

# Peri-urbanization, land-use, and air quality patterns in Viet Nam

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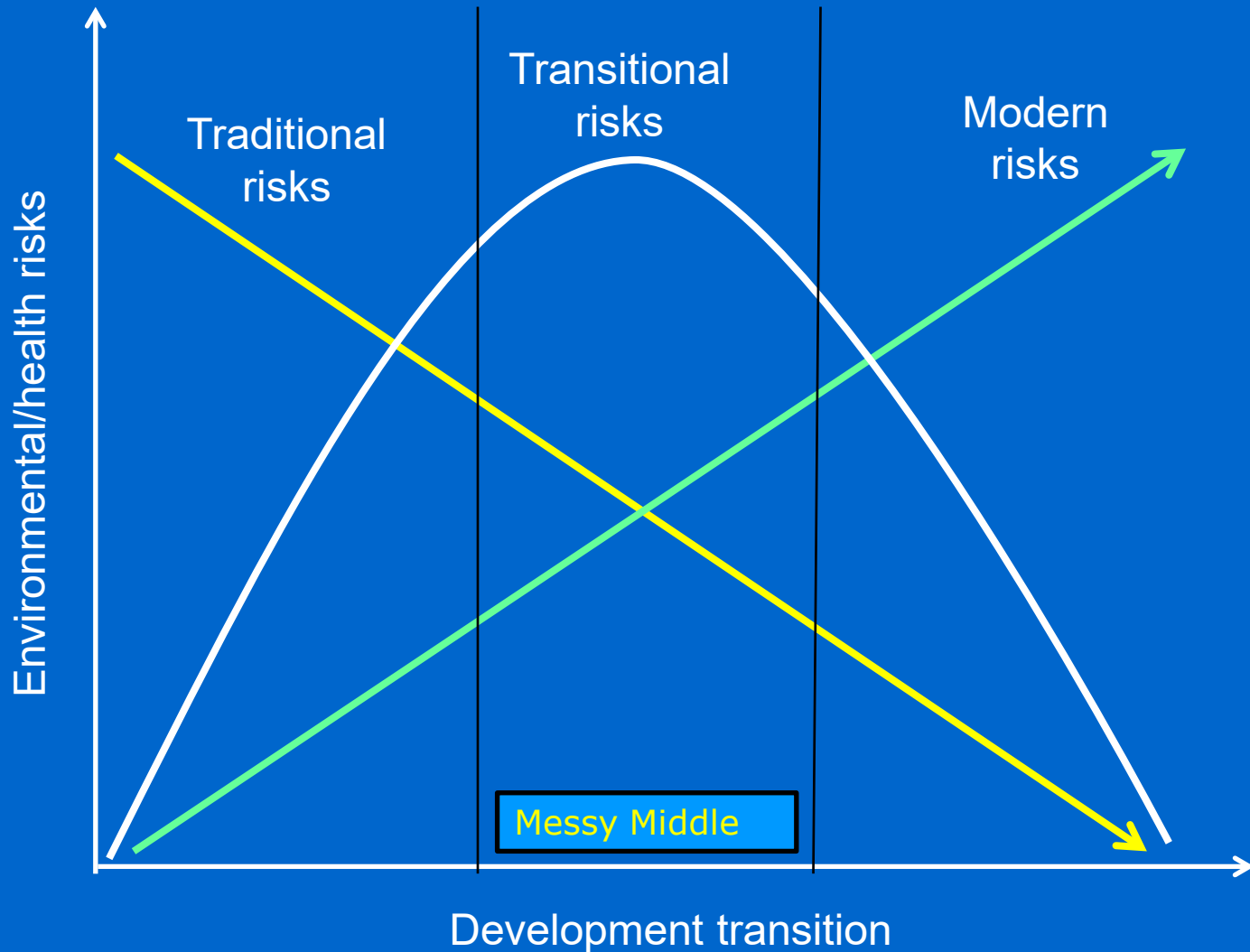
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What is the relationship between development/modernization and environmental risks?

# Three types of relationships between development and environmental/health risks

- Traditional risks (sanitation, indoor air pollution, etc. for example) operate essentially at the household level.
- The modern risks generally have a regional or global spatial character (such as CFCs or greenhouse gases).
- Examples of transitional risks are urban air pollution and deforestation which operate mainly at the community level.



# Environmental Kuznets Curve at sub-national levels

- At the global level (inter-country) transitions are measured in terms of Gross Domestic Product (GDP), Human Development Index, or their variants, etc.
- How does one measure similar transitions at the sub-national levels, including at the lowest level of public administration?
  - Urbanicity
  - Peri-urbanization
- The rural-urban duality is no longer a valid paradigm

Part 1: What is peri-urbanization? And how do you measure and map it?

# What is peri-urbanization

- No consensus on definition
- Allen (2003) 'heterogeneous mosaic of:
  - Natural ecosystems
  - Agro ecosystems
  - Urban ecosystems
- All affected by the material and energy flows demanded by urban and rural systems.'
- While there are many definitions of what is rural and what is urban classifying them can be difficult

# Why do we care about peri-urbanization?

- In Asia population of periurban areas will increase by 200 million people over the next 25 years, accounting for 40% of urban population growth.
- Because most large manufacturing enterprises now locate in periurban areas, these regions will continue to attract most of the foreign direct investment (FDI) and domestic investment.
- These changes will involve wrenching social adjustment as small agricultural communities are forced into an industrial way of life in a short time.

Peri-urban places: you will know it  
when you see it



# A place in transition: Phang Xa Commune, Thach That, Ha Noi



## Mixed land-use: small industries and agriculture





# The jungle of terminology!

- Urban fringe
- Rurban
- Ruralurban
- Suburbs
- Rural non farm
- Urbanicity
- Desakota
- Periurban
- Sattelites

# Deagrarianization

Rigg et al (2006, World Development )  
identifies eight characteristics

- —Occupations and livelihoods in the countryside are diversifying.
- —Occupational multiplicity is becoming more common and more pronounced.
- —The balance of household income is shifting from farm to non-farm.
- —Livelihoods and poverty are becoming delinked from land (and from farming).
- —Lives are becoming more mobile and livelihoods correspondingly delocalized.
- —Remittances are playing a growing role in rural household incomes.
- —The average age of farmers is rising.
- —Cultural and social changes are being implicated in livelihood modifications, and in new ways.

# Generic strategy to model periurban areas

Participatory  
mode

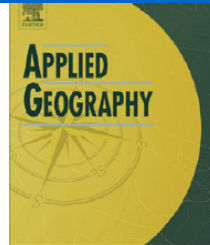
- Identify an appropriate theory
- List the metrics that capture the essence of the theory
- Select a big enough, very likely heterogeneous region
- Identify sources of data at the village/ward and household levels
  - Secondary: censuses, sample surveys, past research
  - Primary: conduct household and village/ward level surveys
  - Hybrid
  - Links with other datasets : poverty, living standards
- Data mining, statistical modeling, mapping
- Validation



Contents lists available at [ScienceDirect](#)

# Applied Geography

journal homepage: [www.elsevier.com/locate/apgeog](http://www.elsevier.com/locate/apgeog)



## Classifying and mapping the urban transition in Vietnam



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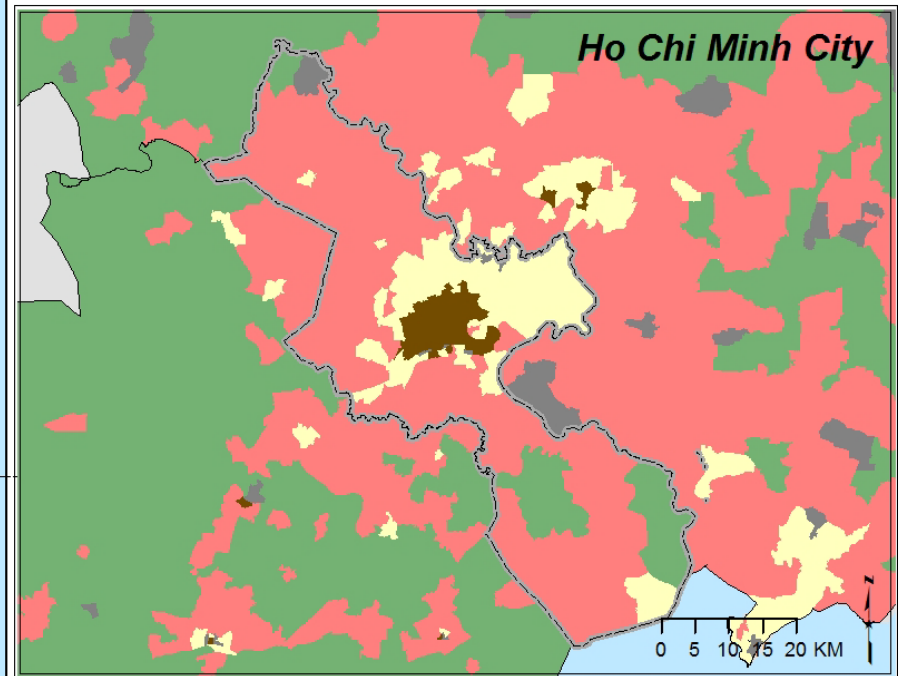
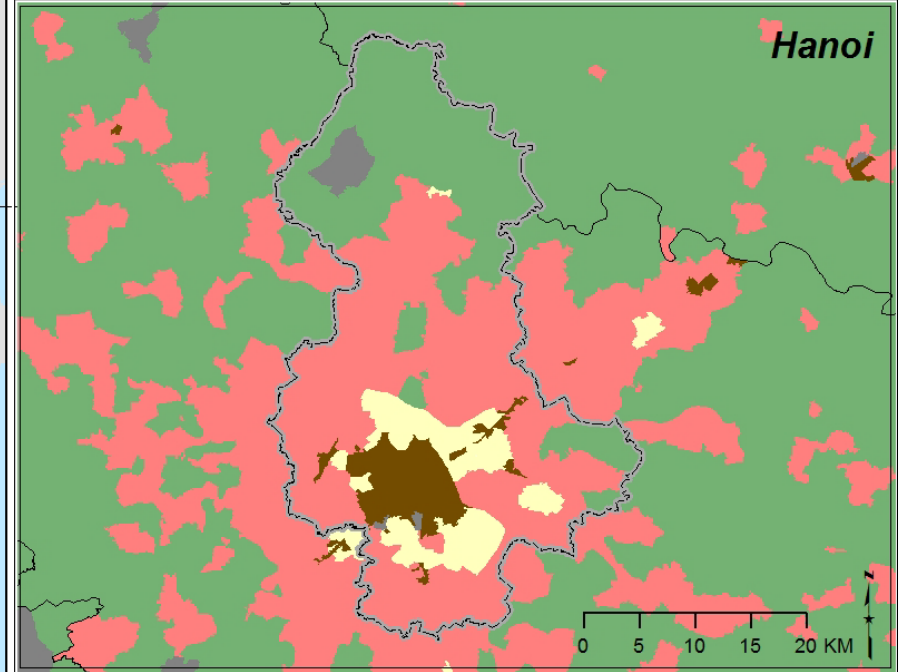
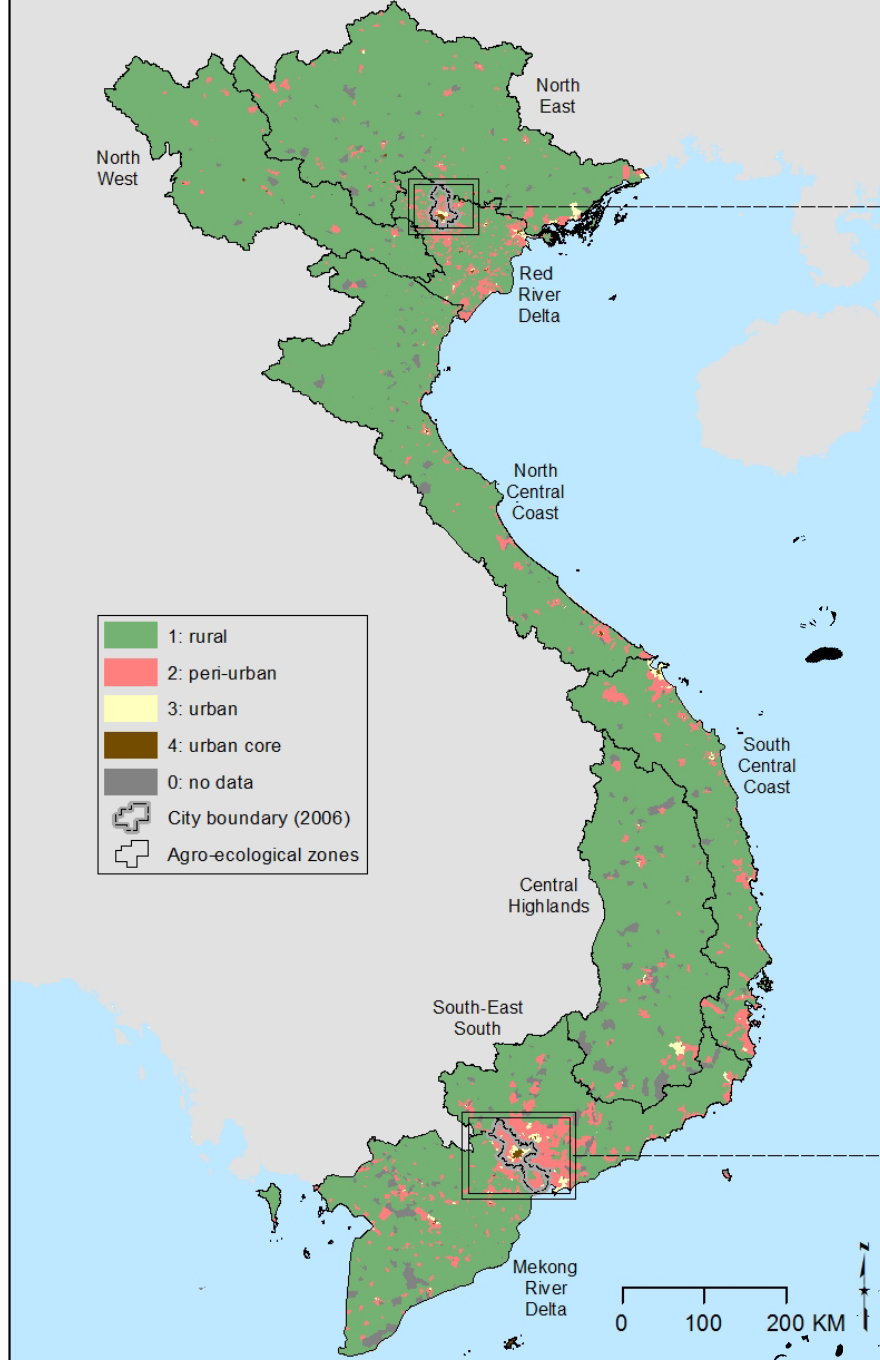
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# EWC-VNUA approach to Classifying and mapping peri-urban places

- Based on theories developed by Riggs, Mcgee, etc.:
  - Dependency on agriculture related income
  - Amount of land under agriculture
  - Type of toilet
  - Vegetation index (NDVI)
- Data sources:
  - Rural agriculture and fisheries census
  - Remote sensing
- Machine Learning model





# Map statistics

- In 2006, out of Viet Nam's 11,000 communes
  - 71% rural
  - 18% peri-urban
  - 3% urban
  - 4% urban core
- Model accuracy based on visits to 50 places
  - 90%
- Three types of transitional places
  - On the periphery of big cities
  - Along highways
  - Provincial capitals, industrial/energy clusters

# Peri-urbanization and Air Quality in Viet Nam

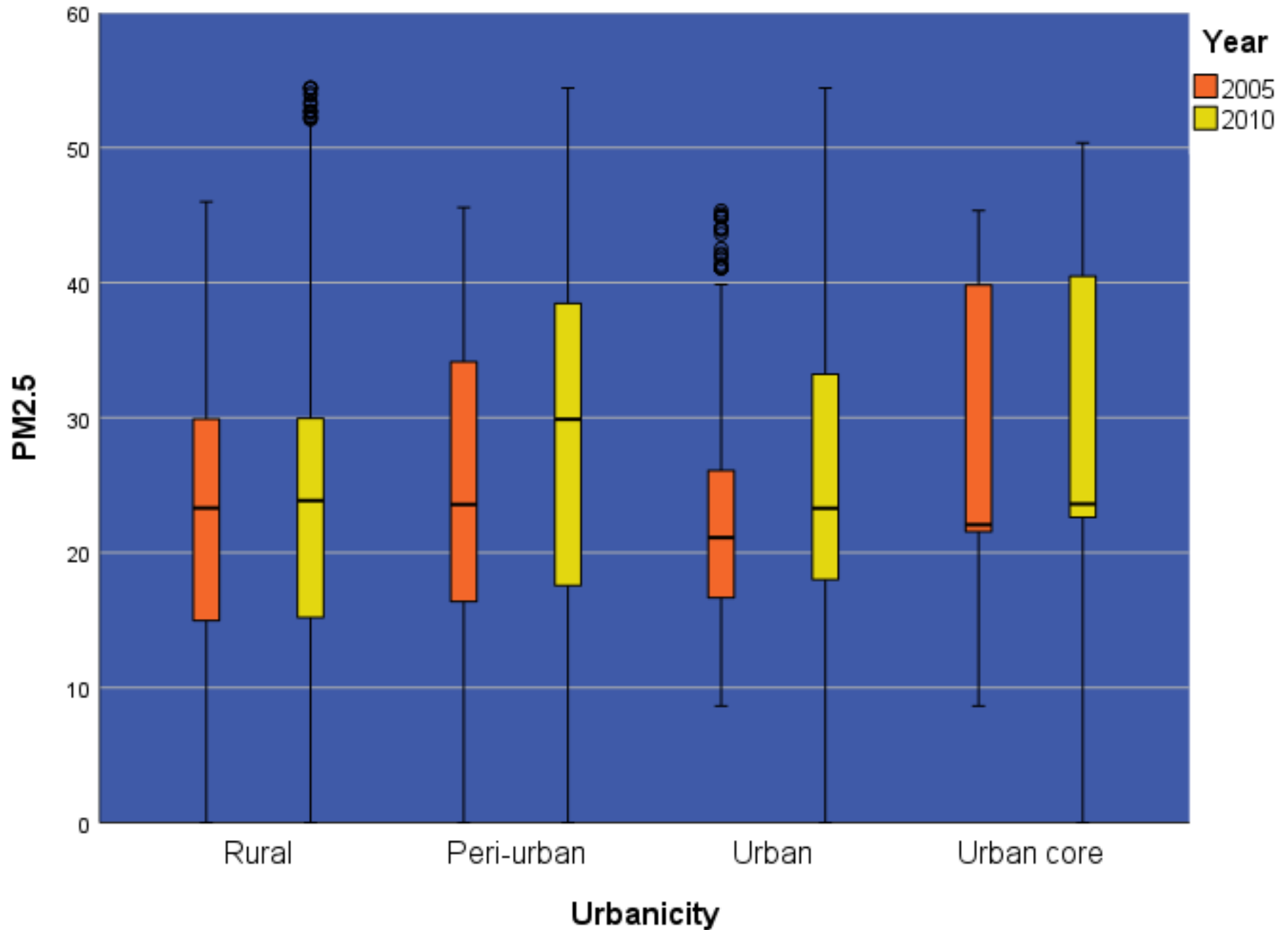
## Research questions

- What is the relationship between urbanicity and air quality?
- How does change in urban status (2005-2010) affect air quality?

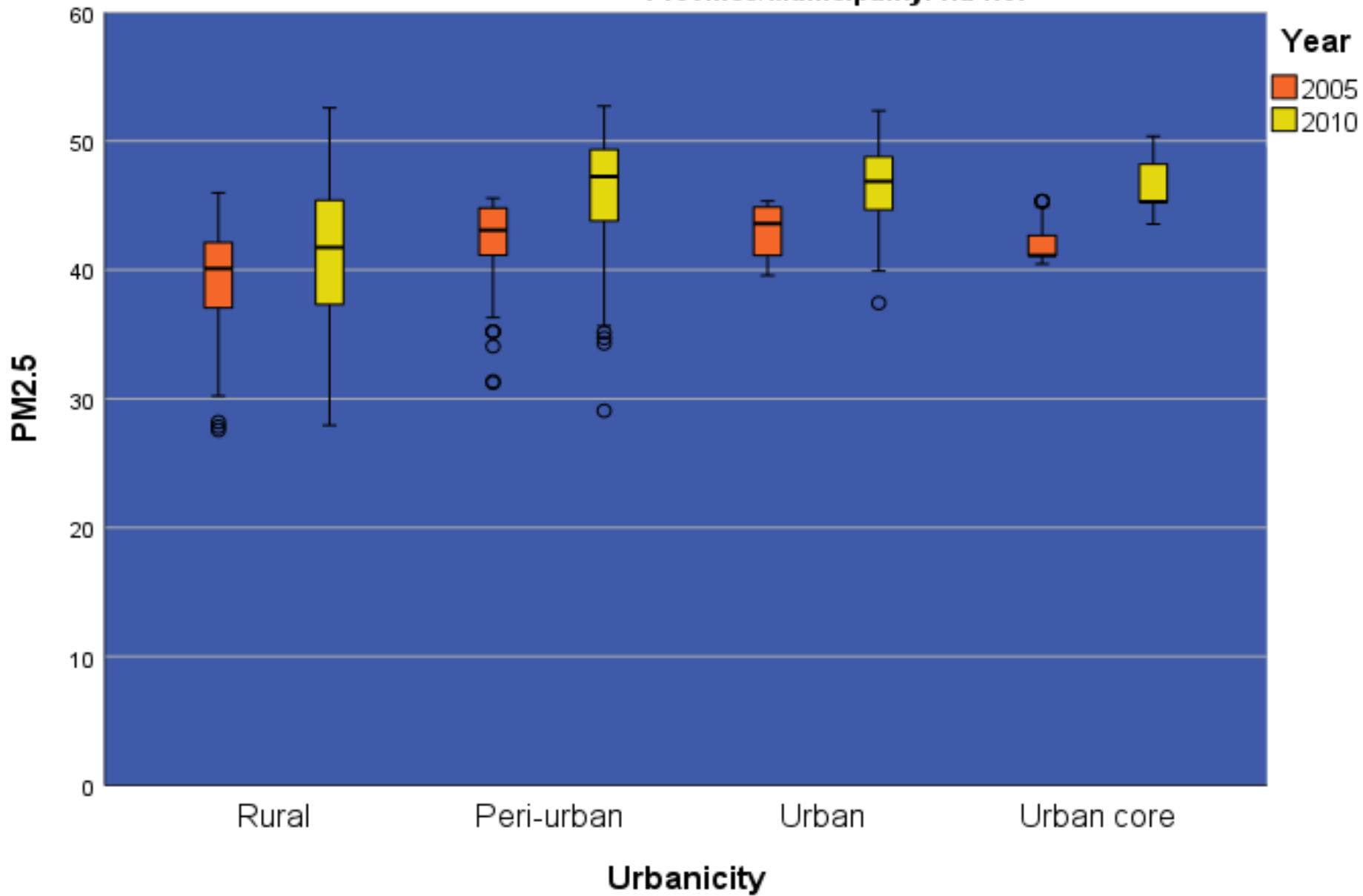
# Peri-urbanization and Air Quality in Viet Nam

- Particulate matter and ozone data from global remote sensing databases (Brauer et al 2016, "Ambient Air Pollution Exposure Estimation for the Global Burden of Disease 2013", *ES&T*)
  - $0.1^\circ \times 0.1^\circ$  spatial resolution for five-year intervals from 1990 to 2010 and the year 2013.
  - Satellite plus Tracer Model, version 5
- Urban classification from EWC studies/maps
  - Saksena et al. 2014, "Classifying and mapping the urban transition in Viet Nam" *Applied Geography*
  - Unit of analysis: Commune (Xã) and urban ward (*Phường*)
  - Sample size approx 11,000

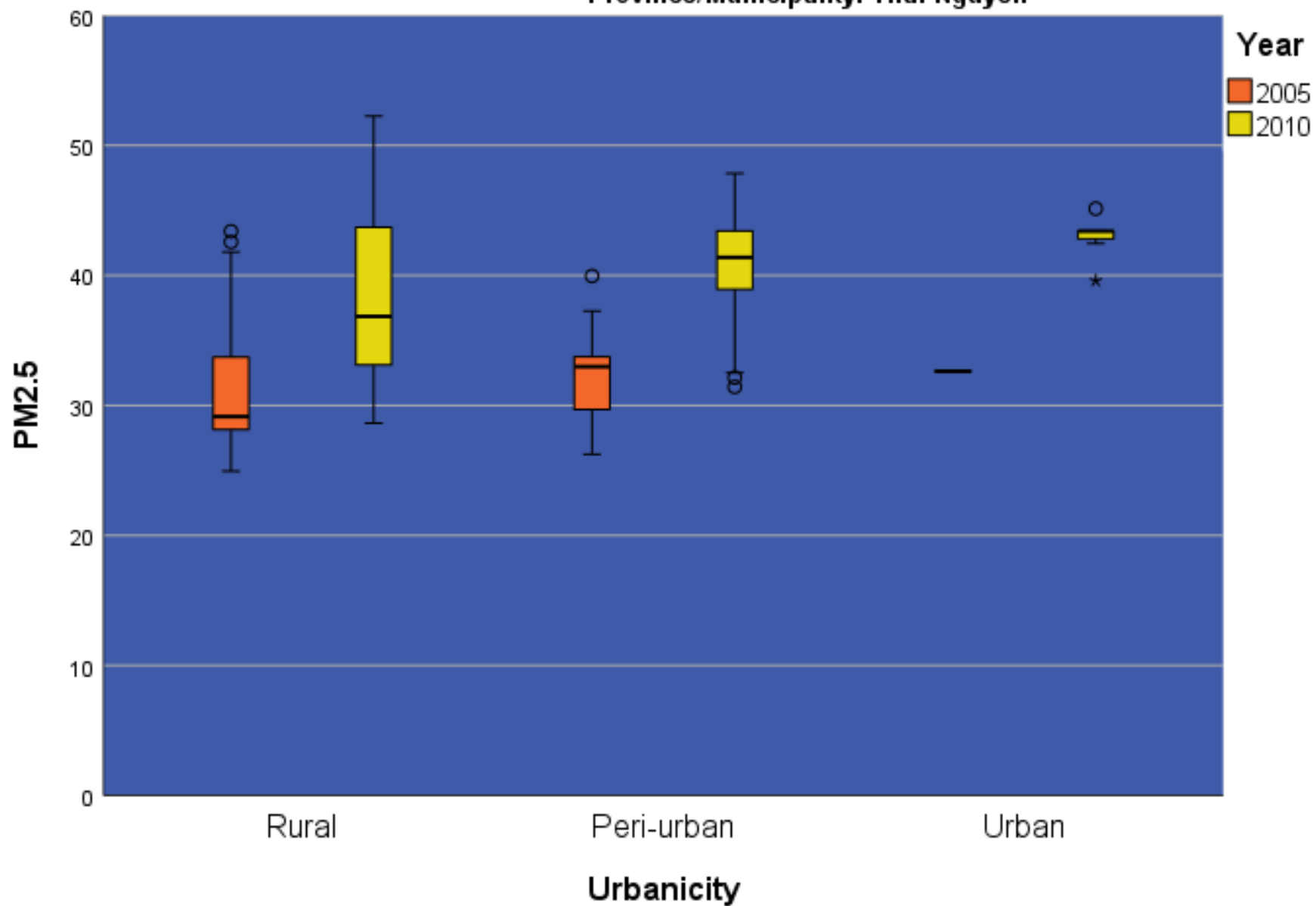
# Viet Nam



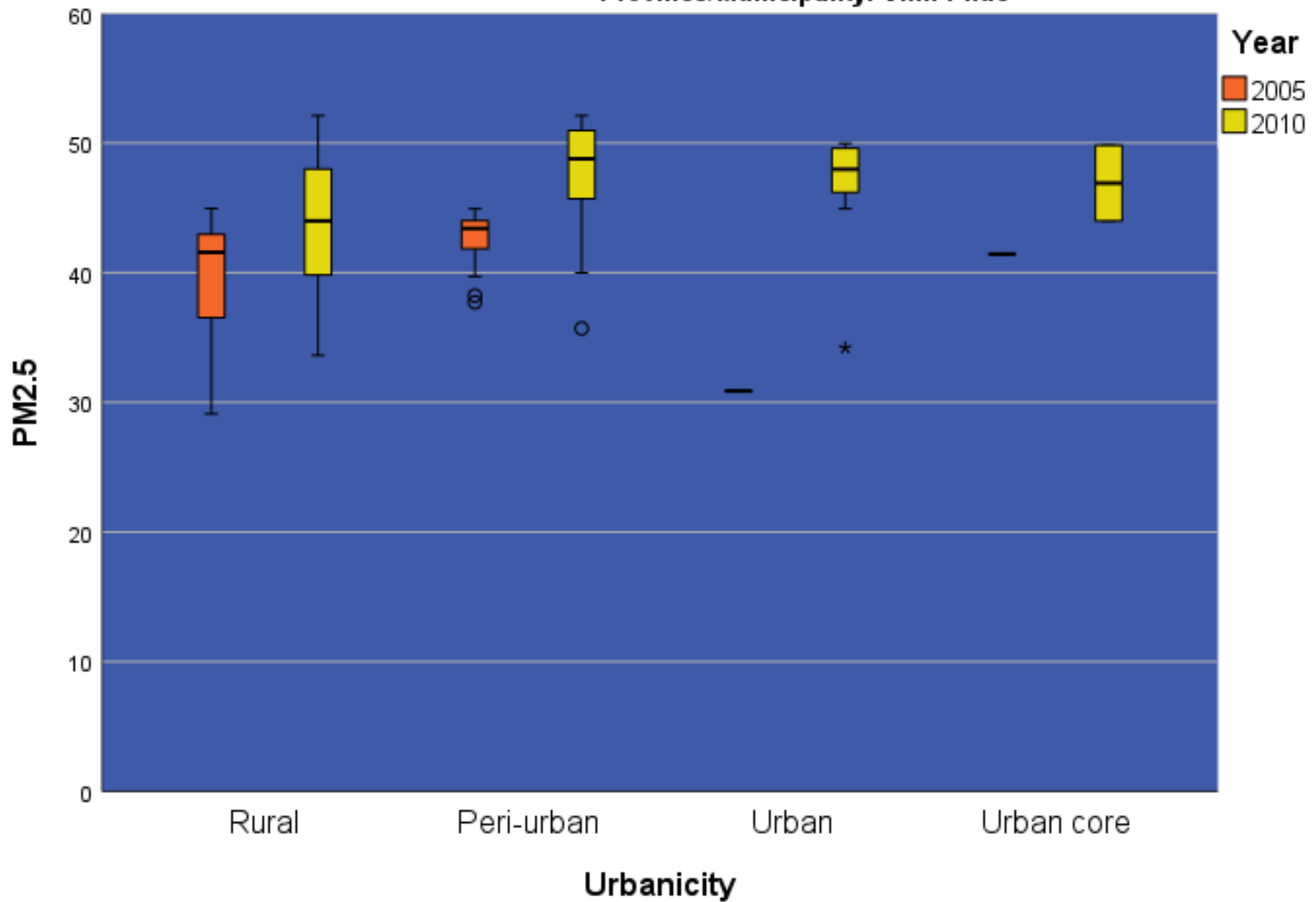
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### Province/Municipality: Thai Nguyen

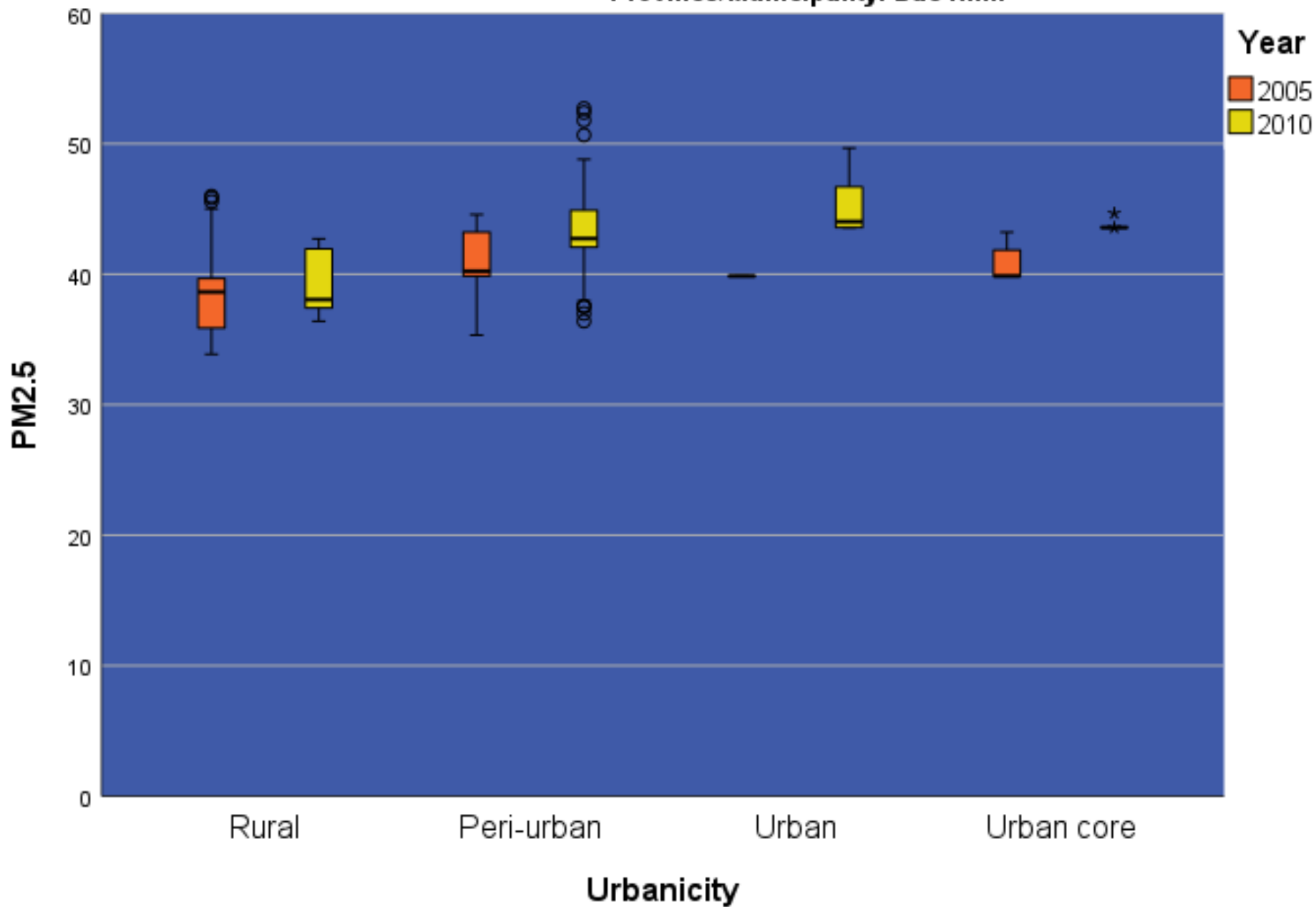


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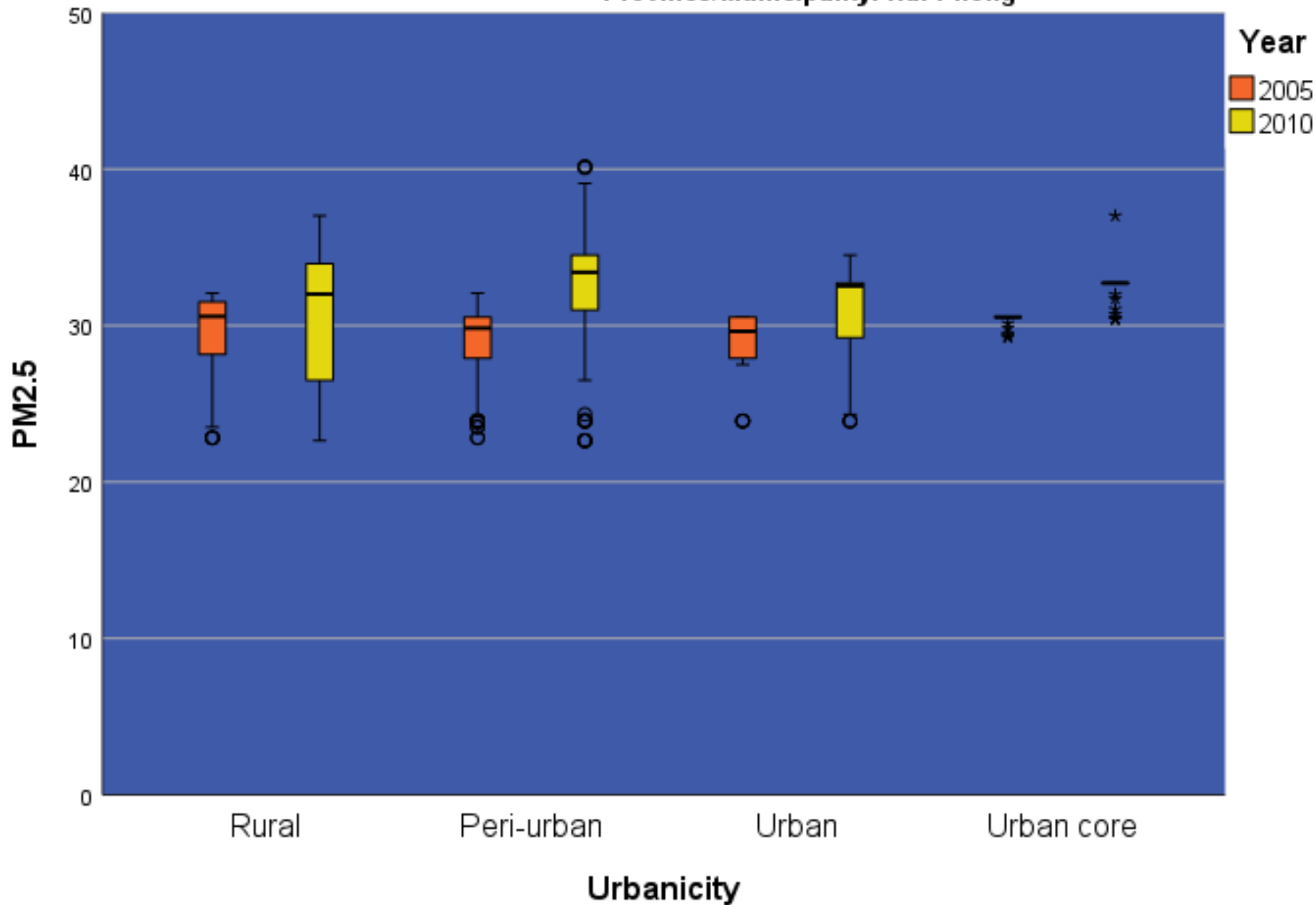




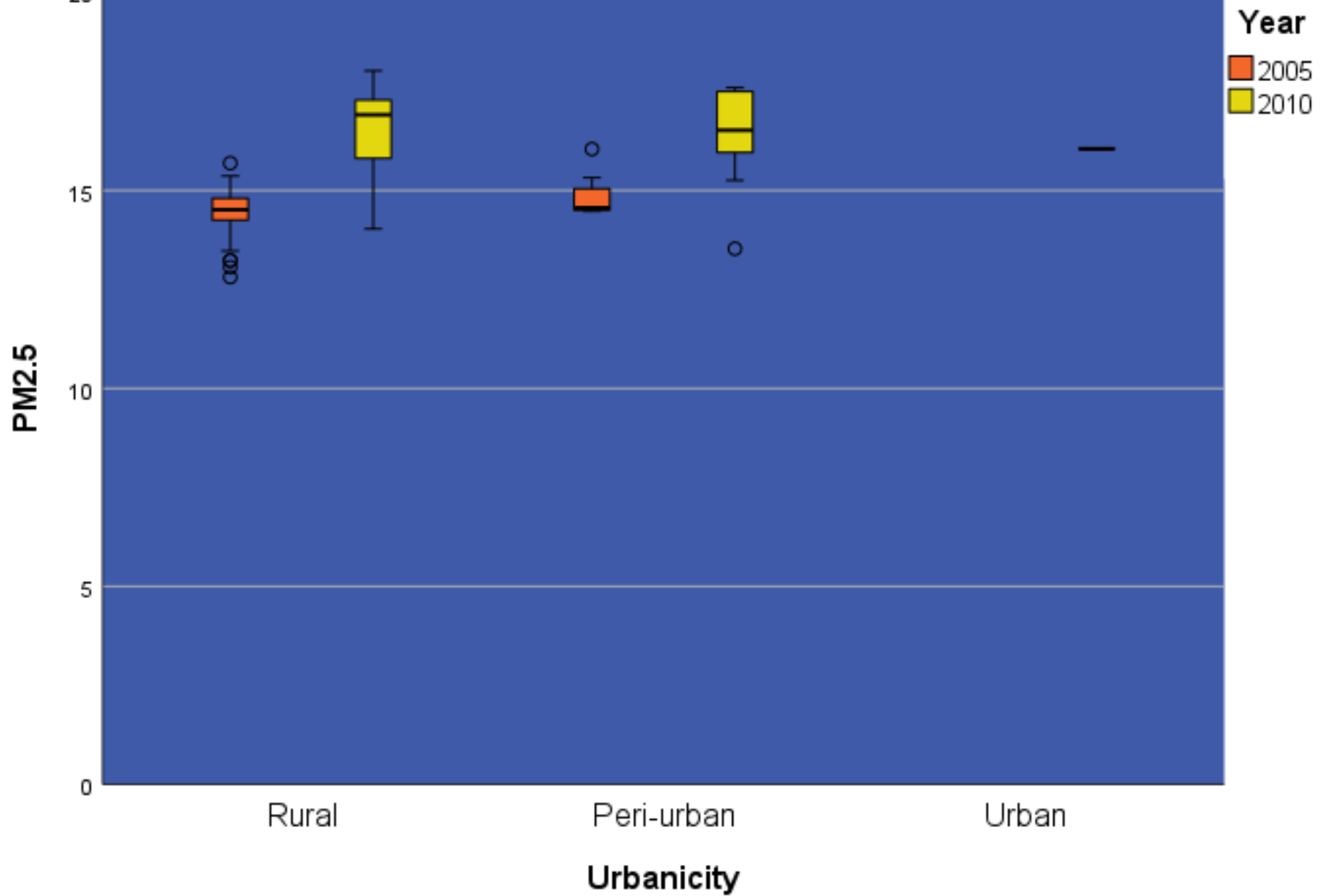
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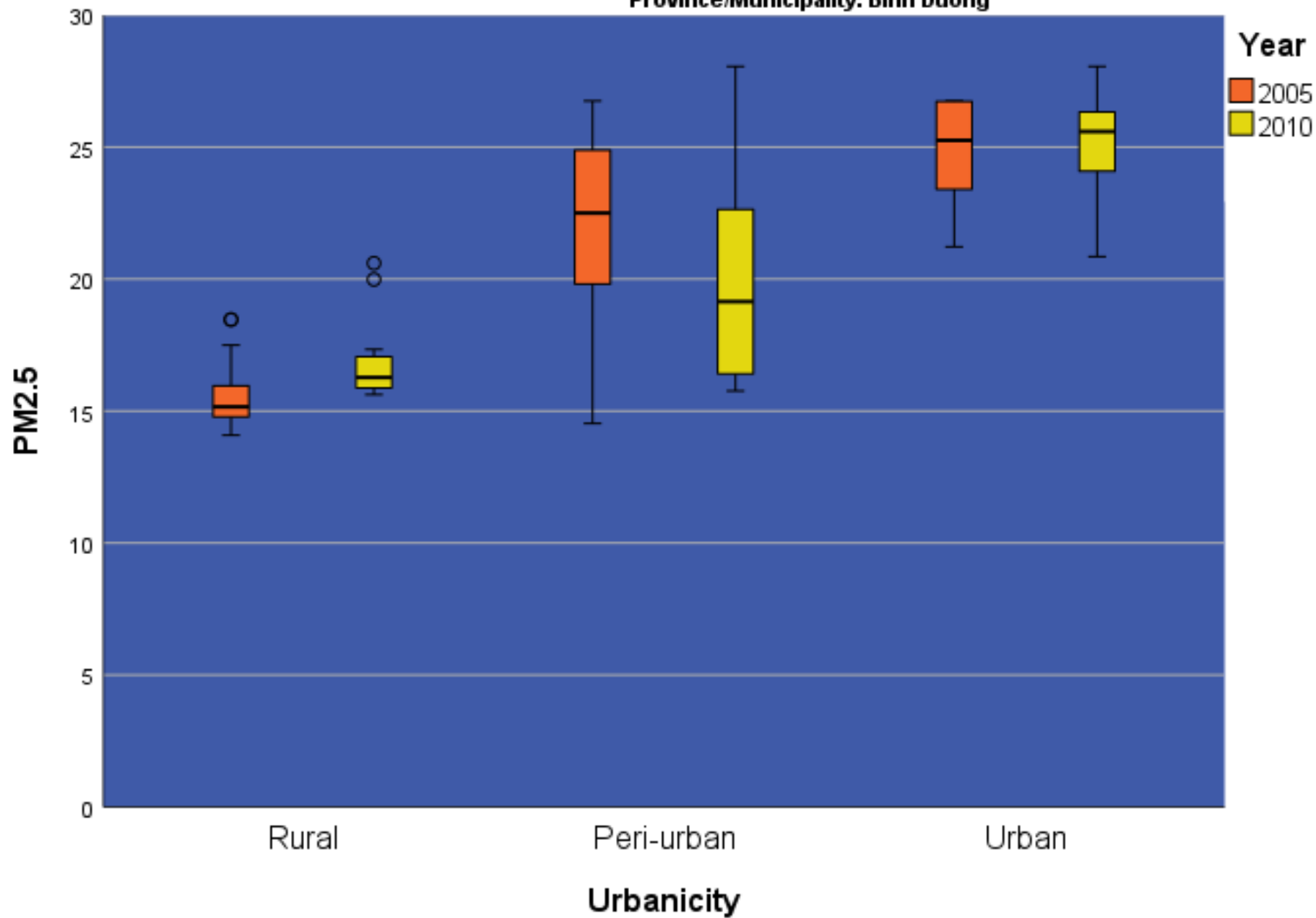
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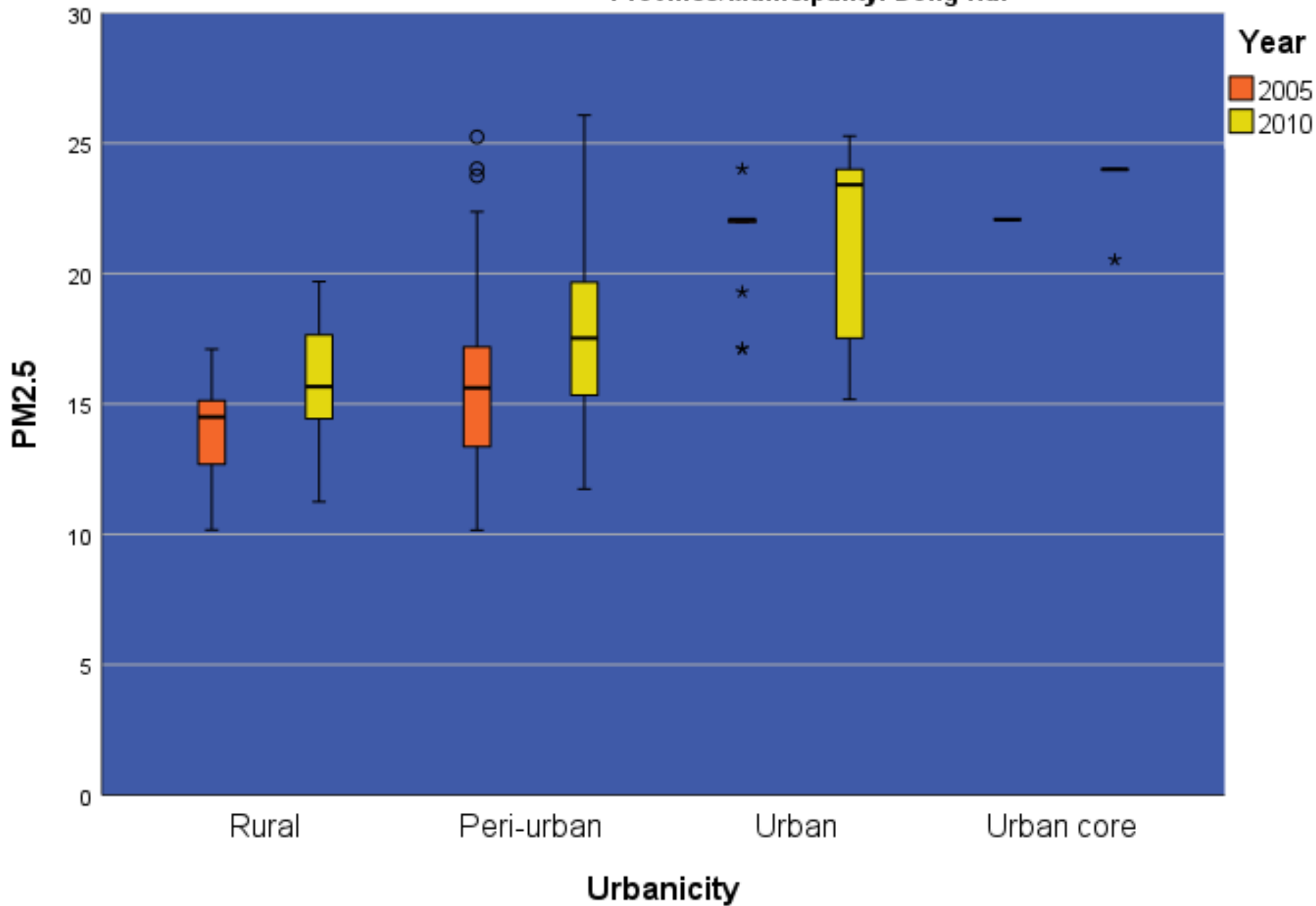
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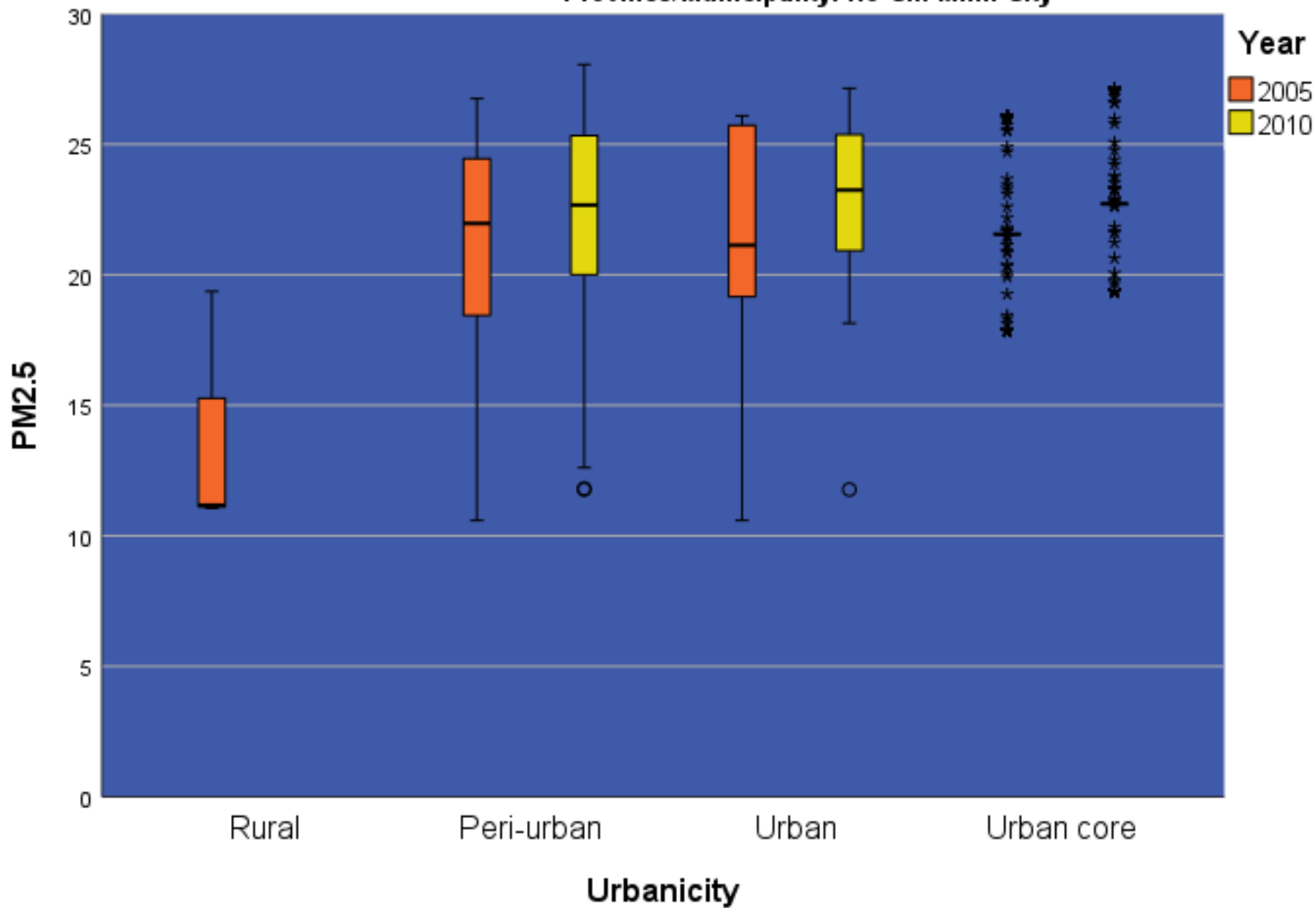
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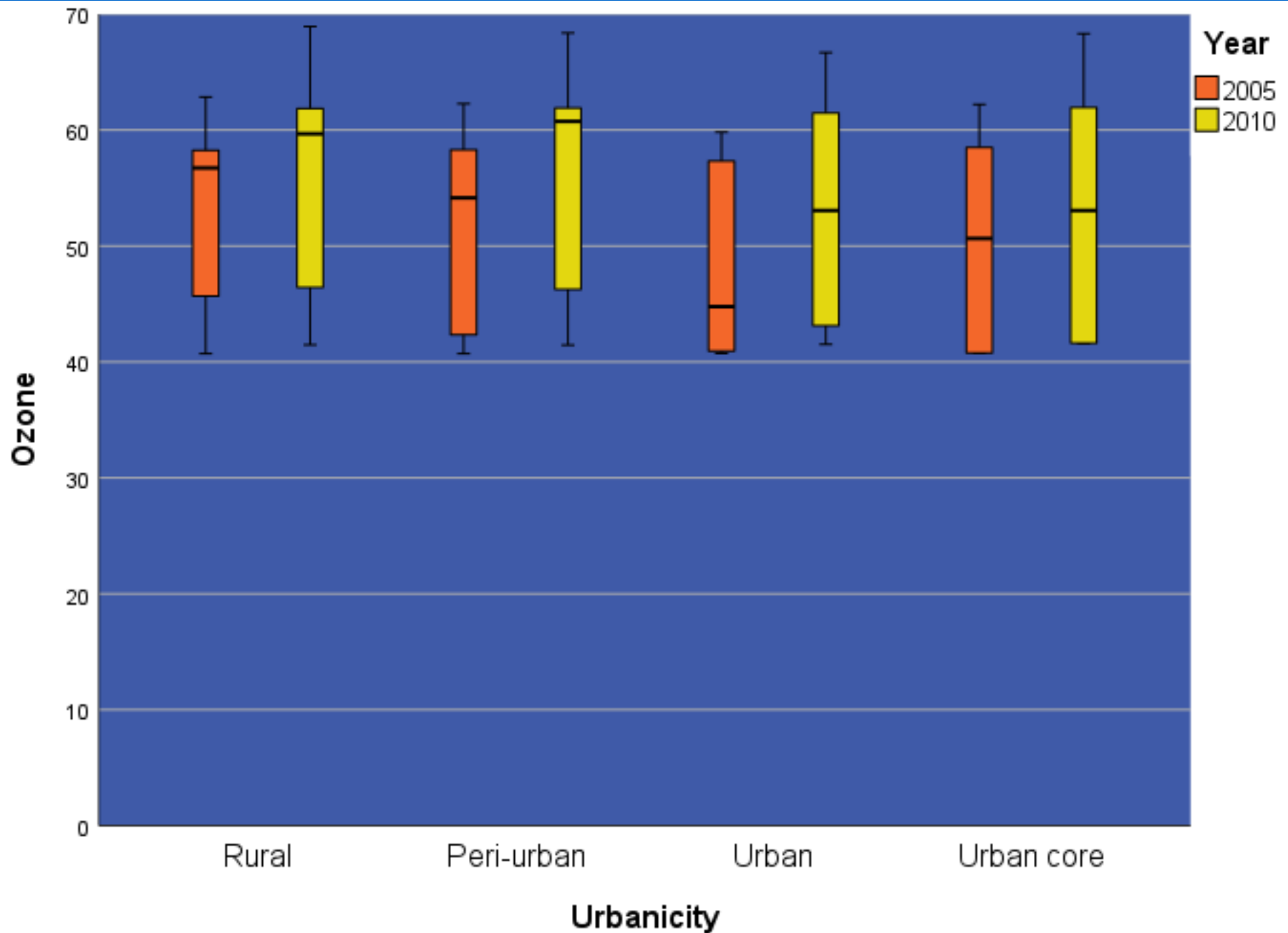
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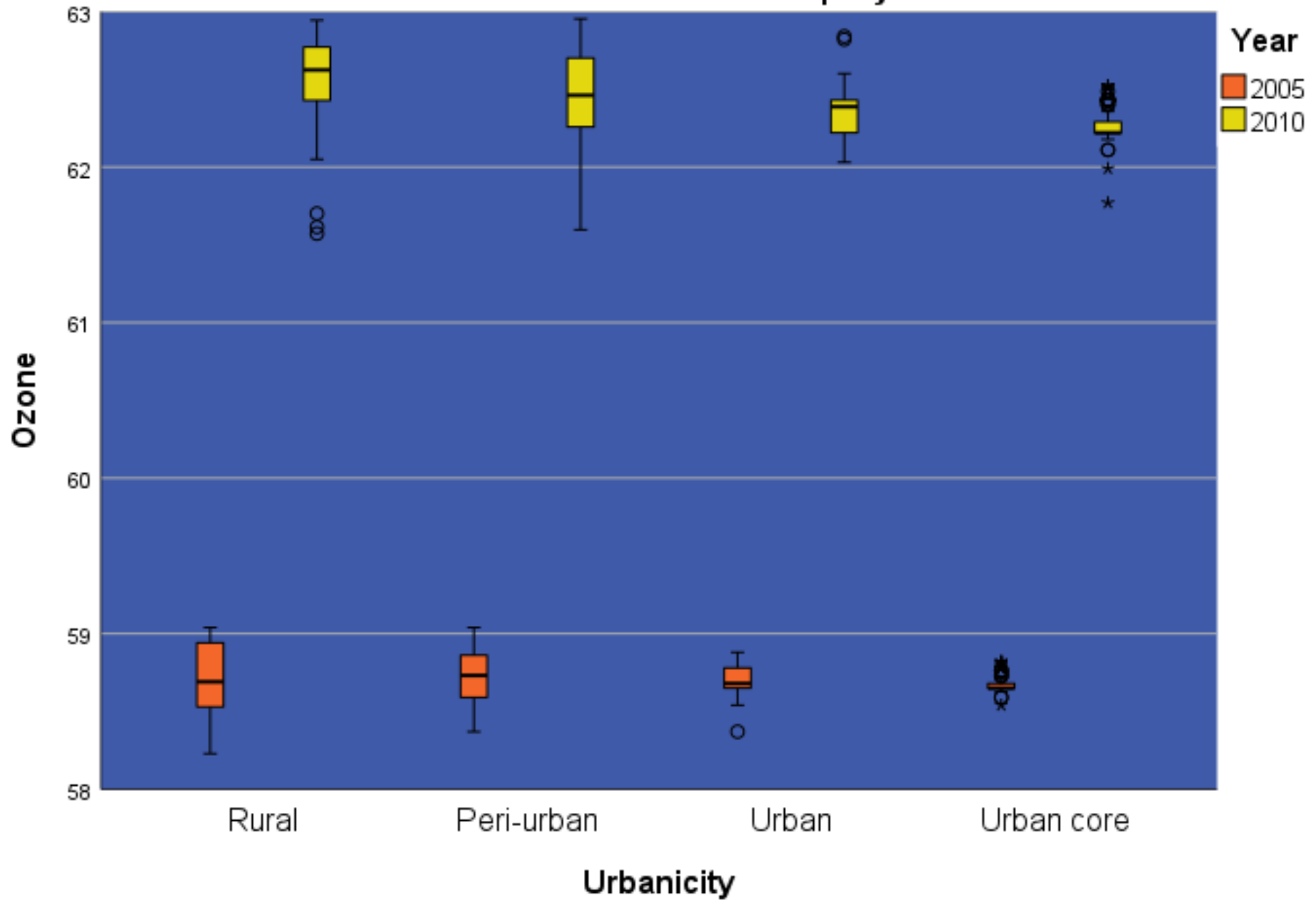
### Province/Municipality: Ho Chi Minh City



# Viet Nam

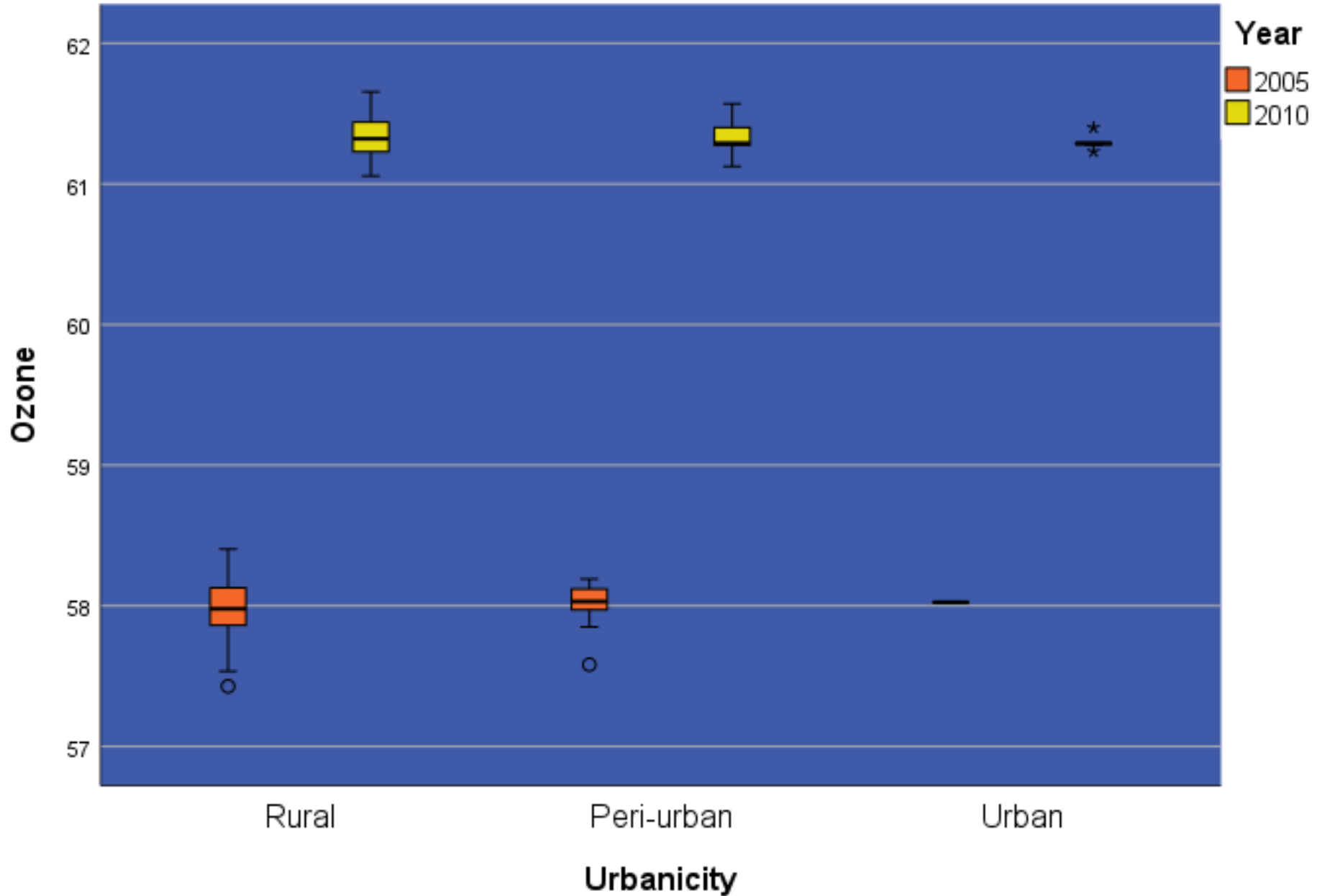


Province/Municipality: Ha Noi

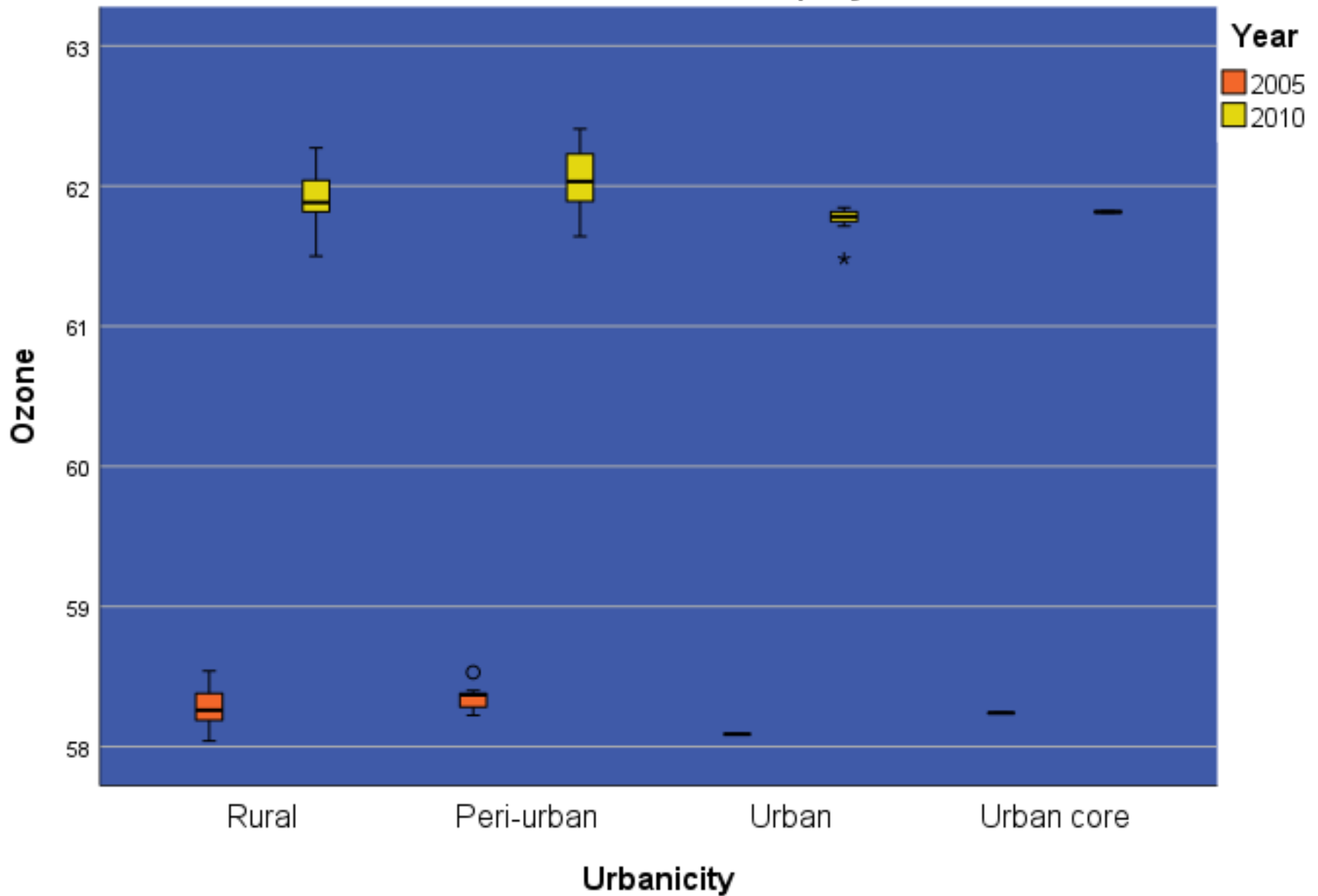




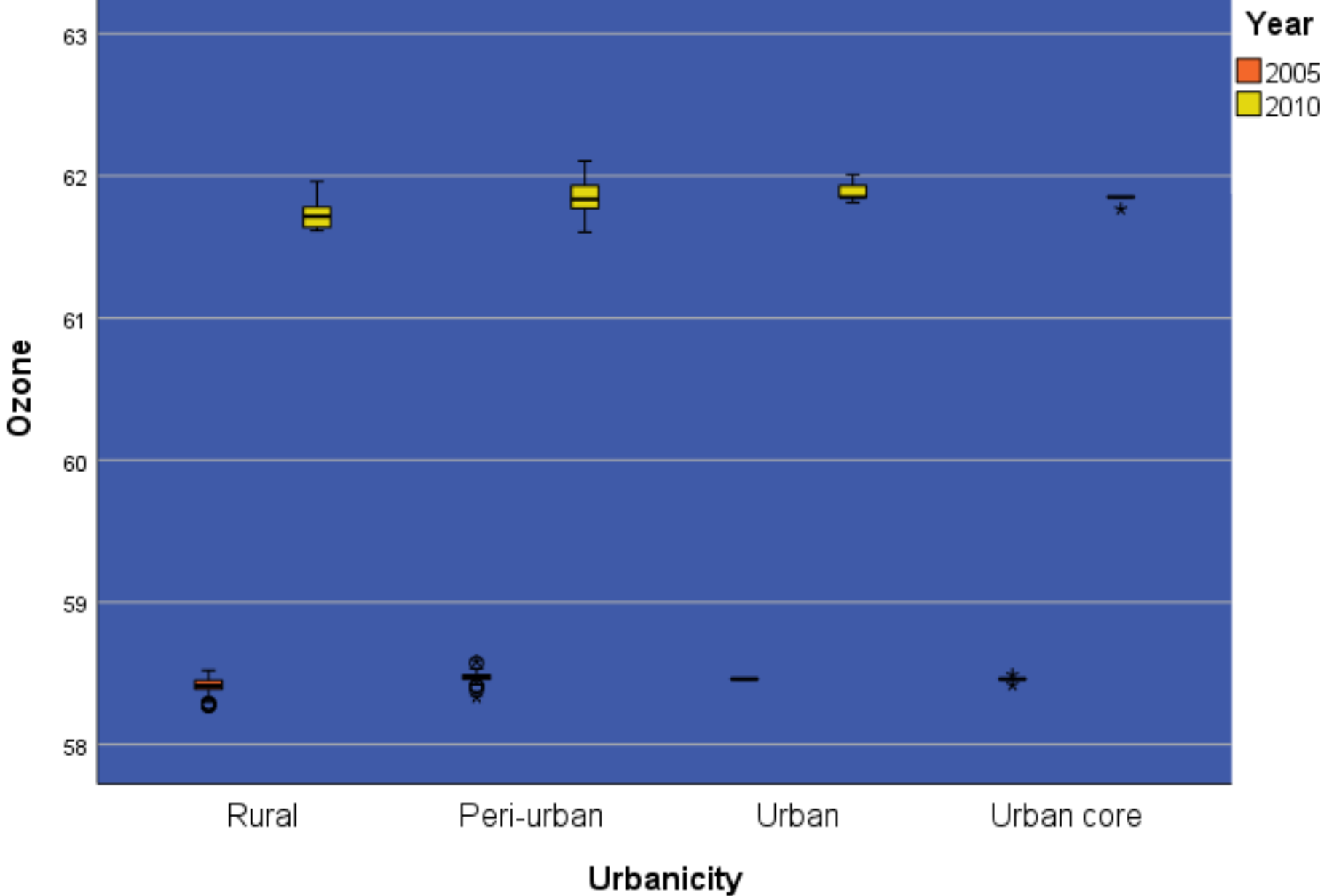
Province/Municipality: Thai Nguyen



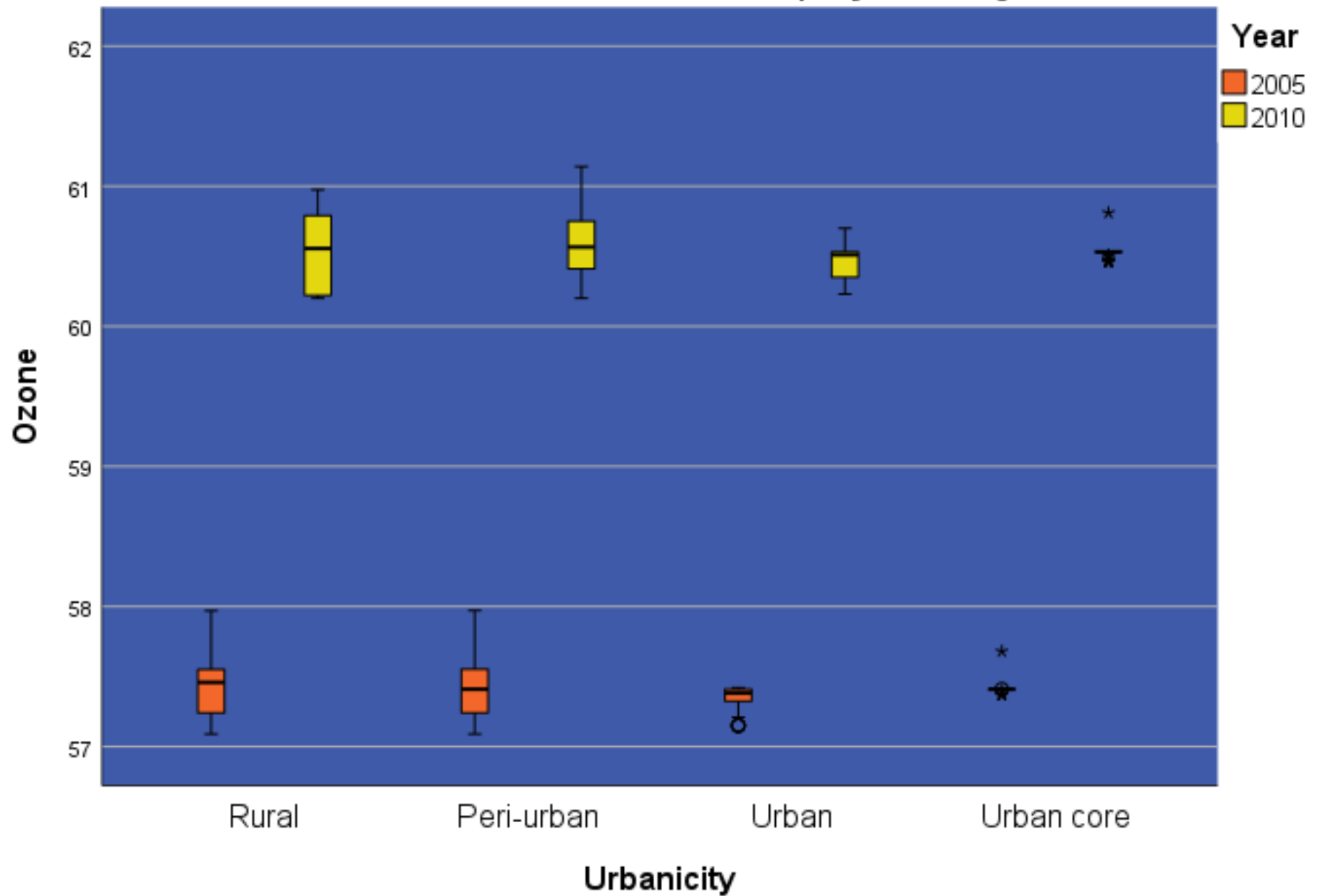
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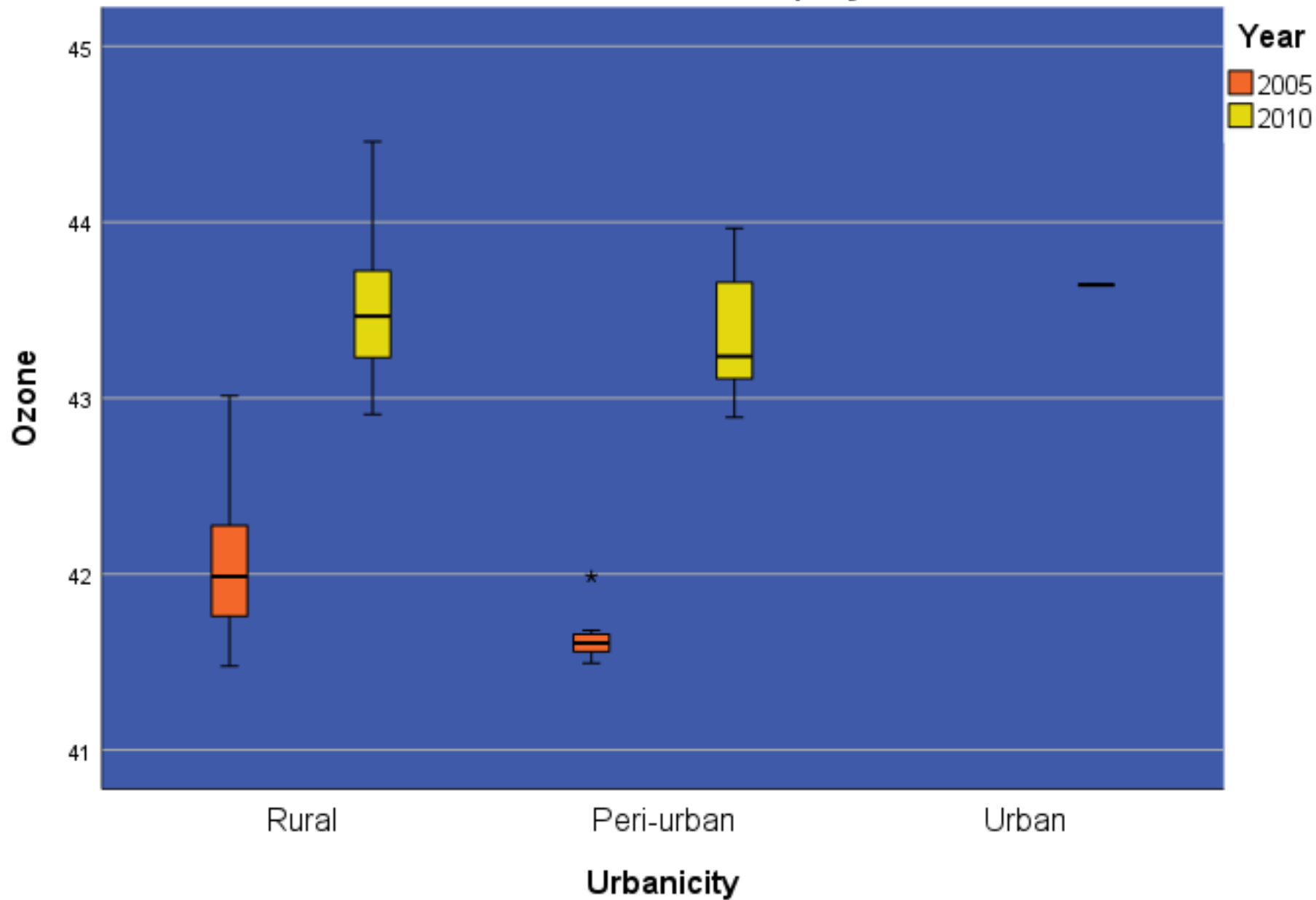
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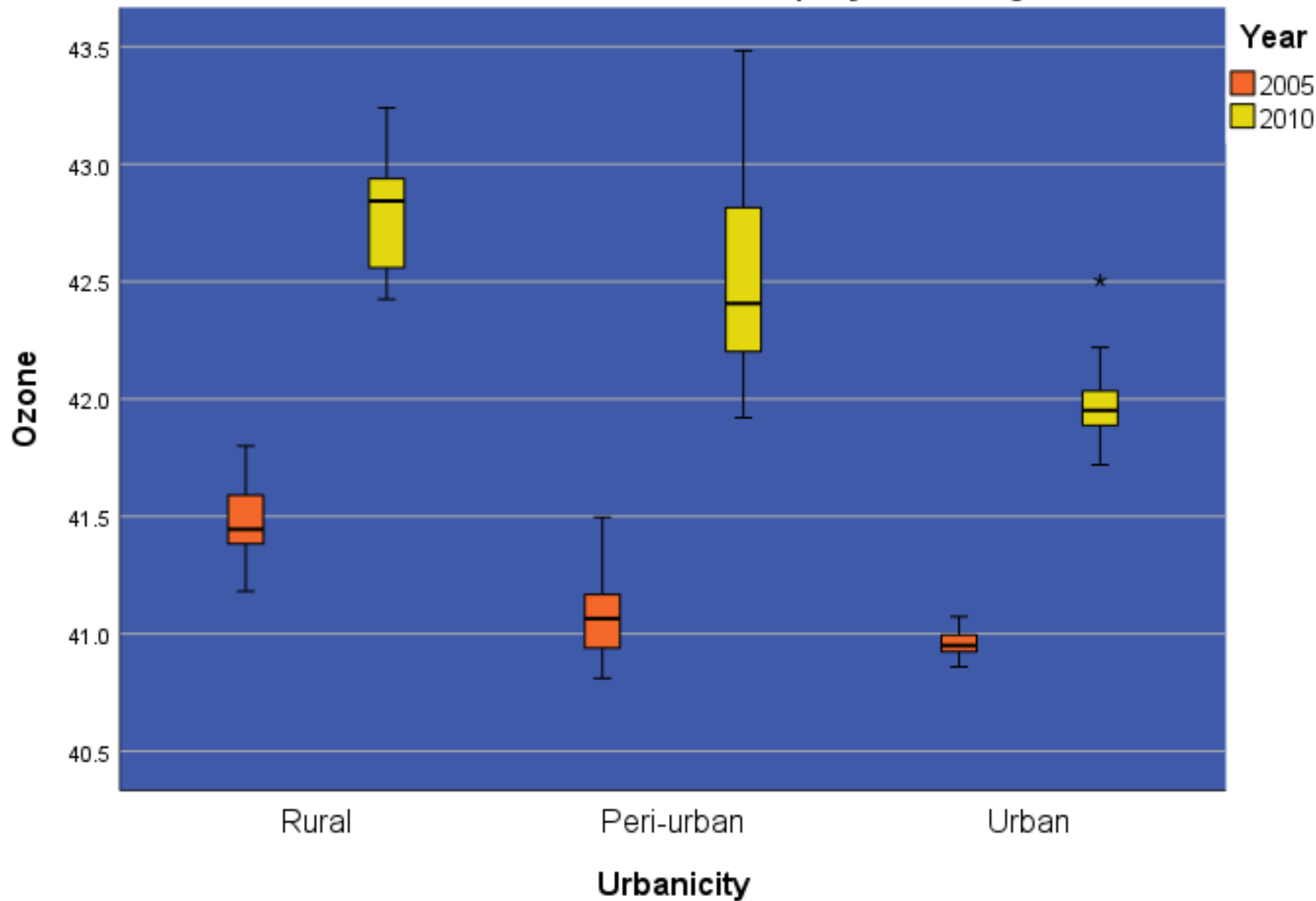
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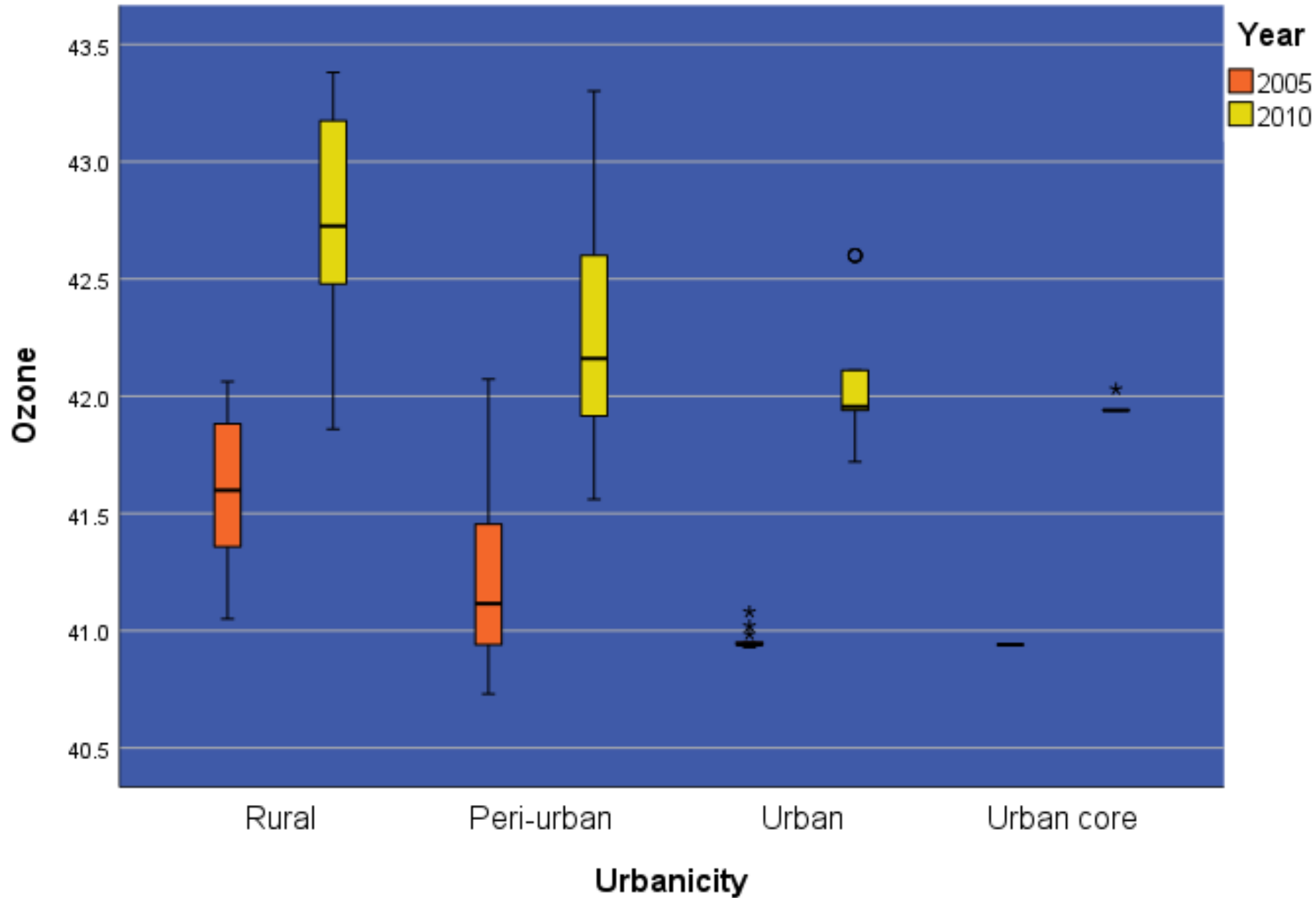
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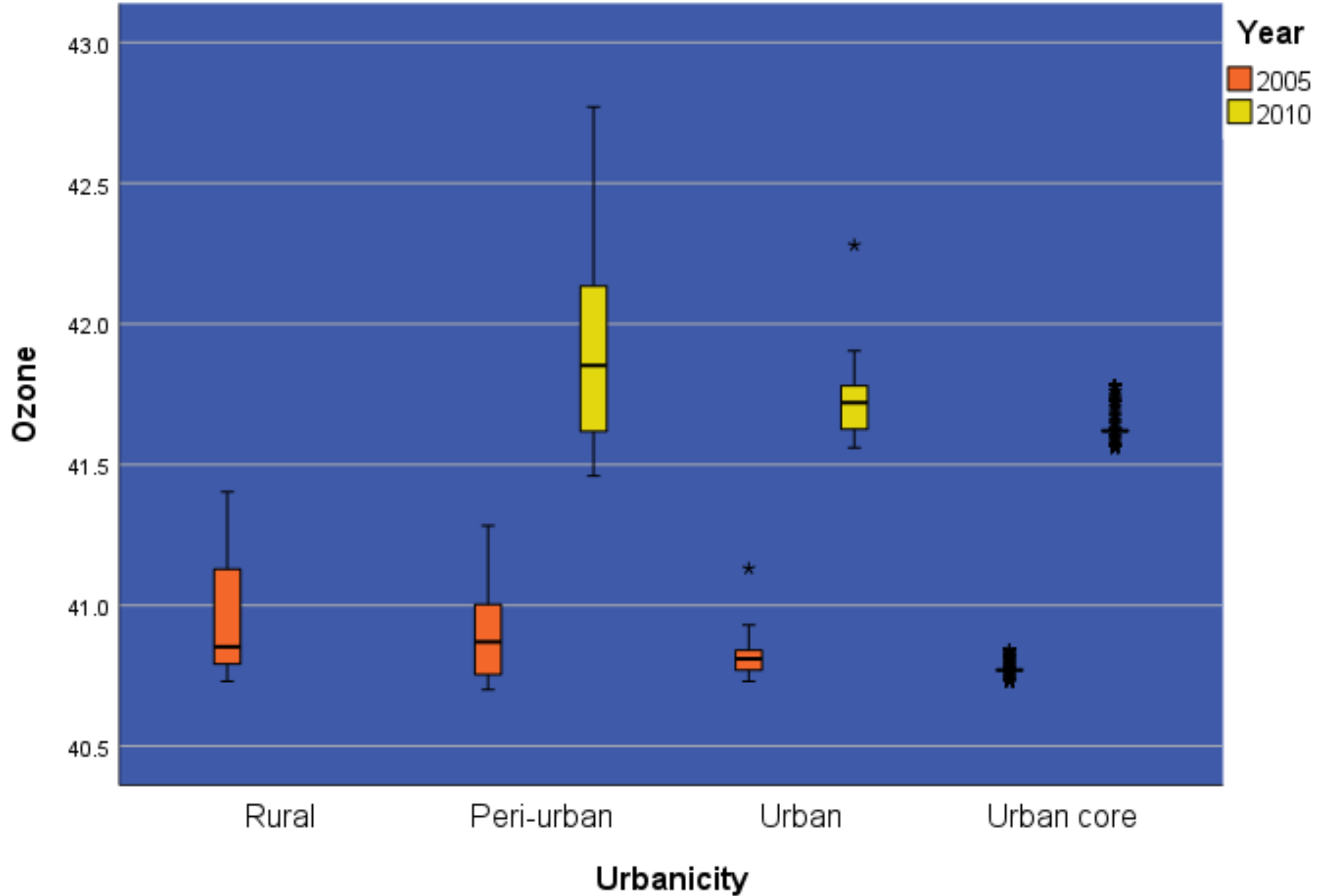
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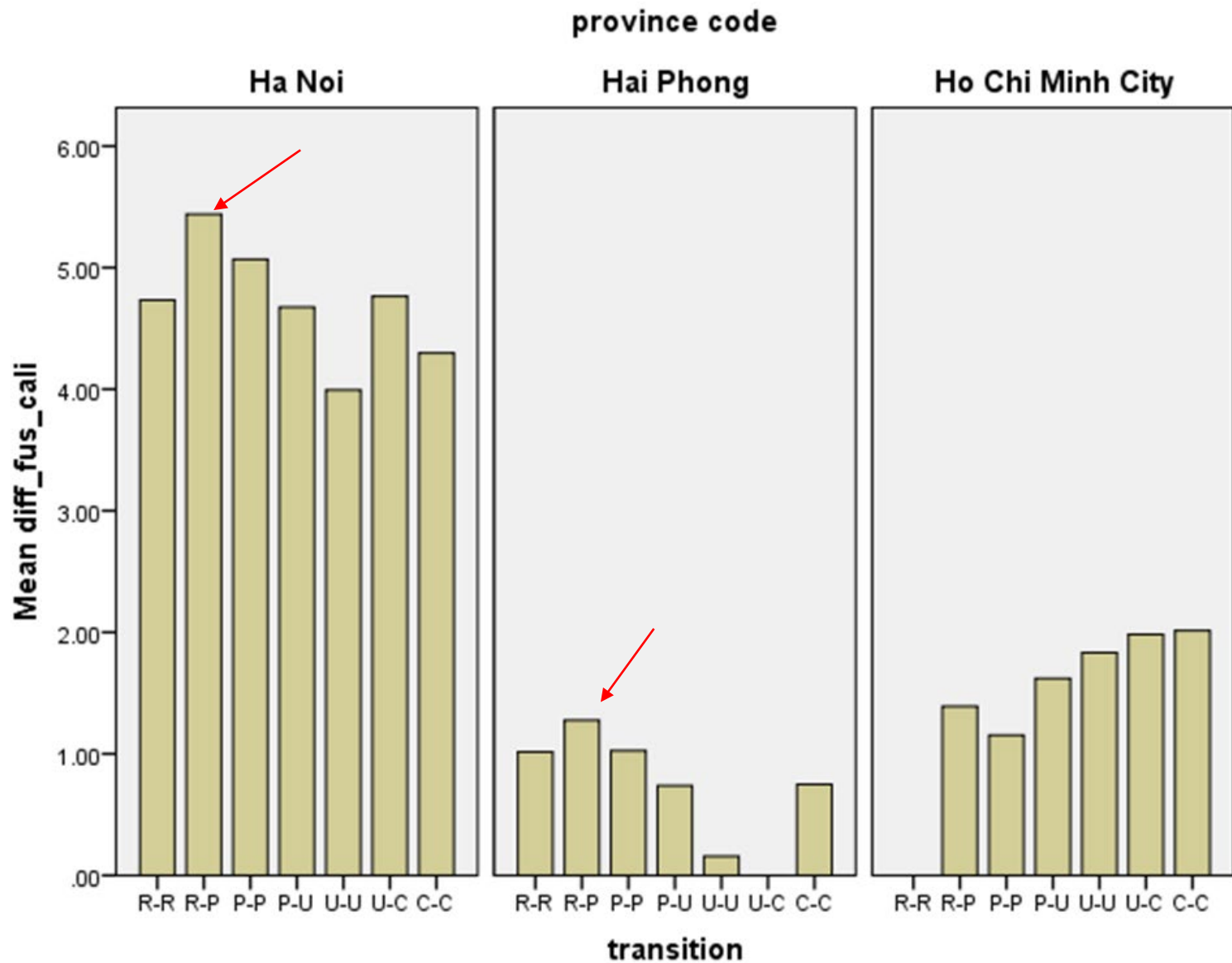


### Province/Municipality: Ho Chi Minh City





# Changes in PM2.5 between 2006 and 2011 in three municipalities



# Summary of patterns

- PM2.5
  - Median concentration highest in peri-urban places - nationally and in provinces (except Bac Ninh, Binh Duong and Dong Nai)
- Ozone
  - Median concentration highest in peri-urban places - nationally and in provinces (except Ha Noi, Binh Duong, Binh Phuoc and Dong Nai, where rural > peri-urban)

# Sources of pollution in peri-urban areas: worst of both worlds!

- Construction
- Industries
- Power generation
- Brick kilns
- Small industries
- Handicraft villages
- Household cookstoves
- Open crop burning
- Wildfires

# Future research potential

- Update the analysis
  - Easy: Remote sensing data from global and Vietnamese sources for recent years
  - Difficult: New peri-urban maps
    - Requires access to lowest level agriculture census data
    - On ground triangulation
- Health Impact analysis
  - Requires differentiated lowest level data on
    - Population
    - Crude mortality rate

# Main takeaways

- The world can no longer be divided neatly into rural and urban areas/places - not for research, not for regulation
- Places in transition have mixed rural and urban characteristics to varying degrees
- Peri-urban places are only a subset, though a major one, of places in transition
- Peri-urban places can further be subclassified, based on migration and social networking patterns (Iaquinta)
- Generic methods/guidelines are available to identify and map places in transition. Multi-disciplinary methods are ideal
- Places in transition often represent “the worst of both worlds” in terms of environmental risks. They are the “messy middle”
- The official misclassification of places can lead to governance failures