Spatial distribution of sanitation and income inequality in Brazilian Slums

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Outline

- Motivation
- Slum definition in IBGE Census
- Data set construction
- Water provision and sewage collection
- Income inequality
- Next steps

Motivation

- **Brazil XIX rapid urbanization =>**
  poor housing quality and infrastructure
- **2010: 6% of population in slums**
- **to study the issue, and formulate public policies, data is needed.**
- **Population census has great potential to detect the phenomenon**

Motivation

- **Possibility of comparing 2000 and 2010 Census**
- **Explore the evolution of Sanitation and income distribution on slums**
- **key poverty issues**
- **Specific federal policies were applied in the past decade**

IBGE Slum definition

- **The statistics office (IBGE) maintained the concept (from 1953) but changed the classification procedures**
- **Slum data on Census are not originally comparable**
- **Concept of subnormal clusters:**
  - **At least 51 households**
  - **Lack of formal titles**
  - **irregular urbanization**
  - **Precarious public services**
  - **Inadequate housing topography**

Data set: minimum comparable areas

- MCAs: smallest possible areas formed by aggregations of census tracts whose outer perimeter is common in all periods of time
- Built using the recordings of the redefinition of census tracts boundaries and graph theory
- Only 3% were not simple subdivision changes

Data set: slum classification

- in 2010 classification procedures improved:
  - Aid of digital maps and satellite images
  - Previous local field work
- Originally, total slum population in 2000 was 6,5 million, and in 2010 was 11,4 million
- Much of the "new" slums in 2010 were badly classified as regular areas in 2000
- Our hypothesis: if an area is occupied regularly it does not revert to slum
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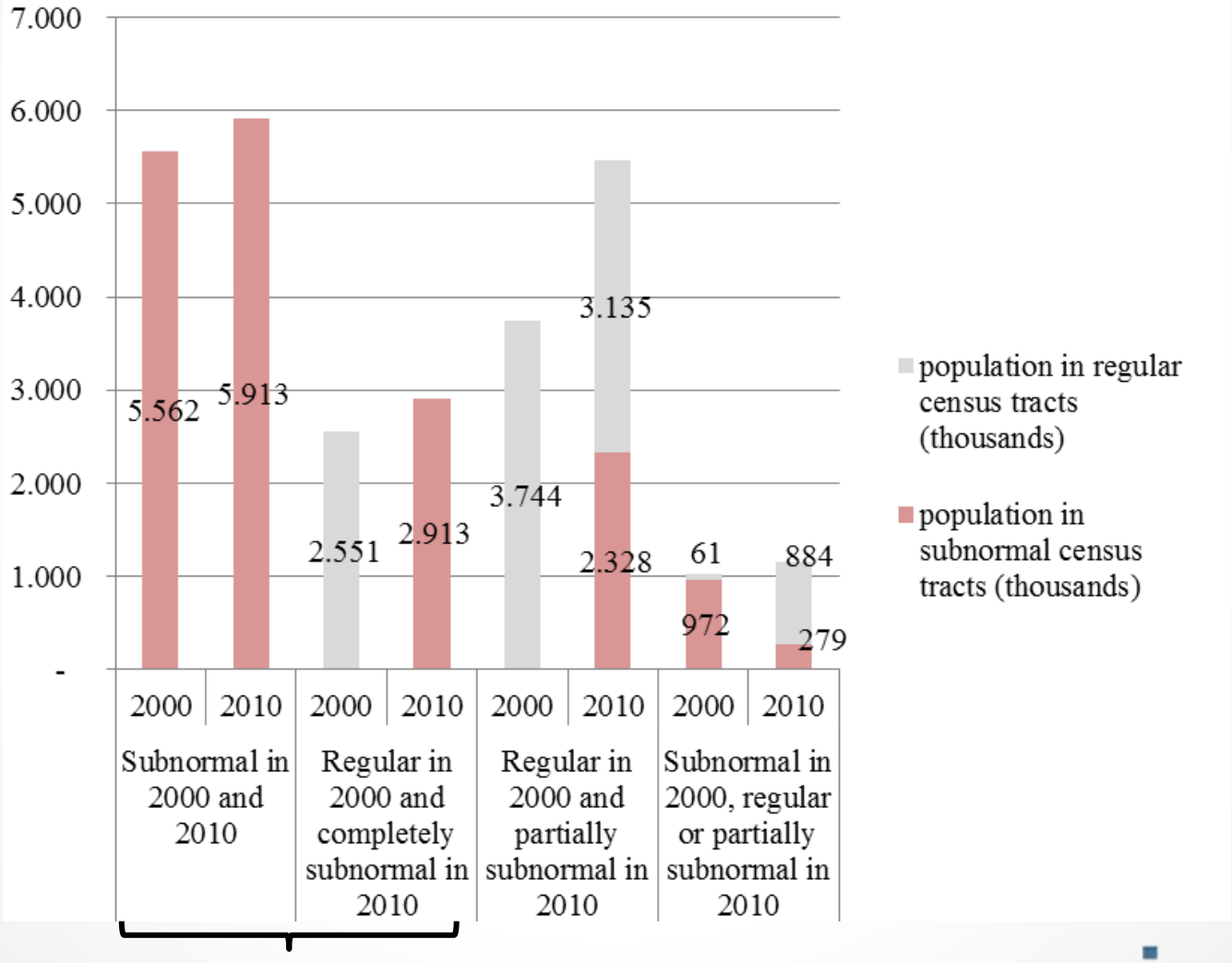
Data set: slum classification



- **Slums considered in this work**

Data set: income data

- 2010: portable eletronic devide did not have the option to leave income blank
- Too much households with zero income
- Imputation of income for these
- In sample data: clustering zero income in "true"and "false" zero income
  - False zero income did not want to declare income
- Hot deck imputation for "false"
- Distribution for each census tracts: according to how much original zero income

Water and sewage in slums

- **Overall improvement, greater for slums**
- **Diff diff regression:**

	water	sewage
slums	-0.028	-0.185
	(8.62)**	(40.68)**
2010	0.029	0.039
	(13.56)**	(13.89)**
slums*2010	0.018	0.07
	(4.18)**	(11.30)**
Constant	0.889	0.793
	(538.76)**	(375.15)**
Observations	61462	61462
R-squared	0.01	0.05

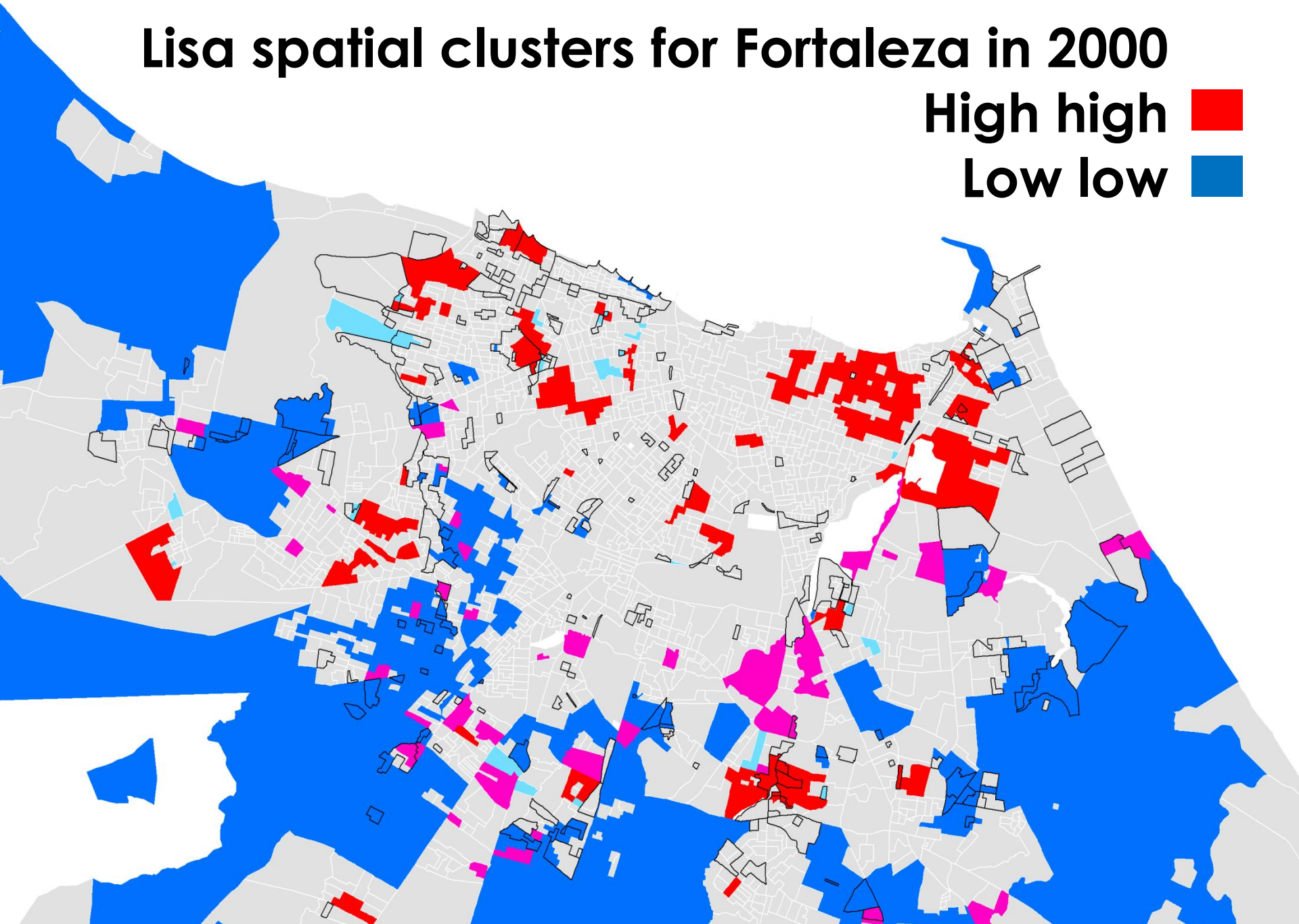
Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Water and sewage in slums

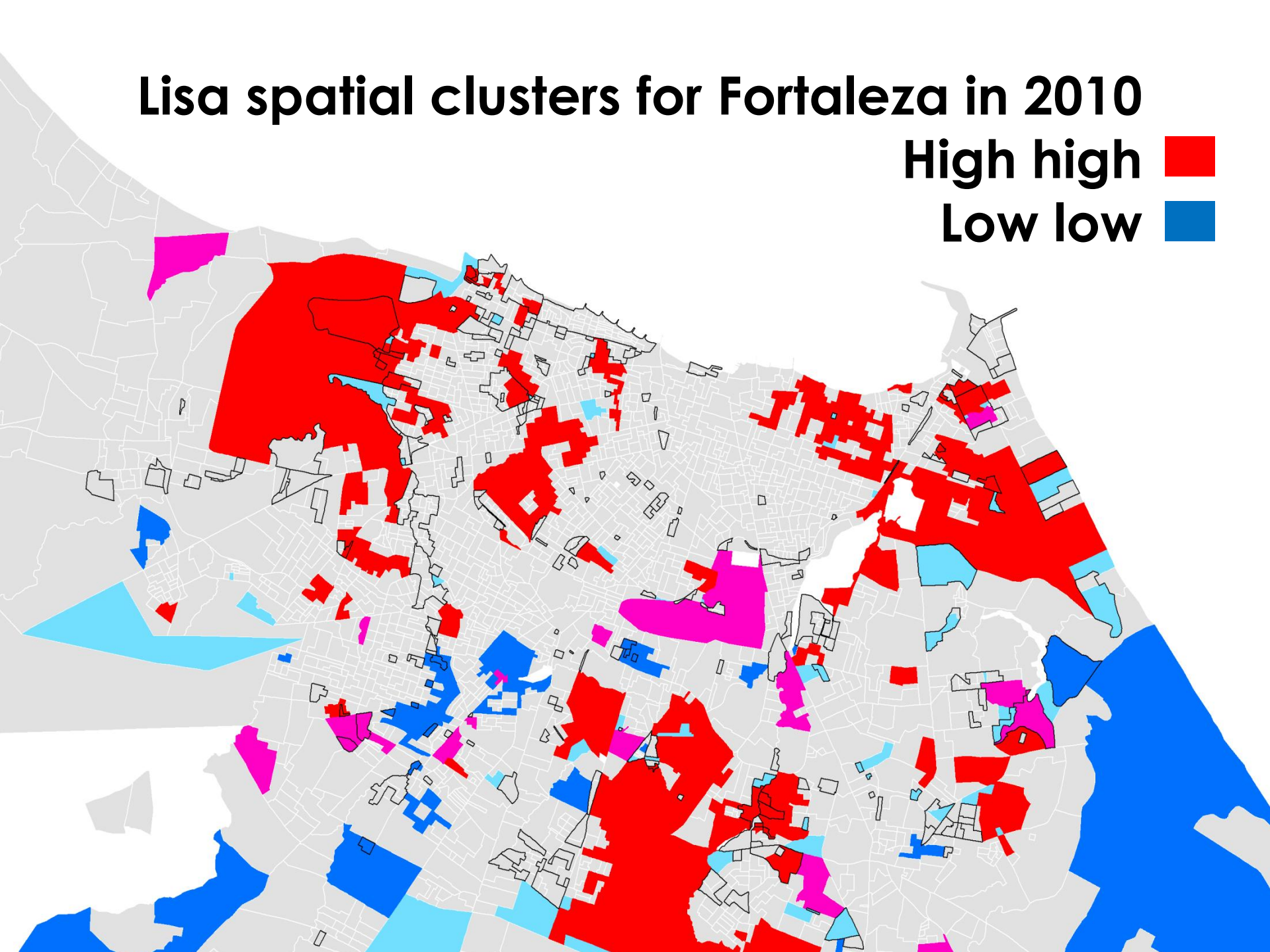
- **From 2000 to 2010 LL clusters decreased**
- **Better spatial distribution of infrastructure**
- **In sewage they decreased less for slums**

		water			sewage		
		2000	2010	growth	2000	2010	growth
Slums	% of households with provision	85.9%	89.2%	3.4%	60.2%	70.6%	10.4%
	LL clusters	823	522	-36.6%	690	553	-19.9%
	% of total LL clusters	6.2%	5.3%		3.7%	4.5%	
Slums contiguous neighbors	% of households with provision	90.1%	91.8%	1.7%	78.7%	81.5%	2.8%
	LL clusters	2690	1955	-27.3%	3298	2496	-24.3%
	% of total LL clusters	20.2%	19.8%		17.5%	20.5%	
Brazil	% of households with provision	87.9%	90.5%	2.6%	70.7%	74.2%	3.5%
	LL clusters	13339	9862	-26.1%	18890	12195	-35.4%
	% of LL clusters over total MCAs	8.1%	6.0%		11.5%	7.4%	

Lisa spatial clusters for Fortaleza in 2000

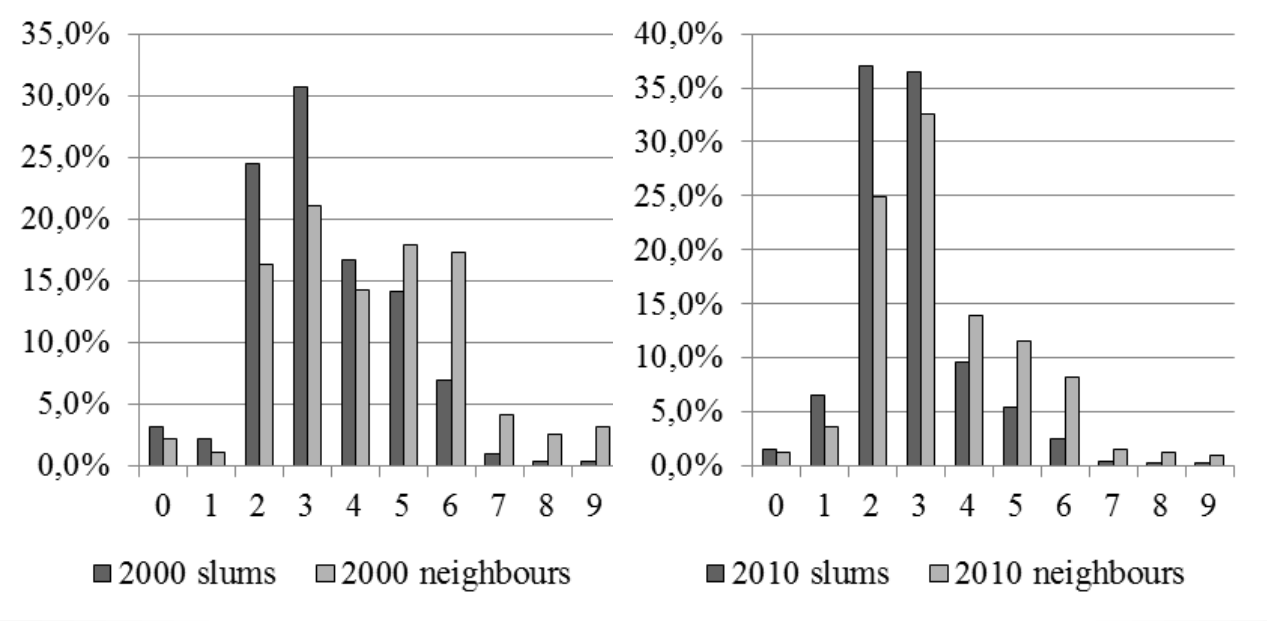


Lisa spatial clusters for Fortaleza in 2010



Slums income inequality

- **Income data from grouped observations**
- **Inequality within income range is zero**



- **Neighbors have more wealthier households**

Slums income inequality

- **Slums less unequal than neighbors and Brazil**
- **Slums income lower but increased more**
- **Poverty traps?**

		2000	2010	delta/growth
Slums	Gini mean (x100)	37.30	35.20	-2.10
	Gini Std. Dev. (x100)	6.60	8.21	
	Average income	767.85	898.19	17.0%
Slums contiguous neighbors	Gini mean (x100)	40.56	38.62	-1.94
	Gini Std. Dev. (x100)	7.12	7.64	
	Average income	1469.24	1519.03	3.4%
Brazil	Gini mean (x100)	41.60	39.16	-2.44
	Gini Std. Dev. (x100)	8.23	8.57	
	Average income	1510.76	1530.86	1.3%

Next steps

- **Geographical disaggregation for regions and metropolitan regions**

- **Explore whithin and between income inequality effects in slums and neighbors or the rest of the city.**

Thank you

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