumption poverty rate



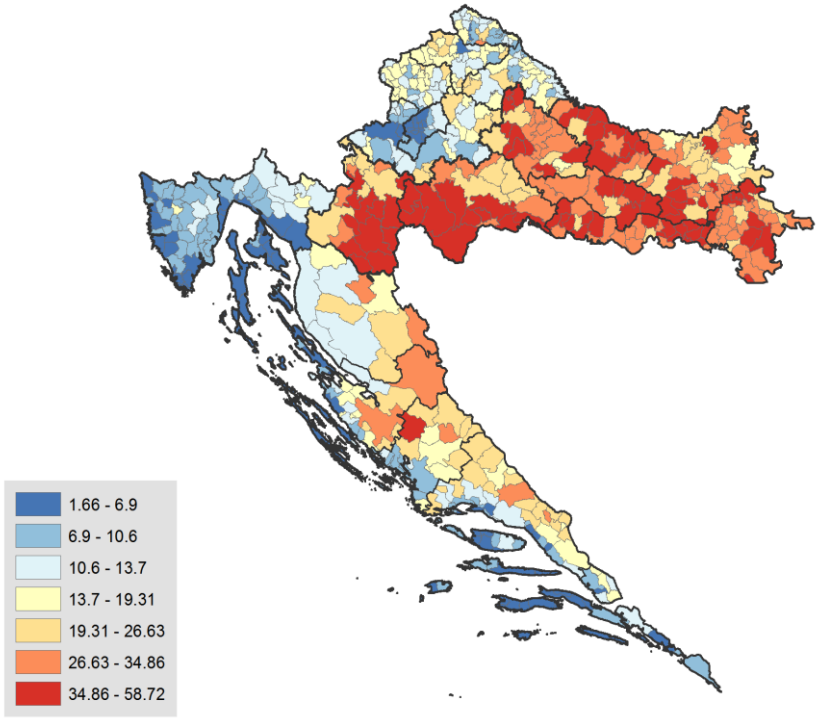
Share of consumption poverty



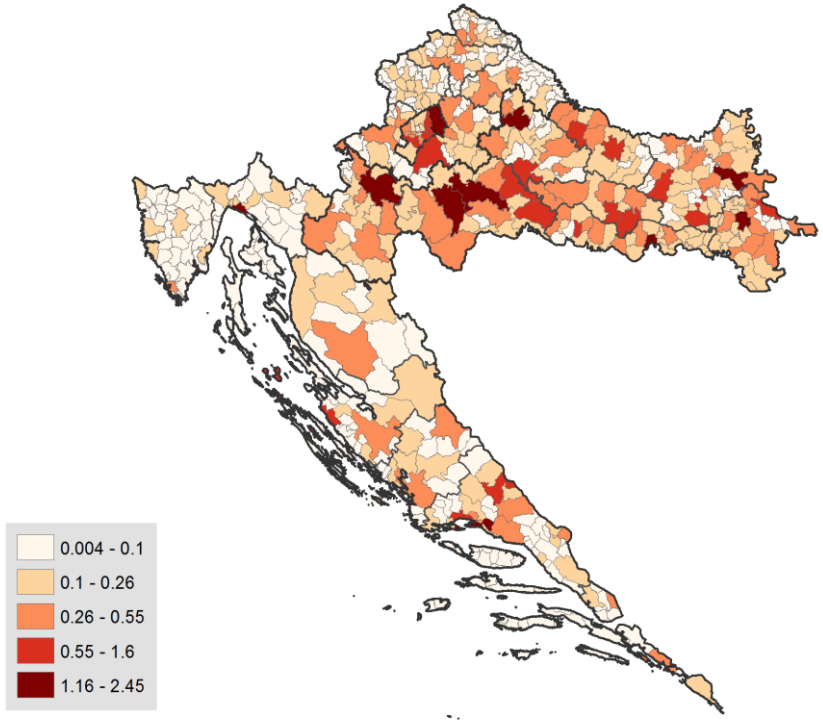
Small area estimates

HBS: Poverty Rate and Proportion of the Poor (LAU2)

Consumption poverty rate



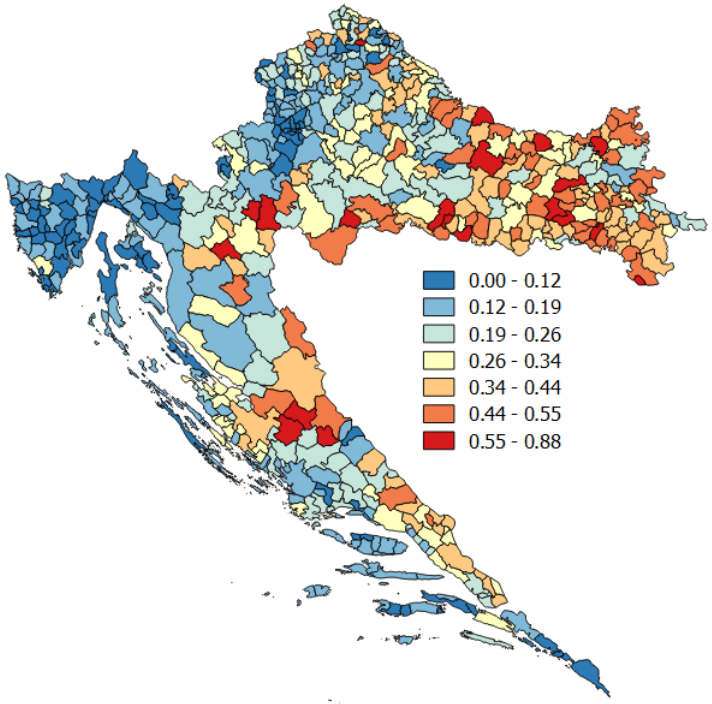
Share of consumption poverty



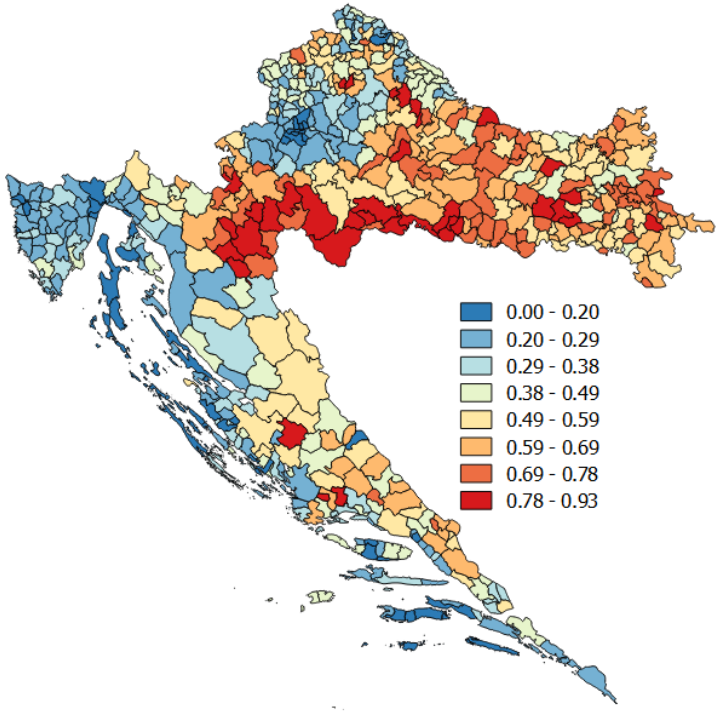
Small area estimates

Poverty Map for Children

Children: Income Poverty



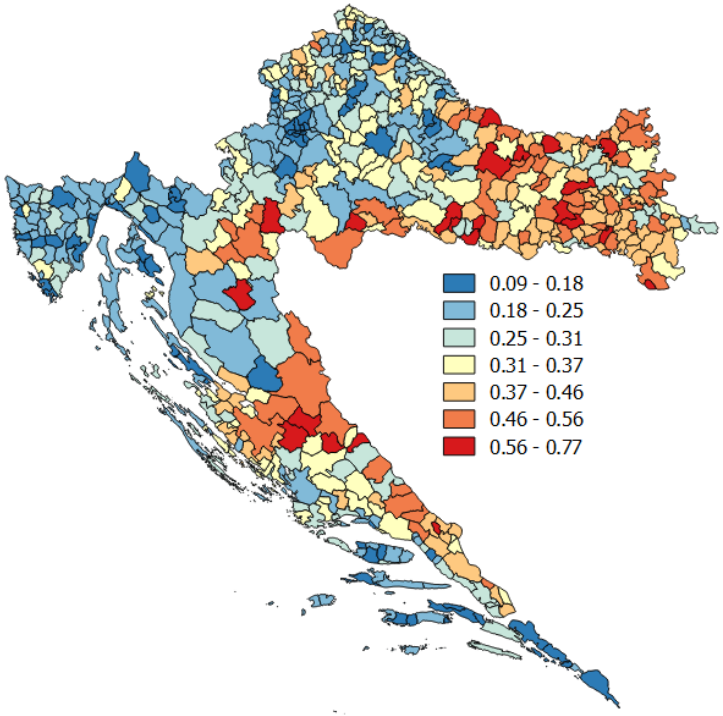
Children: Consumption Poverty



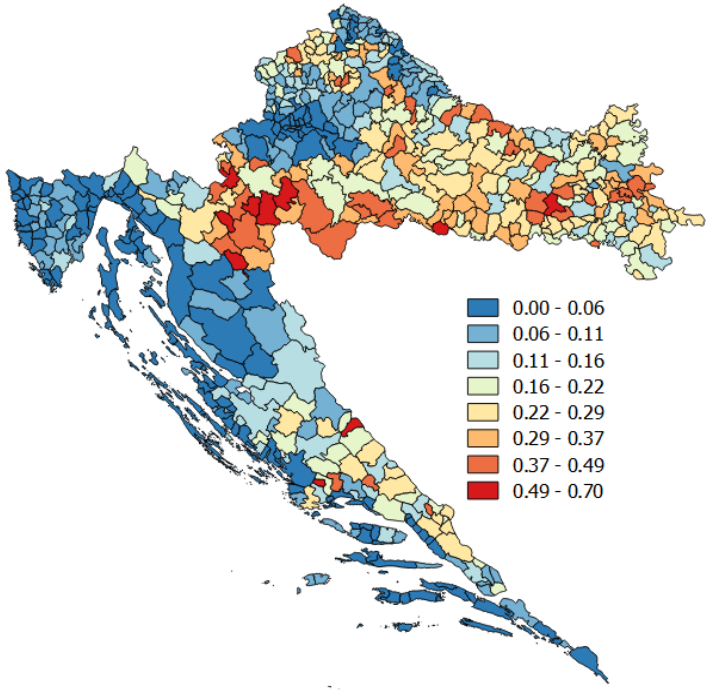
Small area estimates

Poverty Map for the Elderly

Children: Income Poverty



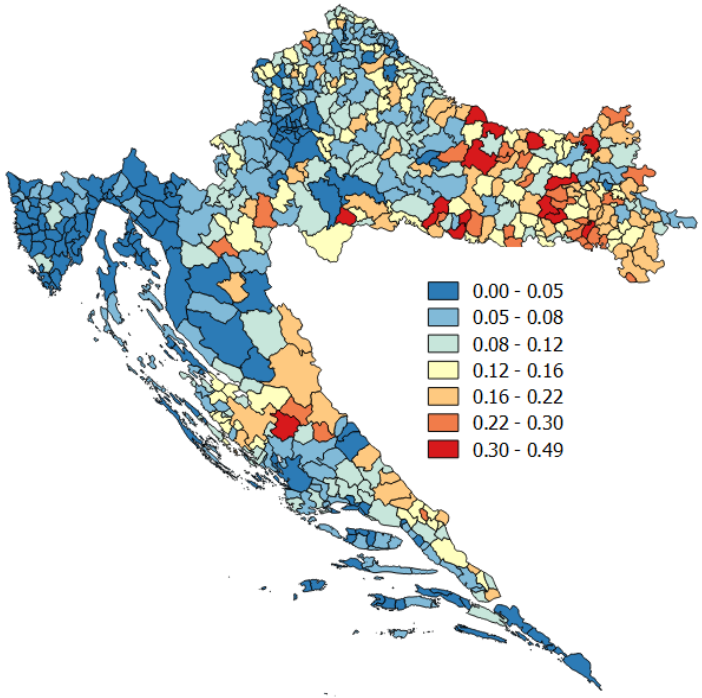
Children: Consumption Poverty



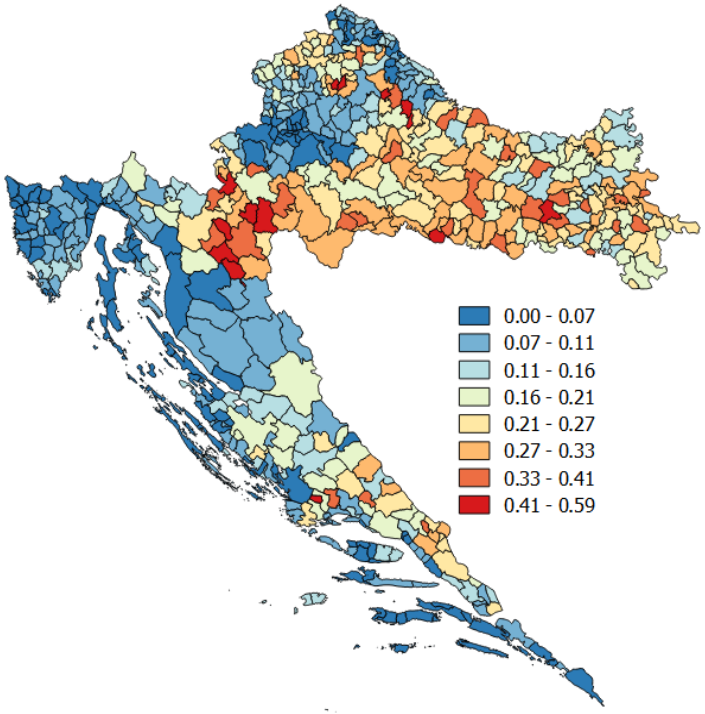
Small area estimates

Poverty Map for Those Who Work

In work: Income Poverty



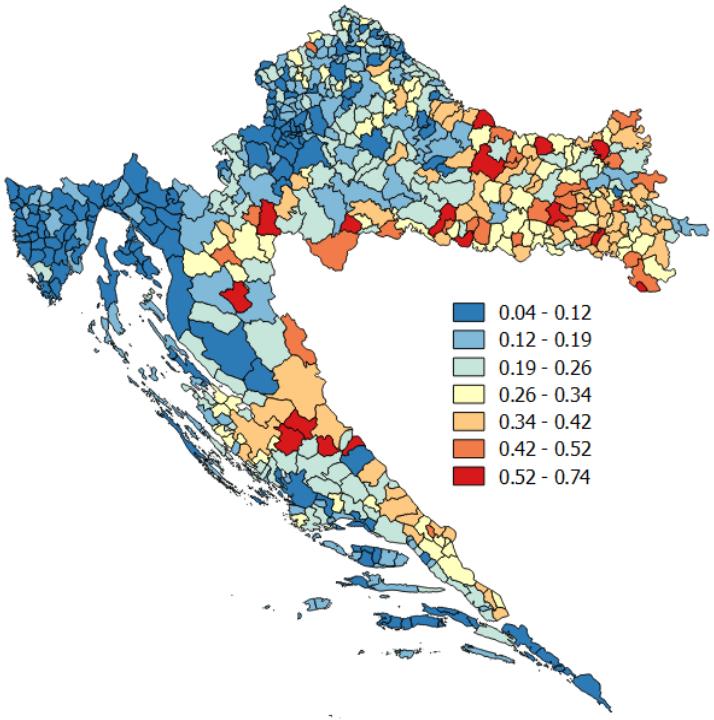
In work: Consumption Poverty



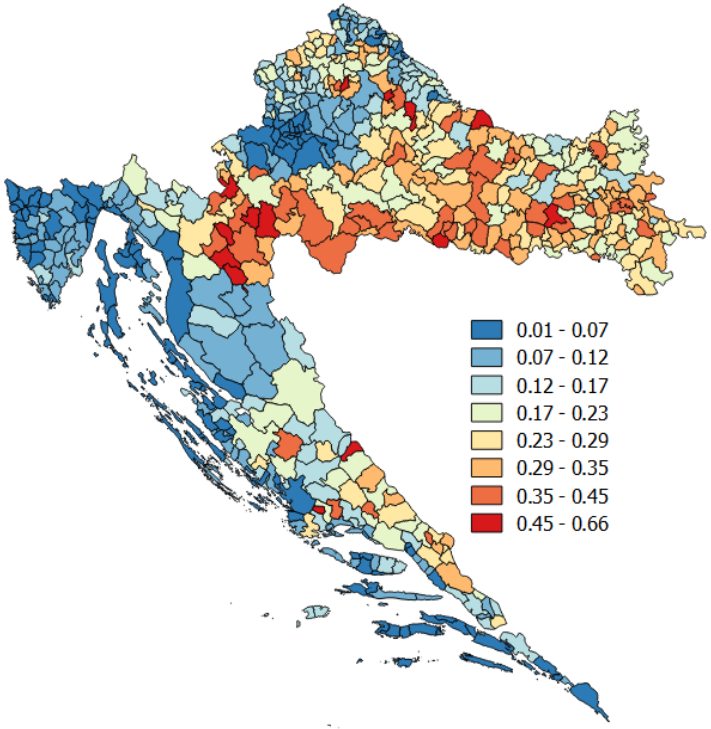
Small area estimates

Poverty Map Among Working Age Population

Working age: Income Poverty



Working age: Consumption Poverty



Small area estimates

HOW OFTEN SPATIAL PATTERNS OF POVERTY CHANGE?

WORLD BANK GROUP

WHAT HAPPENS TO POVERTY OVER TIME?

Brazil - Spearman Correlation Poverty Rate

N=5565	1991	2000	2010
1991	1.000		
2000	0.921	1.000	
2010	0.869	0.929	1.000

USA - Spearman Correlation Poverty Rate

N=3108	1995	2000	2005	2010	2015
1995	1.000				
2000	0.960	1.000			
2005	0.925	0.949	1.000		
2010	0.873	0.887	0.931	1.000	
2015	0.863	0.876	0.925	0.945	1.000

Brazil - Spearman Correlation Poverty Hot Spots

N=5565	1991	2000	2010
1991	1.000		
2000	0.978	1.000	
2010	0.948	0.982	1.000

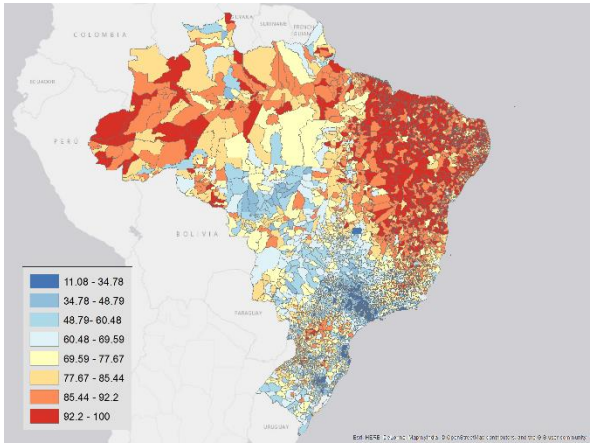
USA - Spearman Correlation Poverty Hot Spots

N=3108	1995	2000	2005	2010	2015
1995	1.000				
2000	0.986	1.000			
2005	0.974	0.979	1.000		
2010	0.923	0.920	0.965	1.000	
2015	0.917	0.912	0.959	0.985	1.000

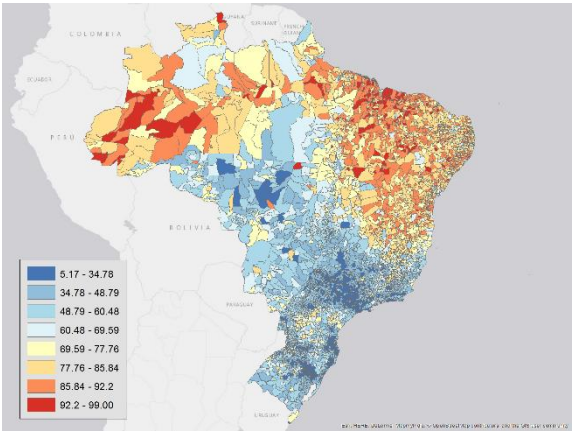
WHAT HAPPENS TO POVERTY OVER TIME?

EVOLUTION OF THE MUNICIPAL POVERTY RATE BETWEEN 1991 AND 2010

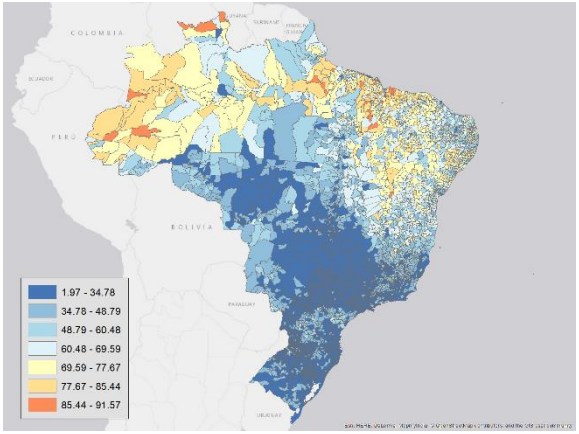
1991



2000



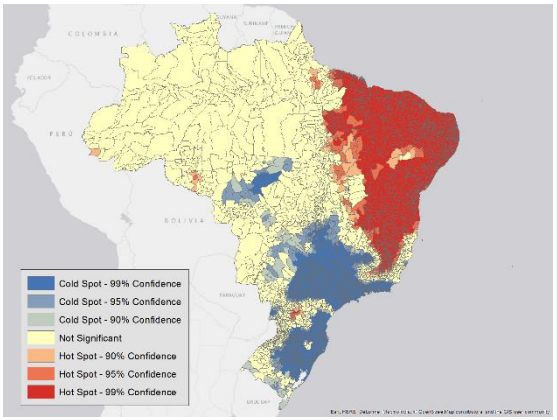
2010



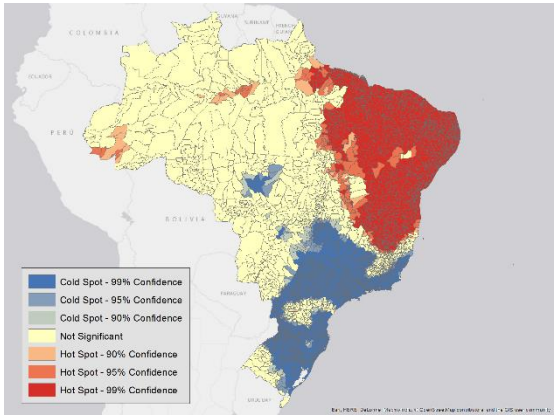
HOWEVER, THE POVERTY HOT AND COLD SPOTS REMAINED LARGELY THE SAME. BOTH IN TERMS OF THE POVERTY RATE…

EVOLUTION OF THE POVERTY RATE HOT AND COLD SPOTS BETWEEN 1991 AND 2010

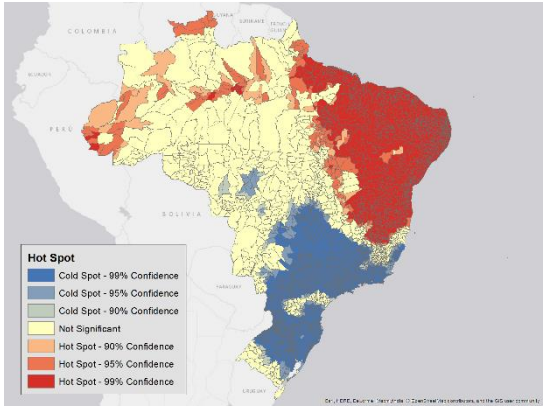
1991



2000



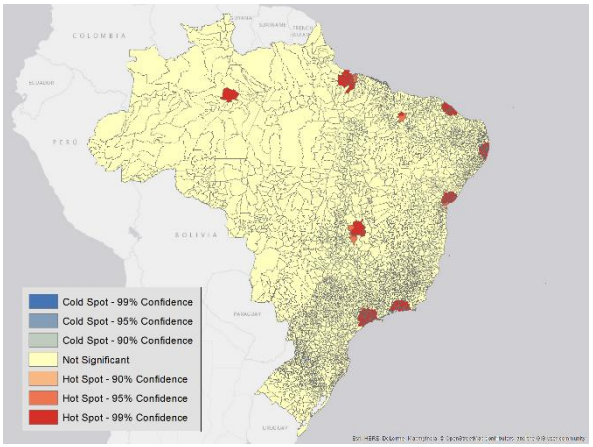
2010



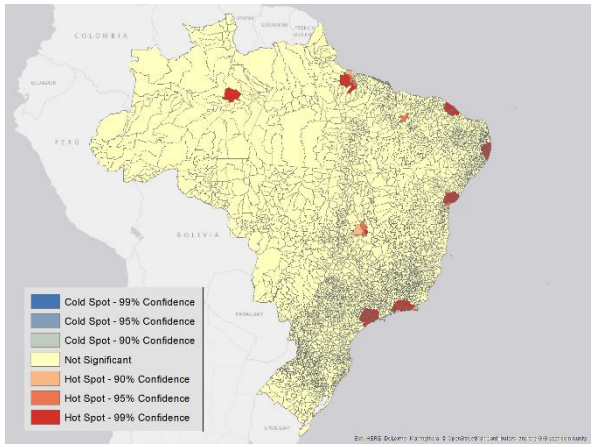
AND EVEN MORE IN TERMS OF THE NUMBER OF POOR.

EVOLUTION OF THE HOT AND COLD SPOTS OF THE POOR BETWEEN 1991 AND 2010

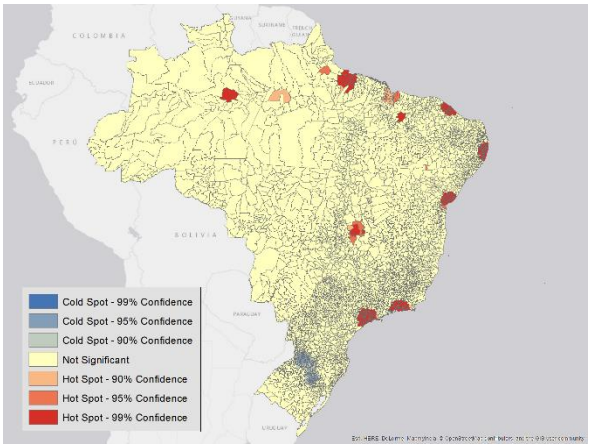
1991



2000

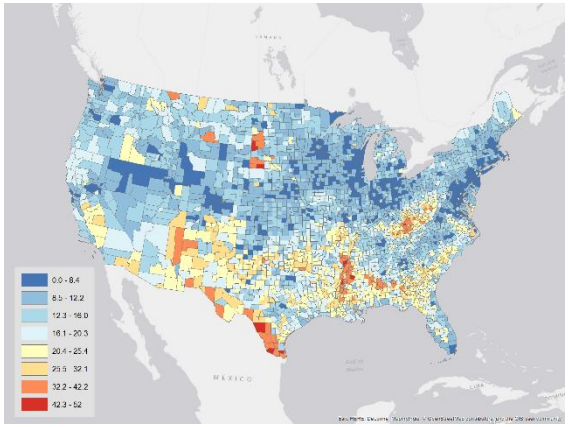


2010

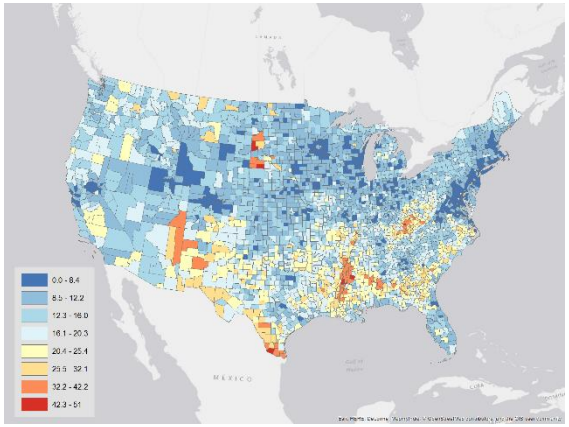


POVERTY IN THE USA DOES NOT CHANGE MUCH BE 1995 AND 2015…

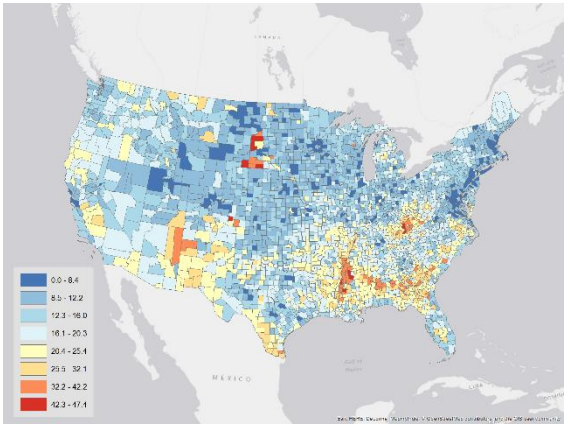
1995



2005

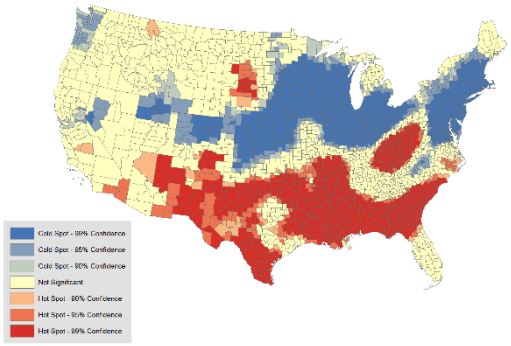


2015

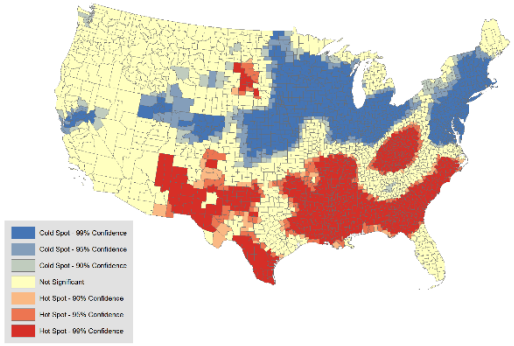


NEVER THE LESS, THE POVERTY HOT AND COLD SPOTS HAVE SIFTED…

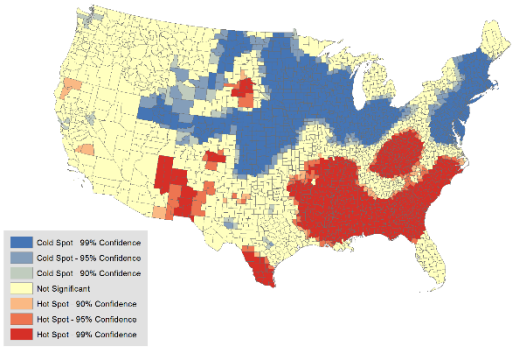
1995



2005

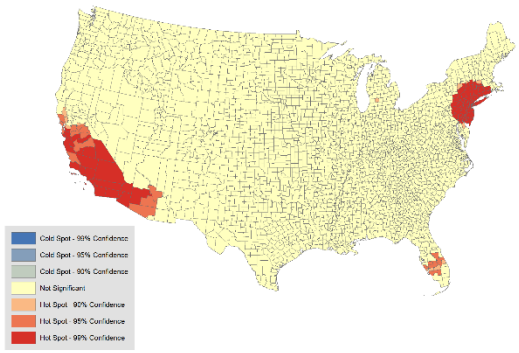


2015

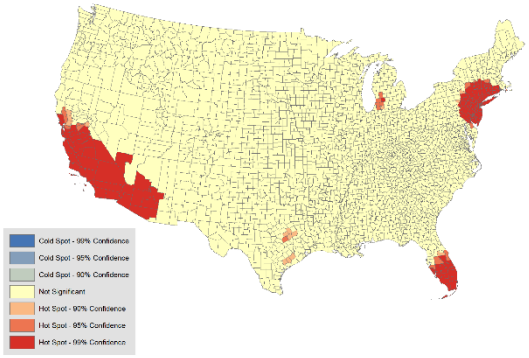


ALTHOUGH THE SPATIAL CONCENTRATION OF THE POOR REMAINED RELATIVELY CONSTANT.

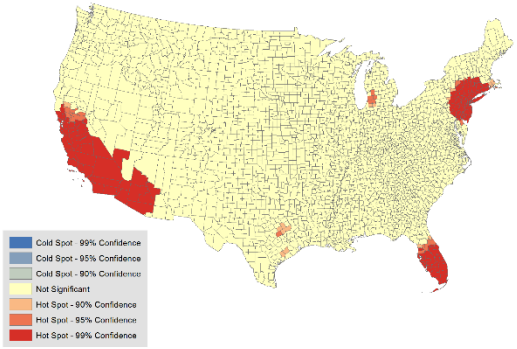
1995



2005



2015



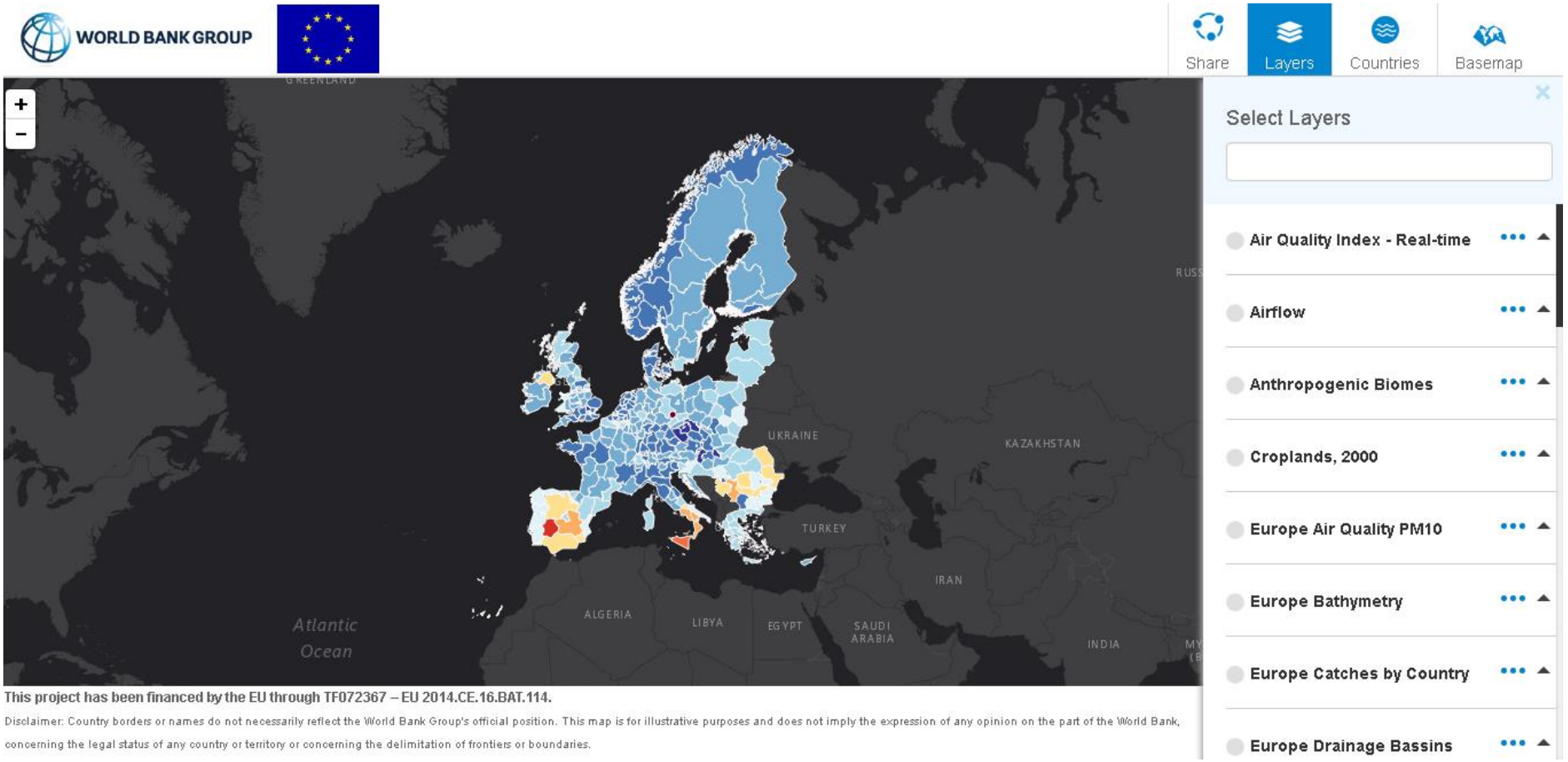
NEW TOOLS FOR DATA VISUALIZATION

Poverty web app (works best on laptops, tablets) at: http://www.appsolutelydigital.com/GlobalReach/poverty.html

- Can overlap layers and change the transparency of each layer – we can add more of the supplementary layers if you want
- You can select countries
- You can change basemaps (incl. new Bank basemaps)
- You can share link and embed map easily (e.g. for blogs, other portals, apps).

Other country examples

- Croatia Poverty Maps
- Croatian Poverty and IMD Inputs


WORLD BANK GROUP
Share
Layers
Countries
Basemap
Select Layers
Air Quality Index - Real-time
Airflow
Anthropogenic Biomes
Croplands, 2000
Europe Air Quality PM10
Europe Bathymetry
Europe Catches by Country
Europe Drainage Bassins
UKRAINE
KAZAKHSTAN
TURKEY
IRAN
ALGERIA
LIBYA
EGYPT
SAUDI ARABIA
INDIA
Atlantic Ocean
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MAIN TAKEAWAYS

- A poverty map is not an end in itself
- Augmented with administrative records it can become an extremely valuable tool to help inform identification, selectivity and prioritization of public investment
- The methods used in this work can find applications well beyond the mapping of poverty and deprivations

THANK YOU