The geography of cellphone robberies in São Paulo: an exploratory analysis

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Outline

"Spatial analysis of cellphone robberies in São Paulo (city & state)"

1 Introduction

- Motivation, objective, background, study area

2 State of São Paulo

- Data, methods, results

3 City of São Paulo

- Data, methods, results

4 Conclusions & Future Work

Why study cellphone robberies in São Paulo?

- **High** robbery rates
- Major cause of **feelings of unsafety**
- ***Cellphones:*** most common stolen item

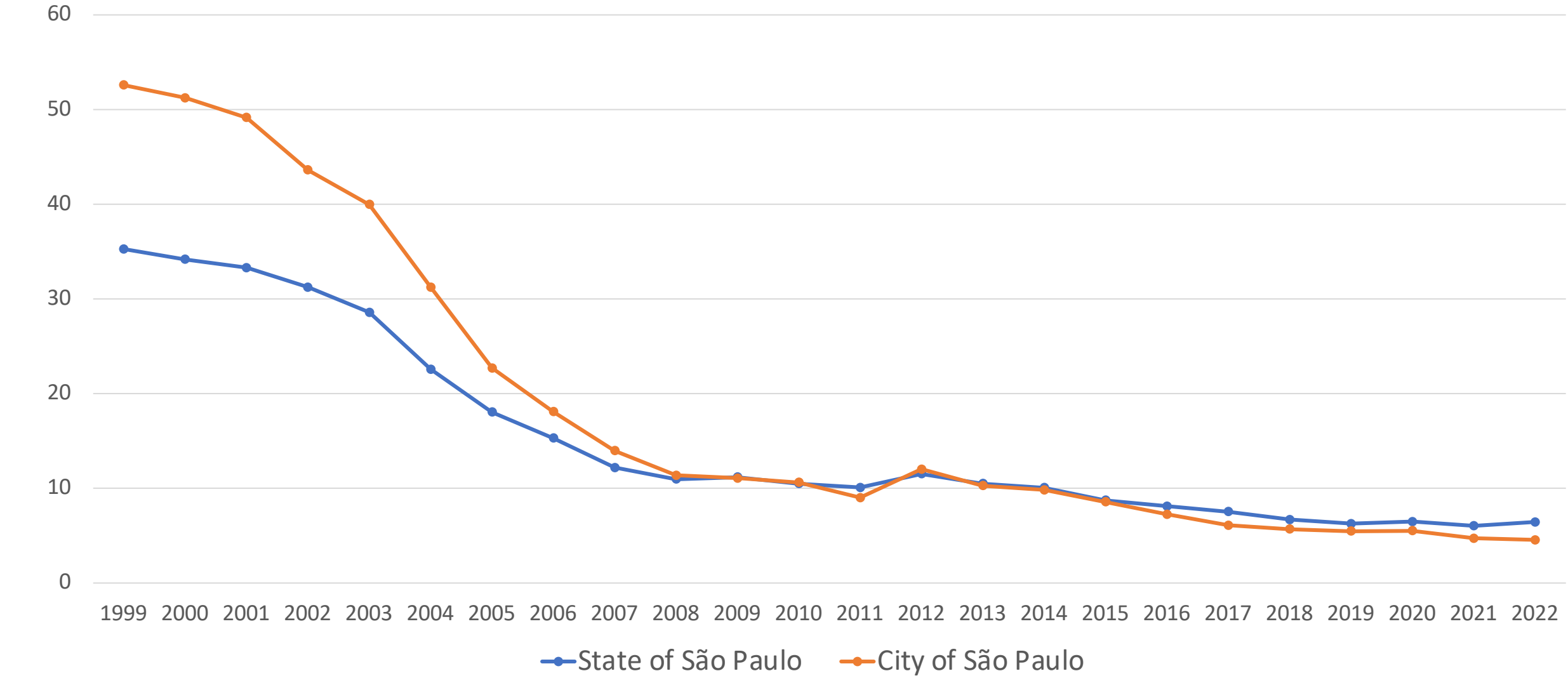
São Paulo: major decline in homicide for two decades.

Robbery has not decreased.

City	Robb. per 100k (2022)
São Paulo, SP	1172.1
Houson, TX	373.2
Memphis, TN	327.4
Milwaukee, WI	326.8

Top 3 robb. rates in the US

Homicides/100k inhabitants



Robberies/100k inhabitants

What explains the **geography** of cellphone **robberies** in the city and state of São Paulo?

Theoretical Background

"What could explain the geography of cellphone robberies?"

Applicable to São Paulo?

- **Routine Activity Theory**

  + people out ➡ + exposure ➡ + robbery

  + cellphones ➡ + cellphone robbery

- **Social Disorganization Theory**

  + disorganization ➡ - control ➡ + robbery

- **Criminology of Place**

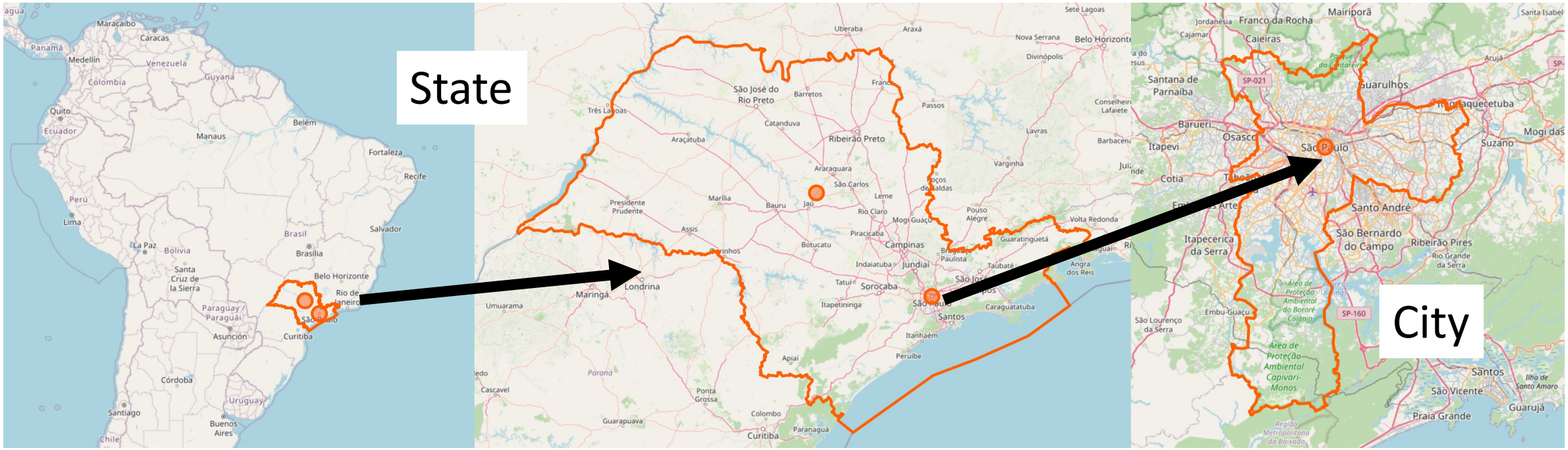
  specific facilities ➡ robbery

State of São Paulo

- Most populous state (~40M, ~20% of Brazil's)
- Largest GDP total
- 2nd largest GDP per capita

City of São Paulo

- Largest city (~10M)
- Largest metro area (~20M)
- Economic & financial center



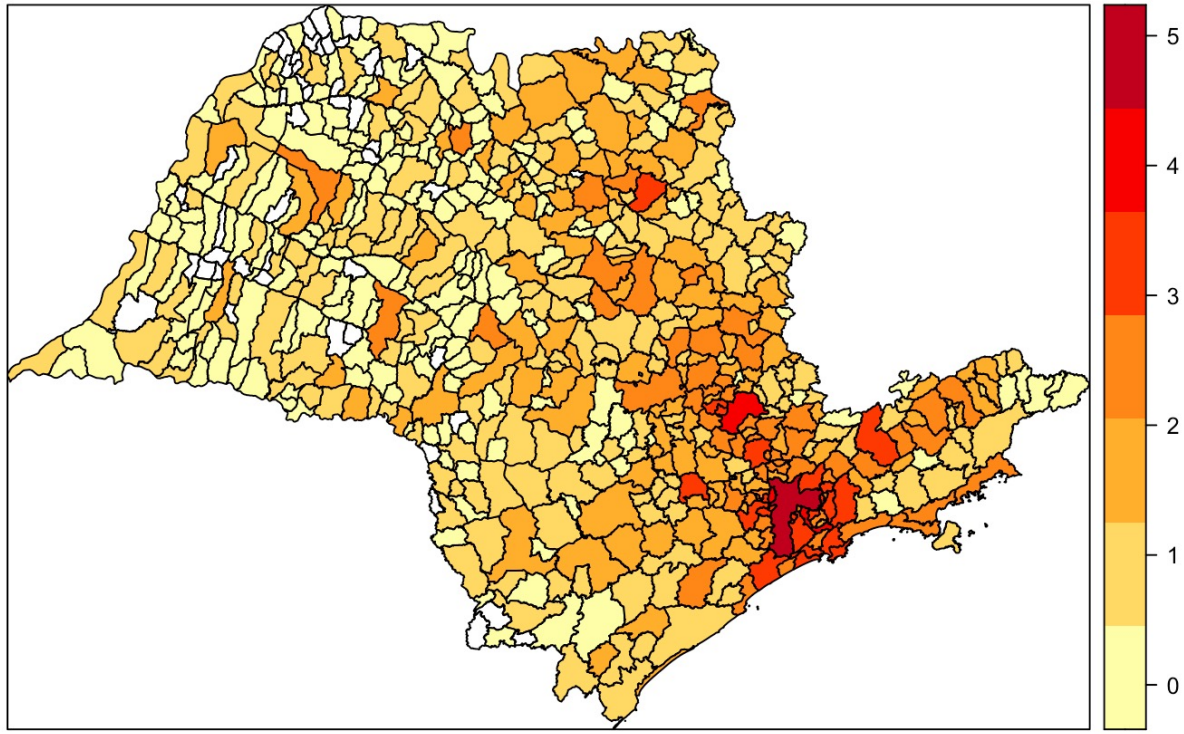
Source: OpenStreetMap

Part 1: State of São Paulo

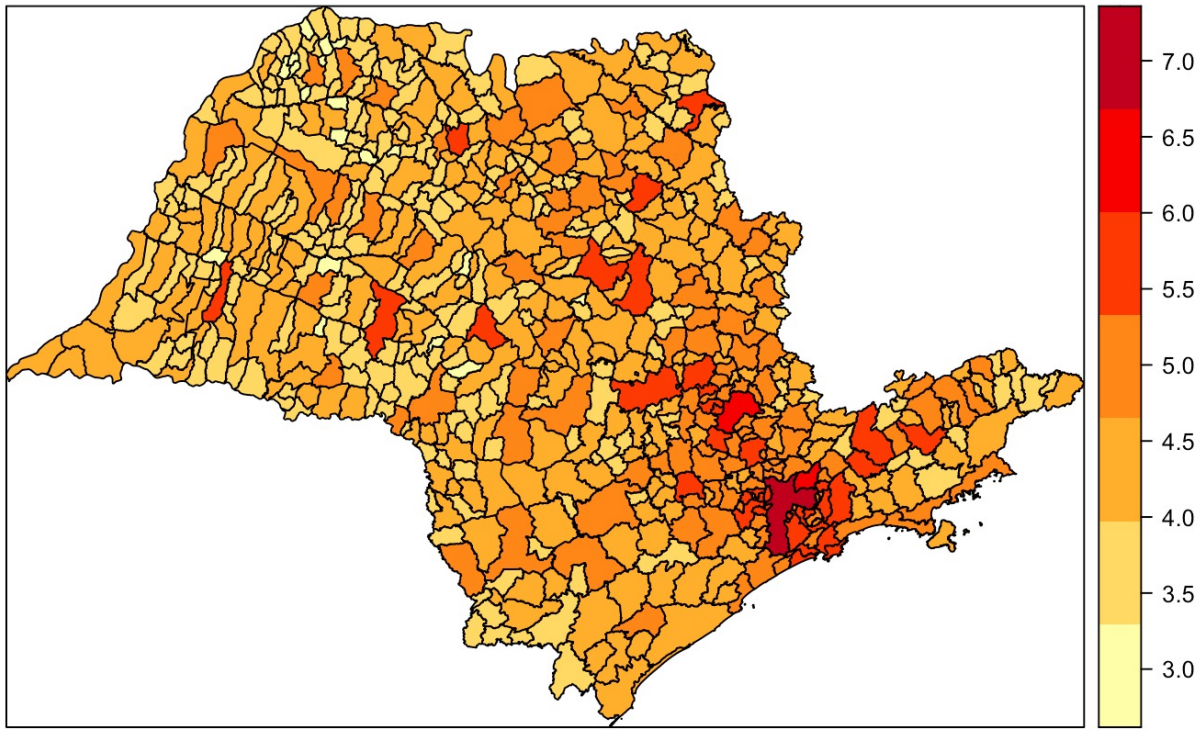
Year: 2017

Unit: municipalities

Cellphone robberies (Source: SSP)



Population size (Source: SEADE)



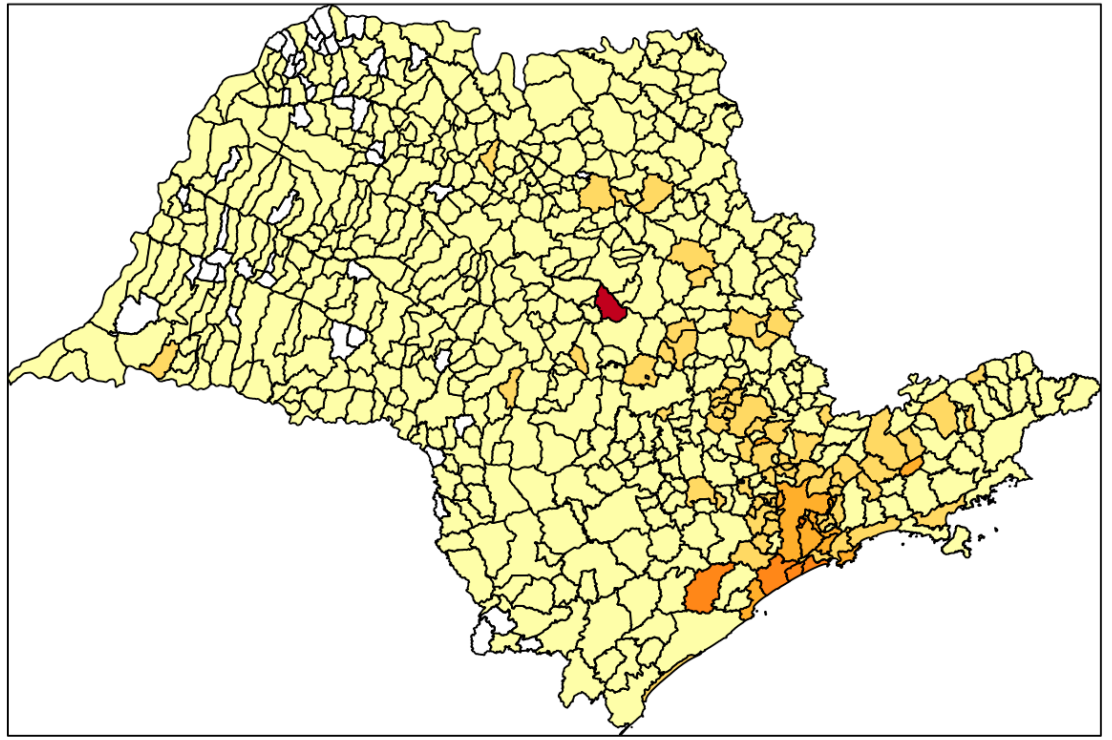
Part 1: State of São Paulo

Year: 2017

Unit: municipalities

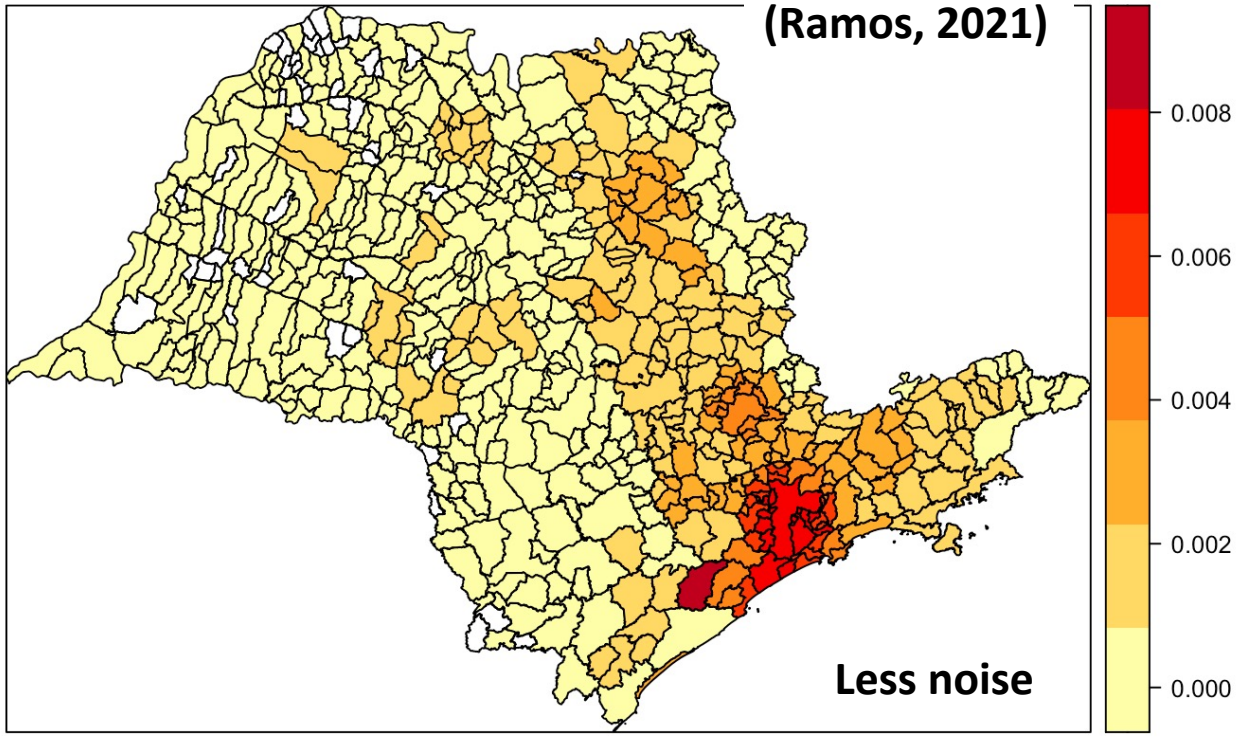
Per capita rates

Robberies/Population



GWRisk: Robb ~ GWR(Population)

(Ramos, 2021)



Part 1: State of São Paulo

Linear Regression Analysis

Robbery rate per capita ~ Socioeconomic variables

Some variations:

- Cases/Population ratio & GWRisk
- OLS & Weighted Linear Regression
  - (population as weight)

Source: SEADE

Exp. Variables
Pop. size
% urbanized
% men
% 6 – 14 yr
% 15 – 17 yr
% fail high school
% fail elem. school
GDP per capita
GDP total
Violent deaths
Pop. dens.
% pop in favela
Inc. ineq. (Gini)
% < half min. wage

Exp. Variable	Ratio weighted OLS	GWRisk weighted OLS	Ratio regular OLS	GWRisk regular OLS
Pop. size	+*	+*	+***	+*
% urbanized	+.	+**		
% men	-*			+.
% 6 – 14 yr				
% 15 – 17 yr		+**		+***
% fail high school	+**	+***		
% fail elem. school	+*	+*	+**	
GDP per capita	+***	+***	+***	+***
GDP total	-*	-*	-**	-*
Violent deaths	+***	+*		+*
Pop. dens.	+***	+***	+***	+***
% pop in favela	+***	+***	+***	+***
Inc. ineq. (Gini)	+*	+***	+**	+***
% < half min. wage				-**
R-squared	**0.794**	**0.786**	**0.360**	**0.501**

Exp. Variable	Ratio weighted OLS	GWRisk weighted OLS	Ratio regular OLS	GWRisk regular OLS
Pop. size	+*	+*	+***	+*
% urbanized	+.	+**		
% men	-*			+.
% 6 – 14 yr				
% 15 – 17 yr		+**		+***
% fail high school	+**	+***		
% fail elem. school	+*	+*	+**	
GDP per capita	+***	+***	+***	+***
GDP total	-*	-*	-**	-*
Violent deaths	+***	+*		+*
Pop. dens.	+***	+***	+***	+***
% pop in favela	+***	+***	+***	+***
Inc. ineq. (Gini)	+*	+***	+**	+***
% < half min. wage				-**
R-squared	**0.794**	**0.786**	**0.360**	**0.501**

Part 1: State of São Paulo

Summary: most of the variance explained!

In all models:

+ Pop. Size
+ Pop. dens.
+ GDP per capita
+ % pop in favela
+ Inc. ineq. (Gini)
- GDP total

→ **City size & socioecon.**

Additionally,
the model with greatest fit features:

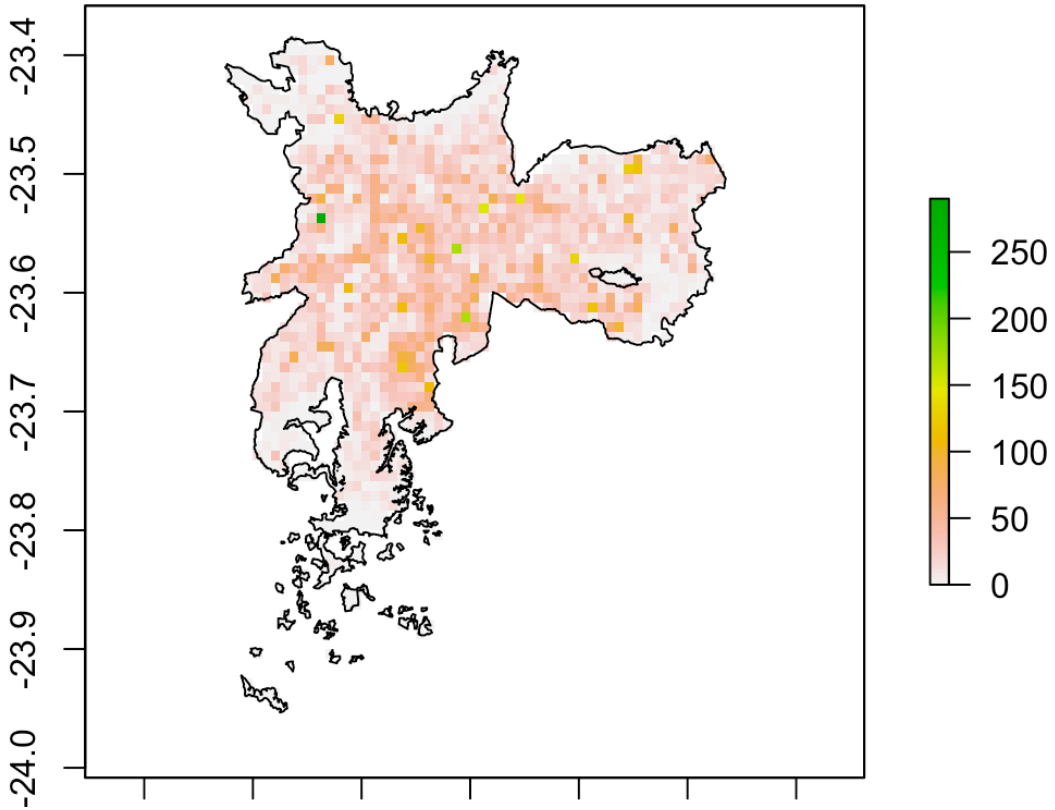
+ % urbanized
+ % fail highschool
+ % fail elementary
+ % violent deaths
- % men

→ **“Societal distress”**

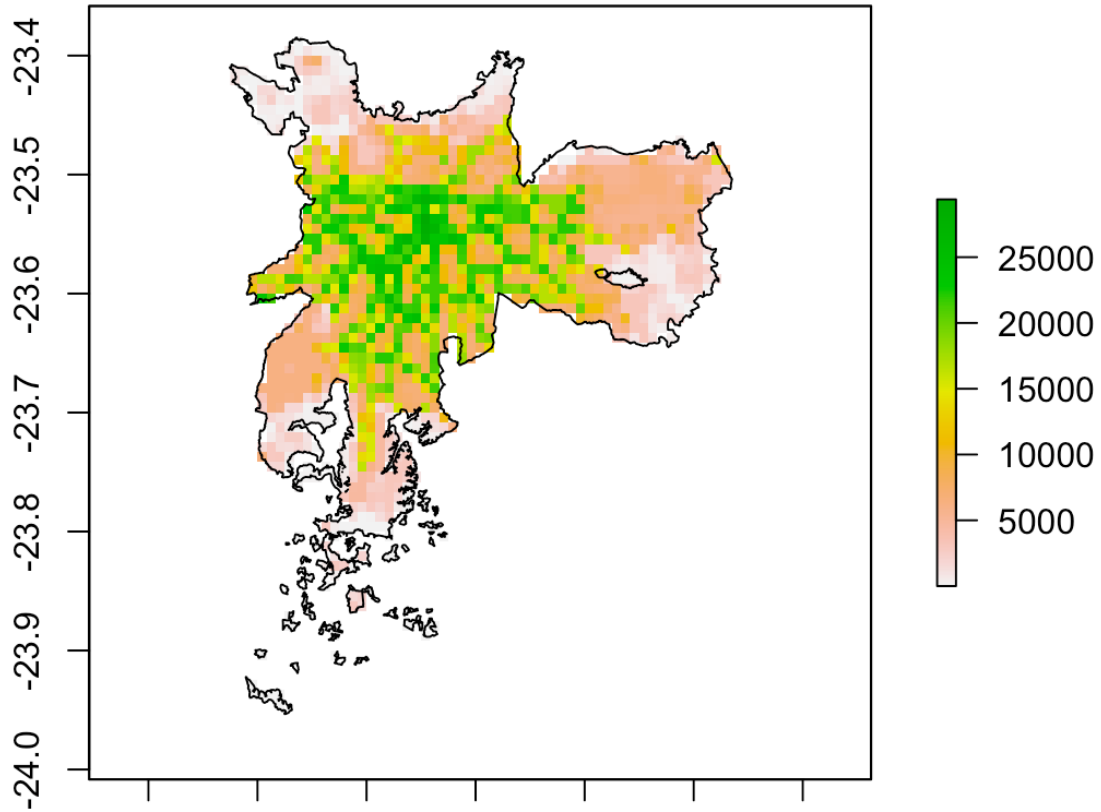
Part 2: City of São Paulo

Year: 2010

Unit: 1km x 1km cells



Number of robberies (Source: SSP)



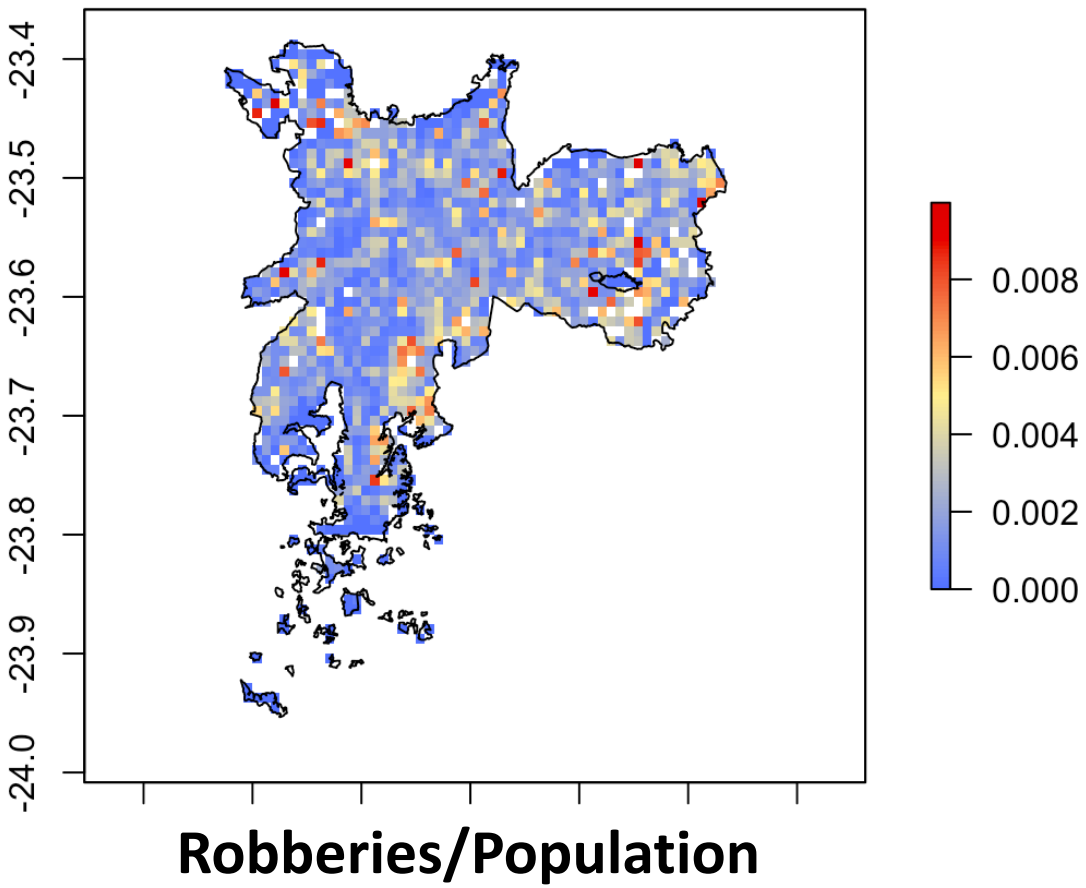
Ambient population (Source: LandScan)

Part 2: City of São Paulo

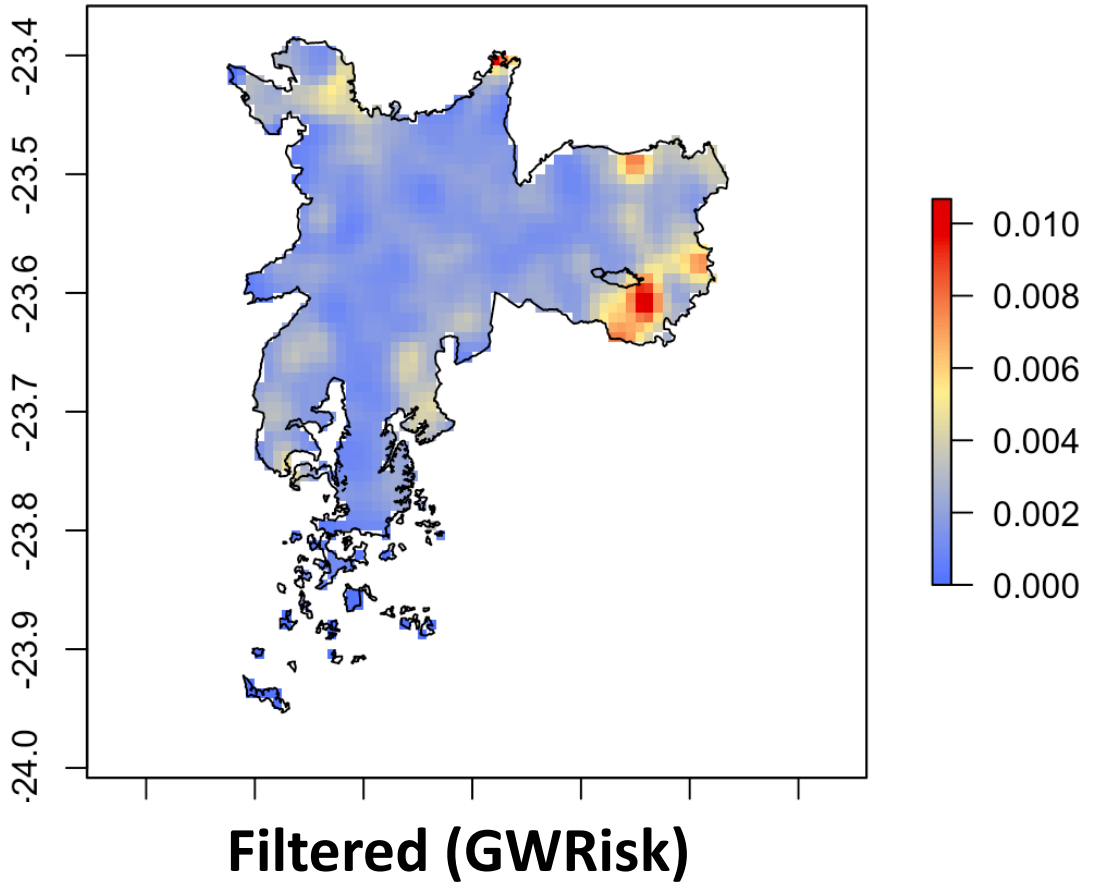
Year: 2010

Unit: 1km x 1km cells

Per capita rates



Robberies/Population



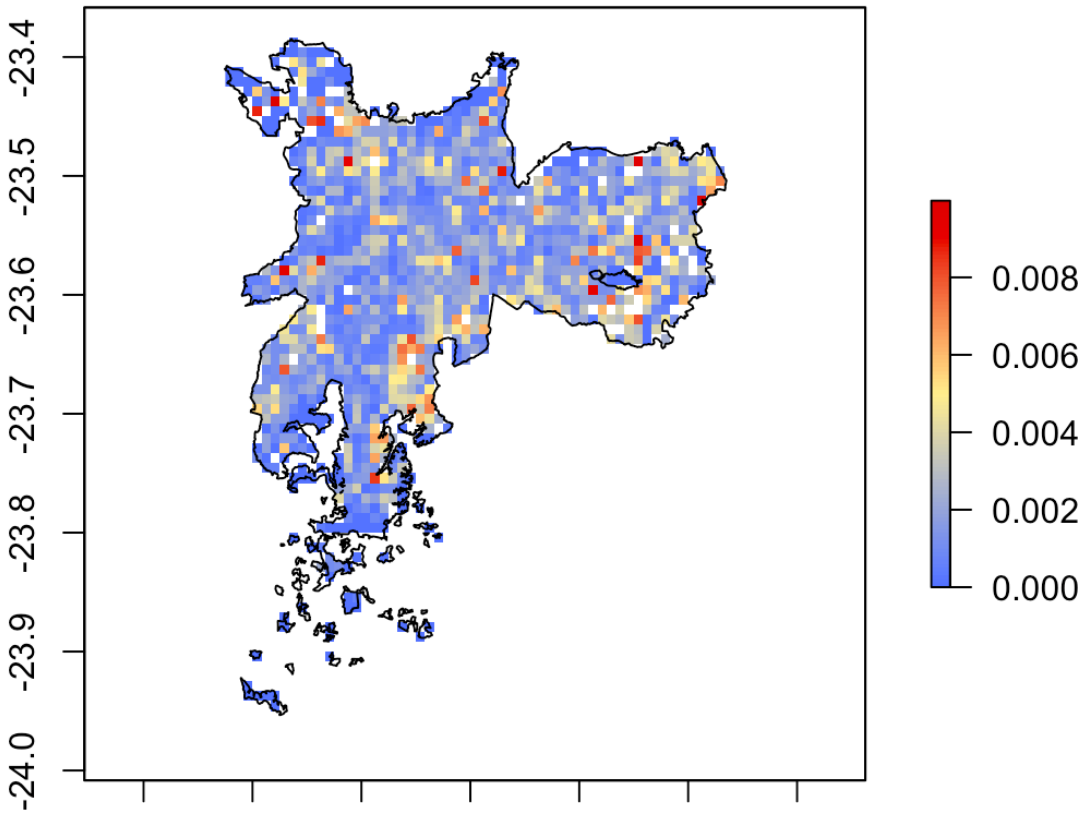
Filtered (GWRisk)

Part 2: City of São Paulo

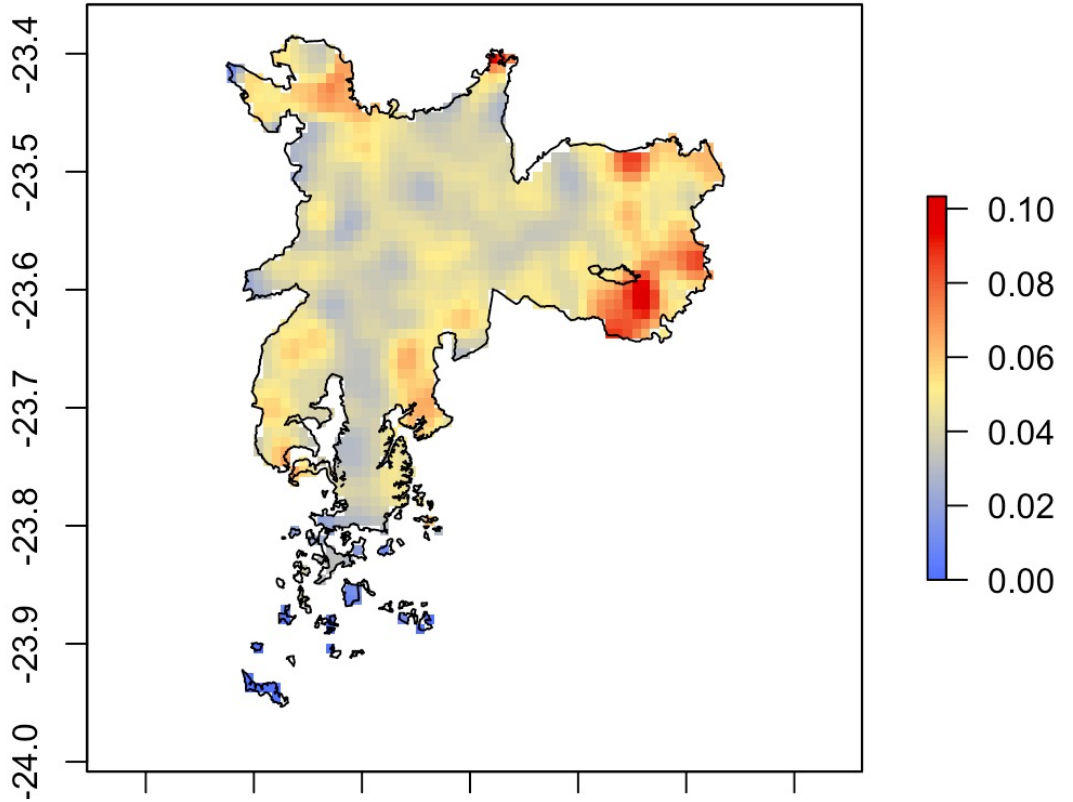
Year: 2010

Unit: 1km x 1km cells

Per capita rates



Robberies/Population



Filtered (GWRisk) & Transformed (sqrt)

Part 2: City of São Paulo

Linear Regression Analysis

Robbery rate per capita ~ Socioeconomic variables

Some variations:

- Cases/Population ratio & GWRisk
- OLS & Weighted Linear Regression
  - (population as weight)

Source: Censo IBGE 2010

Explanatory Variables
Income per capita
% < half min. wage
Inc. Inequality
Ambient population
% in favela
% in gated neighborhood
% single fam. houses
% rentals
% public lighting
% paved roads
% homes with sewer

Not all the same data was available

Exp. Variable	Ratio weighted OLS	GWRisk weighted OLS	Ratio regular OLS	GWRisk regular OLS
Income per capita				
% < half min. wage		+***		+***
Inc. Inequality		-***	-**	-***
Ambient population	-***	-***	-***	-***
% in favela			+*	
% in gated neigh.				
% single fam. houses	-**	-***	-*	-***
% rentals	+**			-.
% public lighting				-**
% paved roads			+**	+***
% homes with sewer	-**	-***	-*	-***
R-squared	**0.109**	**0.2329**	**0.08387**	**0.2267**

Exp. Variable	Ratio weighted OLS	GWRisk weighted OLS	Ratio regular OLS	GWRisk regular OLS
Income per capita				
% < half min. wage		+***		+***
Inc. Inequality		-***	-**	-***
Ambient population	-***	-***	-***	-***
% in favela			+*	
% in gated neigh.				
% single fam. houses	-**	-***	-*	-***
% rentals	+**			-.
% public lighting				-**
% paved roads			+**	+***
% homes with sewer	-**	-***	-*	-***
R-squared	**0.109**	**0.2329**	**0.08387**	**0.2267**

Part 2: City of São Paulo

Summary: less of the variance explained...

In all models:

- Ambient population
- % single fam. houses
- % homes with sewer

→ **Urban environment**

Additionally,
the model with greatest fit features:

+ % < half min. wage
- inc. inequality

Unexplained factors?

Conclusions...

Across the state of São Paulo: clear determinants!

- **Size & socioeconomic** conditions
- **Focus** point in the **city of São Paulo**
- Societal **distress** also significant.

Inside the city of São Paulo: less clear

- Similar socioeconomic variables explain little.
- **Environmental** factors some relevance.

Conclusions...and Future Work!

Across the state of São Paulo: clear determinants!

- **Size & socioeconomic** conditions
- **Focus** point in the **city of São Paulo**
- Societal **distress** also significant.

How to connect the two?

Inside the city of São Paulo: less clear

- Similar socioeconomic variables explain little.
- **Environmental** factors some relevance.

What is missing?

Thank you!

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Key References

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[GWRisk] - Ramos, R. G. (2021). Improving victimization risk estimation: A geographically weighted regression approach. *ISPRS International Journal of Geo-Information*, *10*(6), 364.

[Unit of analysis] - Ramos, R. G., Silva, B. F., Clarke, K. C., & Prates, M. (2021). Too fine to be good? Issues of granularity, uniformity and error in spatial crime analysis. *Journal of Quantitative Criminology*, *37*, 419-443.