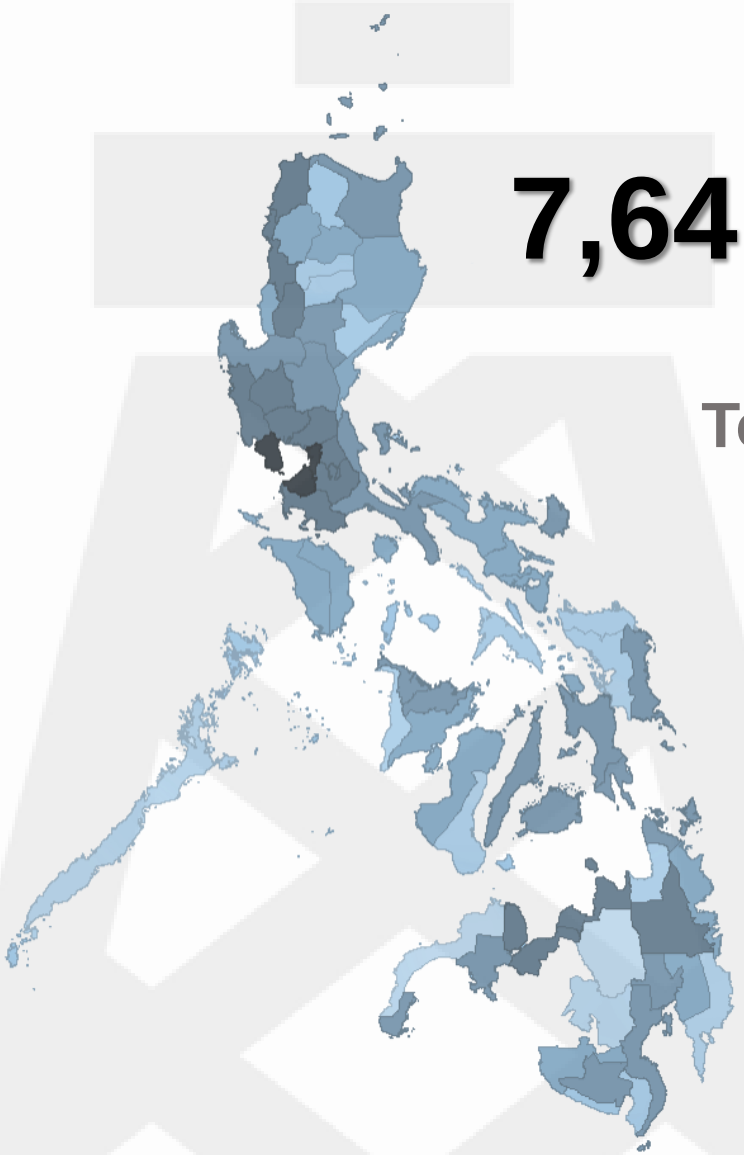
A SPATIAL ECONOMETRIC MODEL FOR HOUSEHOLD ELECTRICITY CONSUMPTION IN THE PHILIPPINES

Marie Therese S. Sario and
Francisco De Los Reyes

Presented by
Marie Therese S. Sario
University of the Philippines Diliman

14th NCS National Convention on Statistics
1-3 October 2019 | Crowne Plaza Manila Galleria
Organized by the Philippine Statistical System
Spearheaded by the Philippine Statistics Authority



7,641 islands

(NAMRIA-DENR, 2017)

Topography

Archipelagic country

Remote communities

SPACE

OBJECTIVES

1 RELATIONSHIP

- Household Electricity Factors
- Economic Factors
- Geographical Factors

2 SPATIAL DEPENDENCE

- Determine
- Quantify

3 COMPARE MODELS

- **Base Model:** Non-spatial Regression Model
- Three Spatial Econometric Models

VARIABLES CONSIDERED

Household Electricity Factors

1. Private Investors Owned Utilities
2. Awareness of Energy Labelling Program
3. Brownout
4. Fluctuating voltage
5. High electricity cost
6. Low voltage

Economic Factors

1. Human Development Index
2. Labor force participation rate
3. Young dependents
4. Internal revenue allotment per capita
5. Inflation

Geographical Factors

1. Concreate National Road
2. Land area
3. Urban area population

METHODOLOGY

DATA COLLECTION

Department of Energy

Household Energy Consumption Survey 2011

Philippine Statistics Authority

Department of Public Works and Highways

DATA CLEANING

- **Missing values:**
  Predictive Mean Matching
- Lighting and Appliances

Household level → Provincial level

- Excluded:
  - Basilan,
  - Lanao del Sur
  - Maguindanao
  - Sulu,
  - Tawi - Tawi
  - Zamboanga Sibugay

METHODOLOGY

1 Relationship

Pearson Correlation

2 Spatial Dependency

- Moran's Index
- LISA
- Lagrange Multiplier

3 Compare Models

Base Model	Spatial Econometric Models
Ordinary Least Squares	• Spatial Lag Model • Spatial Error Model • Spatially Lagged X Model

Model Specification

- Akaike Information Criterion
- Log likelihood Test
- Likelihood Ratio Test
- Spatial Effect: Direct &Indirect

RESULTS

Pearson correlation

Household Electricity Factors

- (+) Awareness of Energy Labelling Program
- (+) Private Investors Owned Utilities
- (+) High electricity cost
- (-) Fluctuating voltage
- (-) Low voltage

Economic Factors

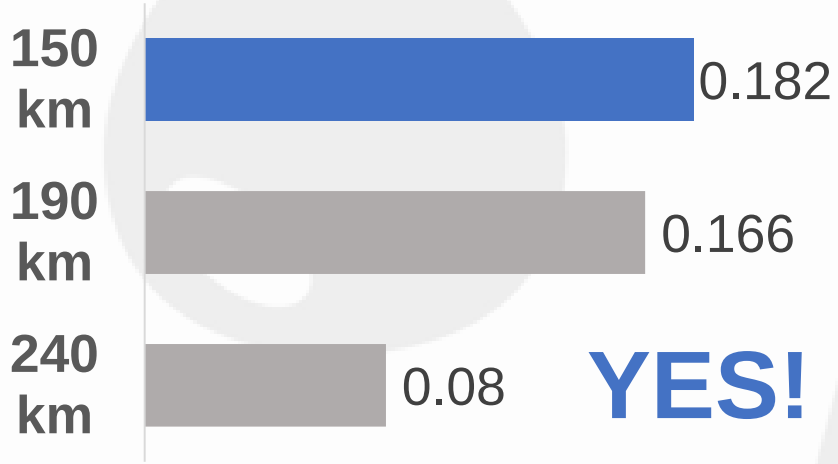
- (+) Human Development Index
- (+) Young dependents
- (-) Labor force participation rate

Geographical Factors

- (+) Urban area population
- (-) Land area

Do nearby provinces exhibit similar household electricity consumption behavior?

Moran's Index



YES!

P value < 0.05

X Batanes, Palawan

14th NCS National Convention on Statistics
1-3 October 2019 | Crowne Plaza Manila Galleria
Organized by the Philippine Statistical System
Spearheaded by the Philippine Statistics Authority

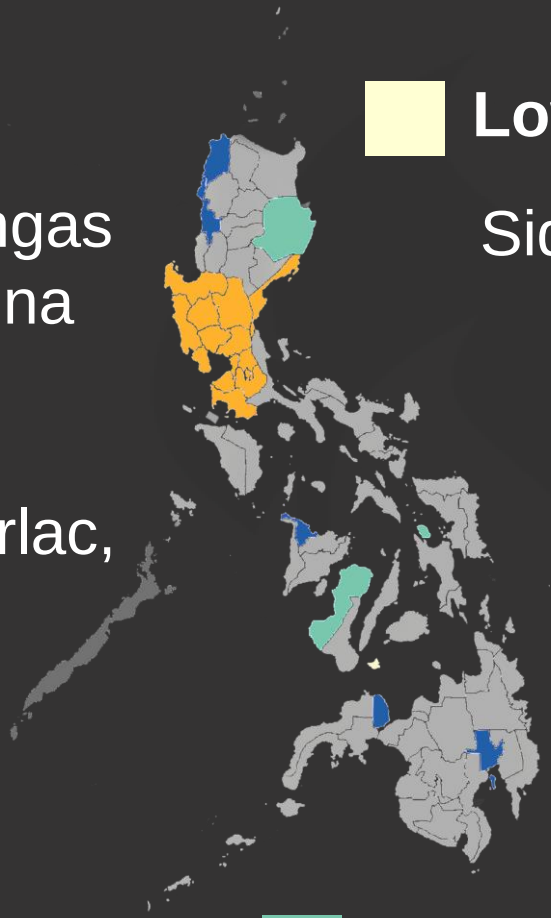
150 km Local Indicator for Spatial Autocorrelation

High-high

Aurora, Bataan, Batangas
Bulacan, Cavite, Laguna
NCR, Nueva Ecija,
Pampanga
Pangasinan, Rizal, Tarlac,
Zambales

Low-High

Siquijor



High-low

Aklan, Davao del Norte,
Ilocos Norte, Ilocos Sur,
Misamis Occidental

Low-low

Biliran, Isabela,
Negros
Occidental

RESULT

LIKELIHOOD RATIO TEST

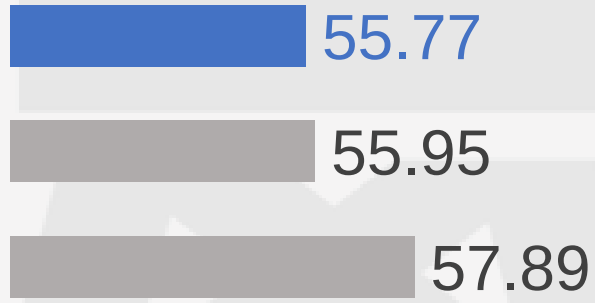
4.21*
150 km

4.03
190 km

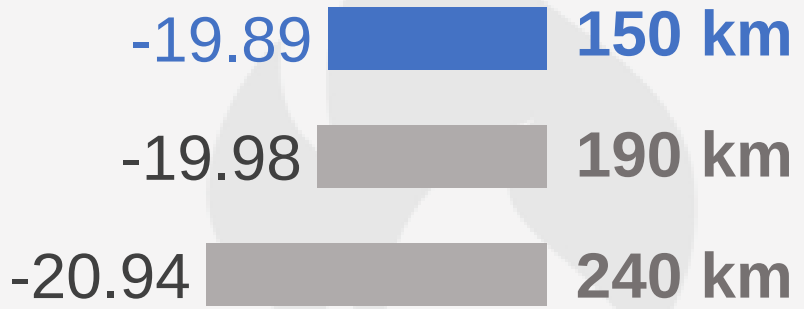
2.10
240 km

* Pvalue < 0.05

Distance metric with **lowest AIC**



Distance metric with **highest Log Likelihood**



150 km is the **most favorable distance to observe similar household electricity consumption**

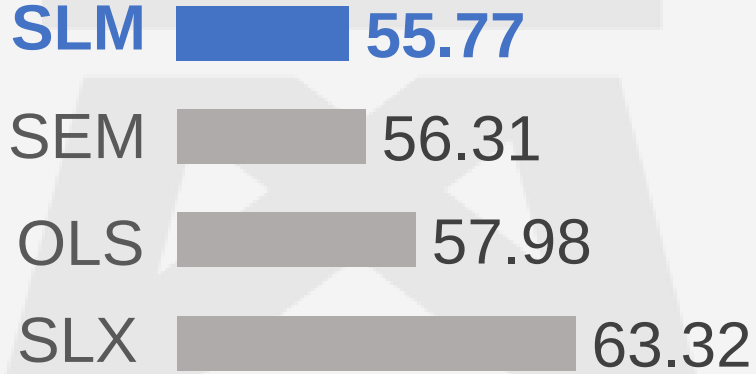
Lag Range Multiplier

LM Error Model	**4.09***
LM Lagged Y Model	**4.13***
RLM Error Model	2.62
RLM Lagged Y Model	2.66

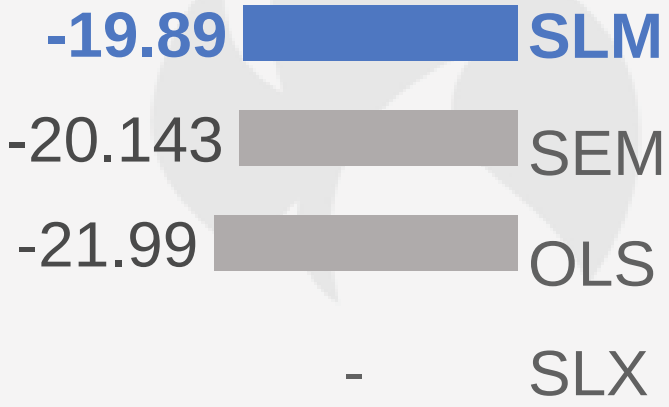
RESULT

Where does spatial dependency reside?

Econometric model with **lowest AIC**



Econometric model with **highest Log Likelihood**



Spatial dependency resides in the household electricity consumption

LIKELIHOOD RATIO TEST

4.21* SLM

3.7 SEM

Spatial Lag Model is the most preferred model.

RESULT
Spatial Effect and Recommendation

Estimated spatial direct impact on the household electricity consumption in the Philippines

- 2.31 ↑ HDI
- 0.24 ↑ Concrete National Road
- 0.12 ↑ Urban Population
- 0.45 ↑ High Electricity Cost
- Low Voltage ↓ - 0.59

Application and Recommendation

- **150 km as a yardstick** in assessing location for potential energy infrastructure
- Valuable input for **local planning committees**
- Concrete National Road
- **Spatio-temporal dimension**

THANK YOU!

A SPATIAL ECONOMETRIC MODEL FOR HOUSEHOLD ELECTRICITY CONSUMPTION IN THE PHILIPPINES

Marie Therese S. Sario and
Francisco De Los Reyes
University of the Philippines
Diliman

14th NCS National Convention on Statistics
1-3 October 2019 | Crowne Plaza Manila Galleria
Organized by the Philippine Statistical System
Spearheaded by the Philippine Statistics Authority