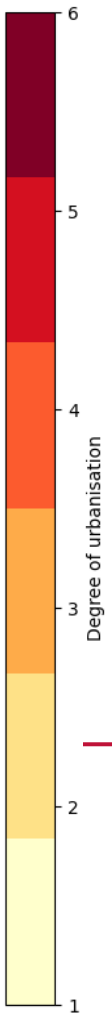
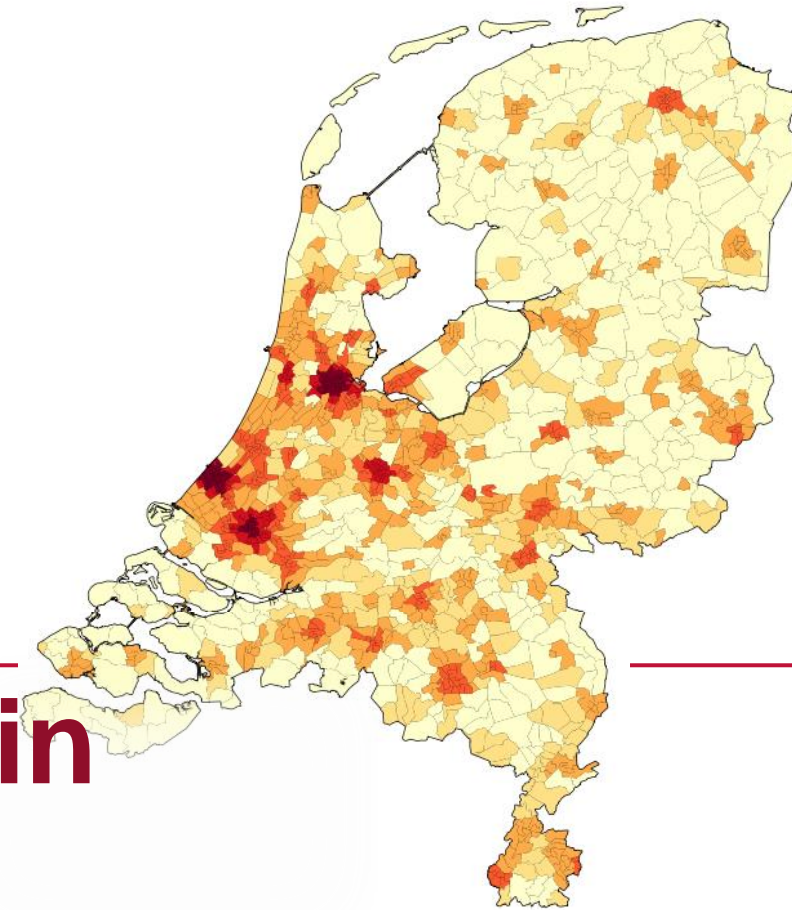


Degree of urbanisation



Stedelijkheidsgraden in transportmodellen

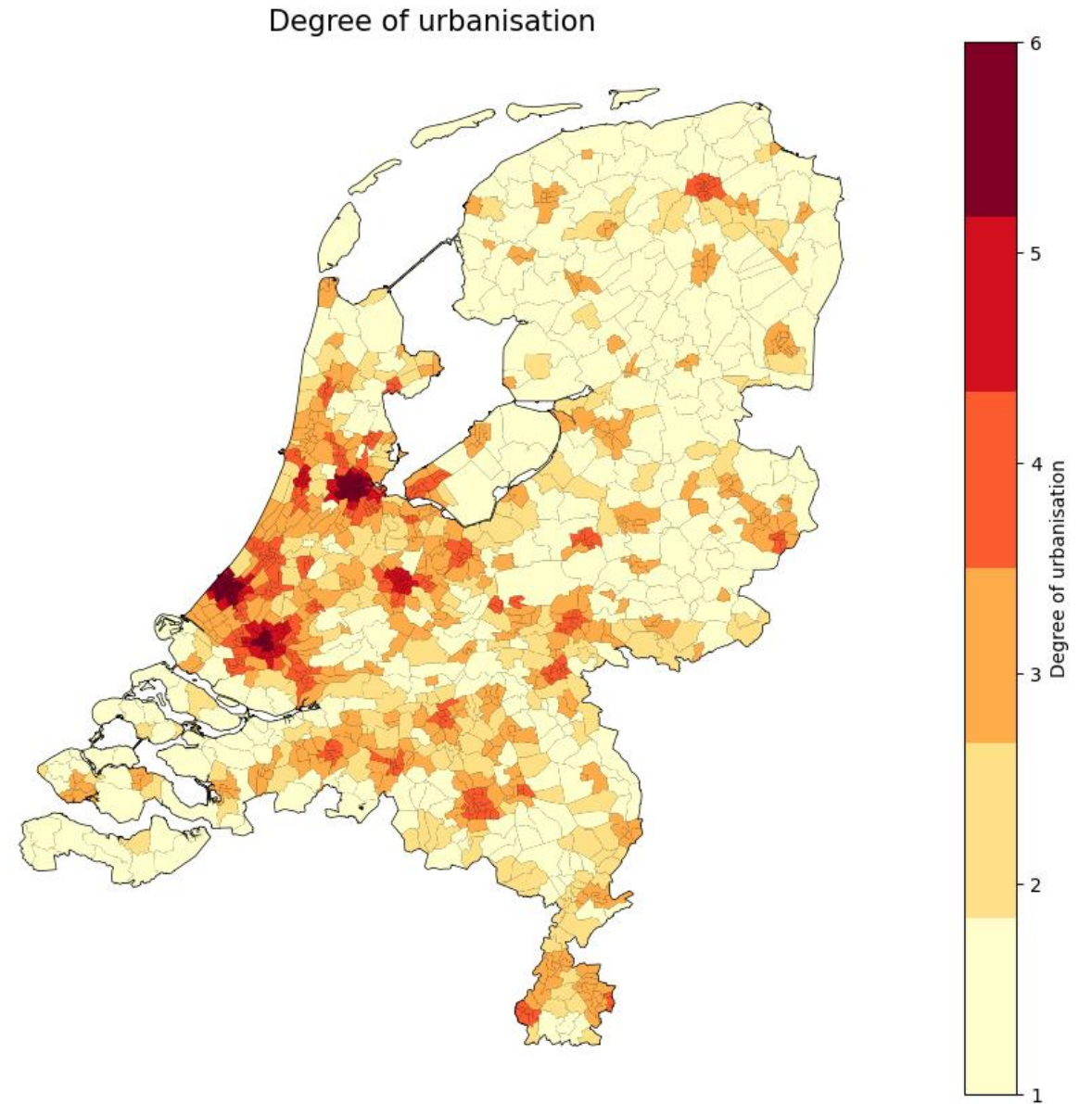
Een analyse over de impact van de ruimtelijke omgeving op reisgedrag

Table of contents

- **Introductie**
- **D-variabelen**
- **Resultaten**
 - Onderzoekende analyse
 - Cluster analyse
 - Propensity score matching
- **Conclusies**

Introductie

- LMS
- OViN
- Stedelijkheidsgraad
- Modal split



Introductie

In hoeverre is de stedelijkheidsgraad in staat om verschil in reisgedrag in verschillende gebieden mee te nemen in transportmodellen en hoe kunnen deze verschillen realistischer worden meegenomen in dezelfde transportmodellen?

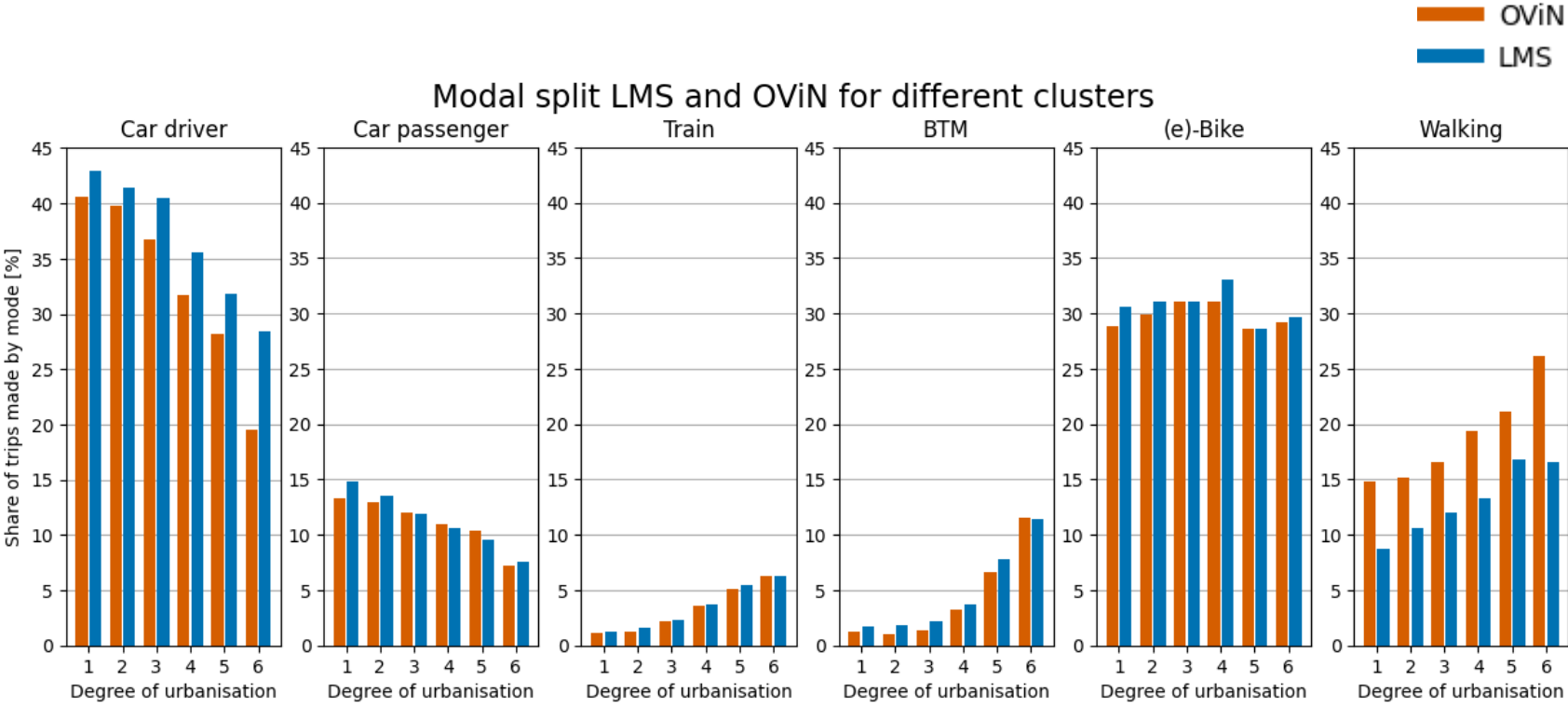
D-variabelen

- Density
- Diversity
- Design
- Destination accessibility
- Distance to transit
- Demand management
- *Demography*

D-variabelen: LMS

- Focus op:
 - Density
 - Distance to transit (voor trein)

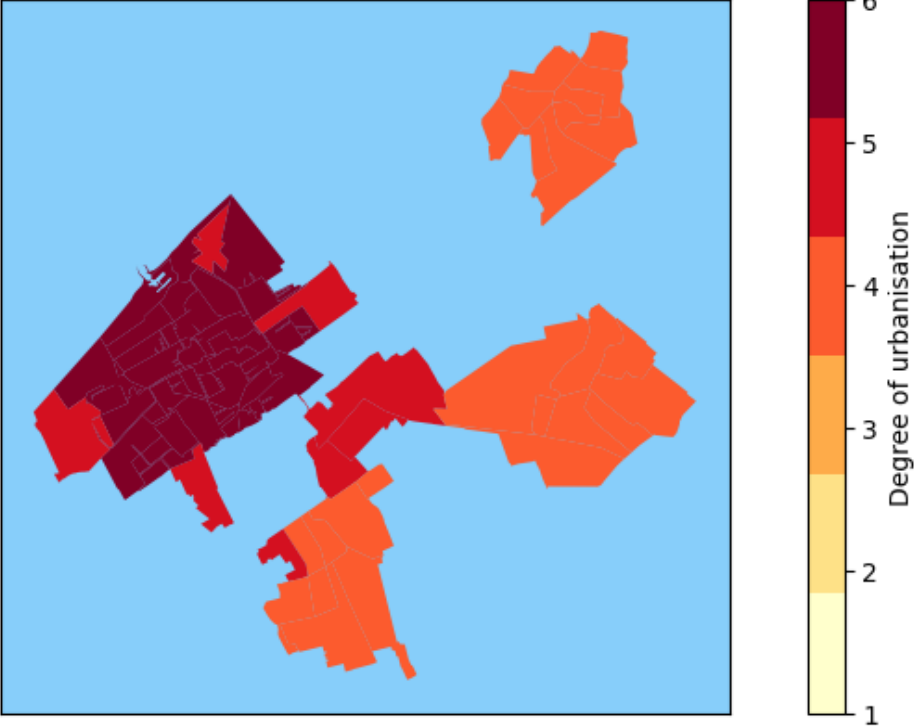
Resultaten: Onderzoekende analyse



Resultaten: Onderzoekende analyse

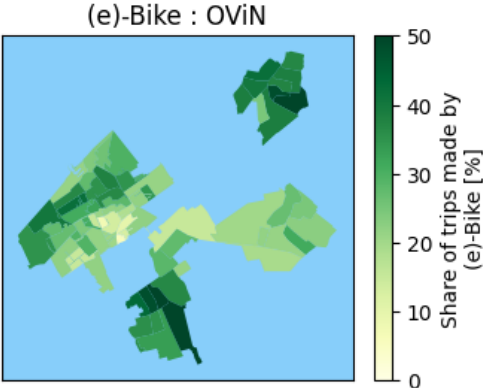
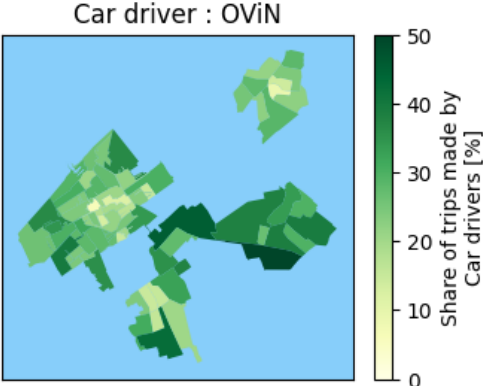
Dezelfde stedelijkheidsgraad \neq dezelfde modal split

Degree of urbanisation for Den Haag, Zoetermeer, Leiden and Delft



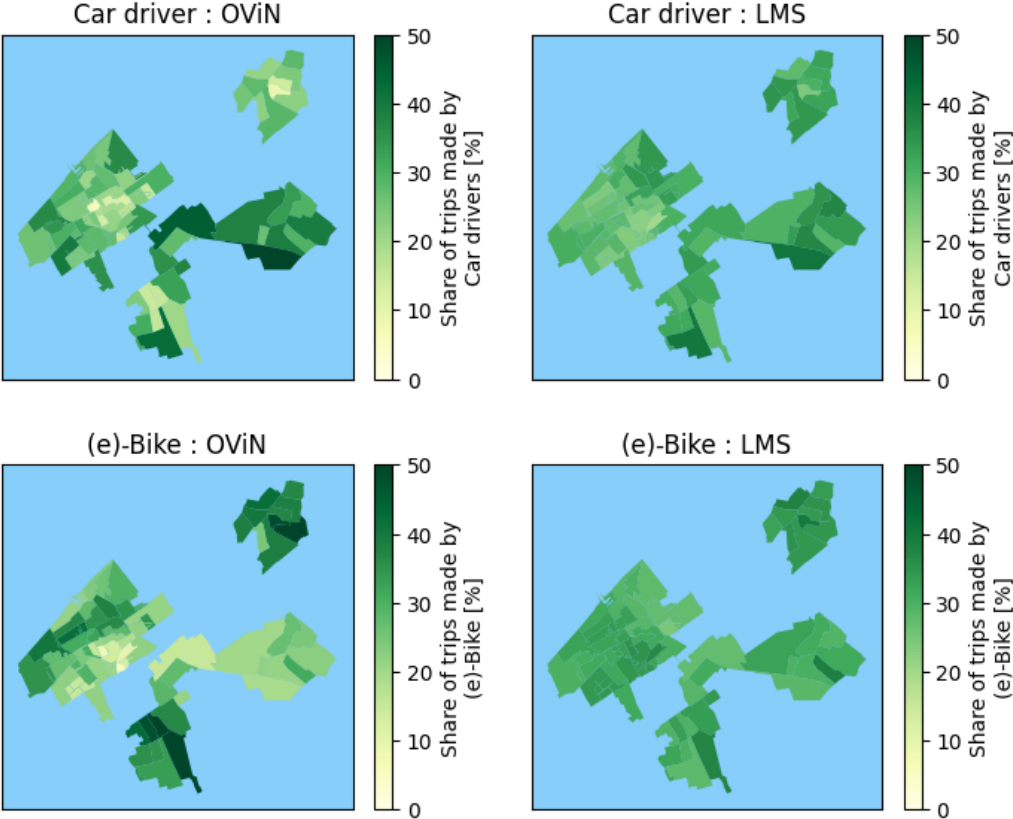
Resultaten: Onderzoekende analyse

Dezelfde stedelijkheidsgraad \neq dezelfde modal split



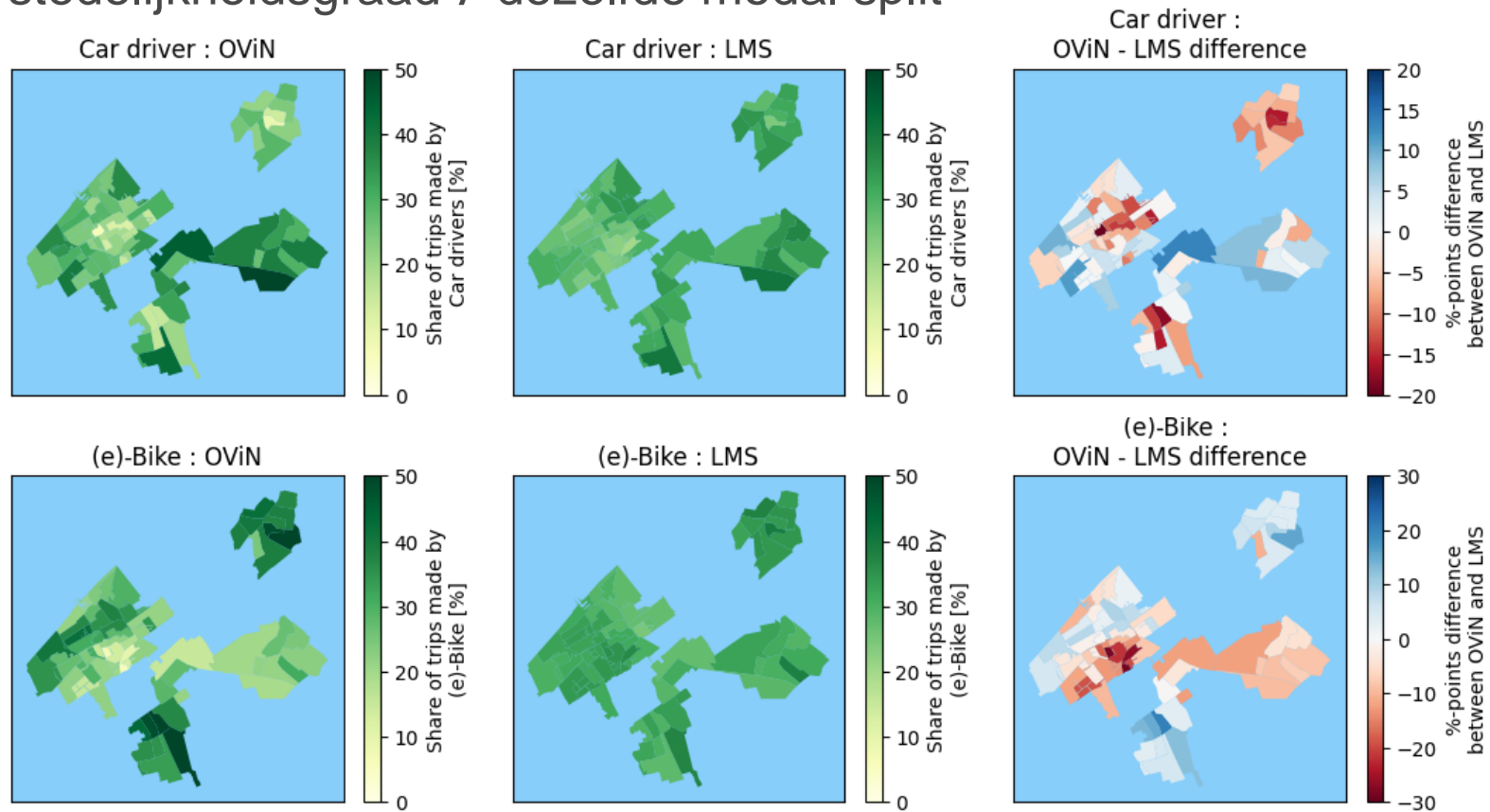
Resultaten: Onderzoekende analyse

Dezelfde stedelijkheidsgraad \neq dezelfde modal split

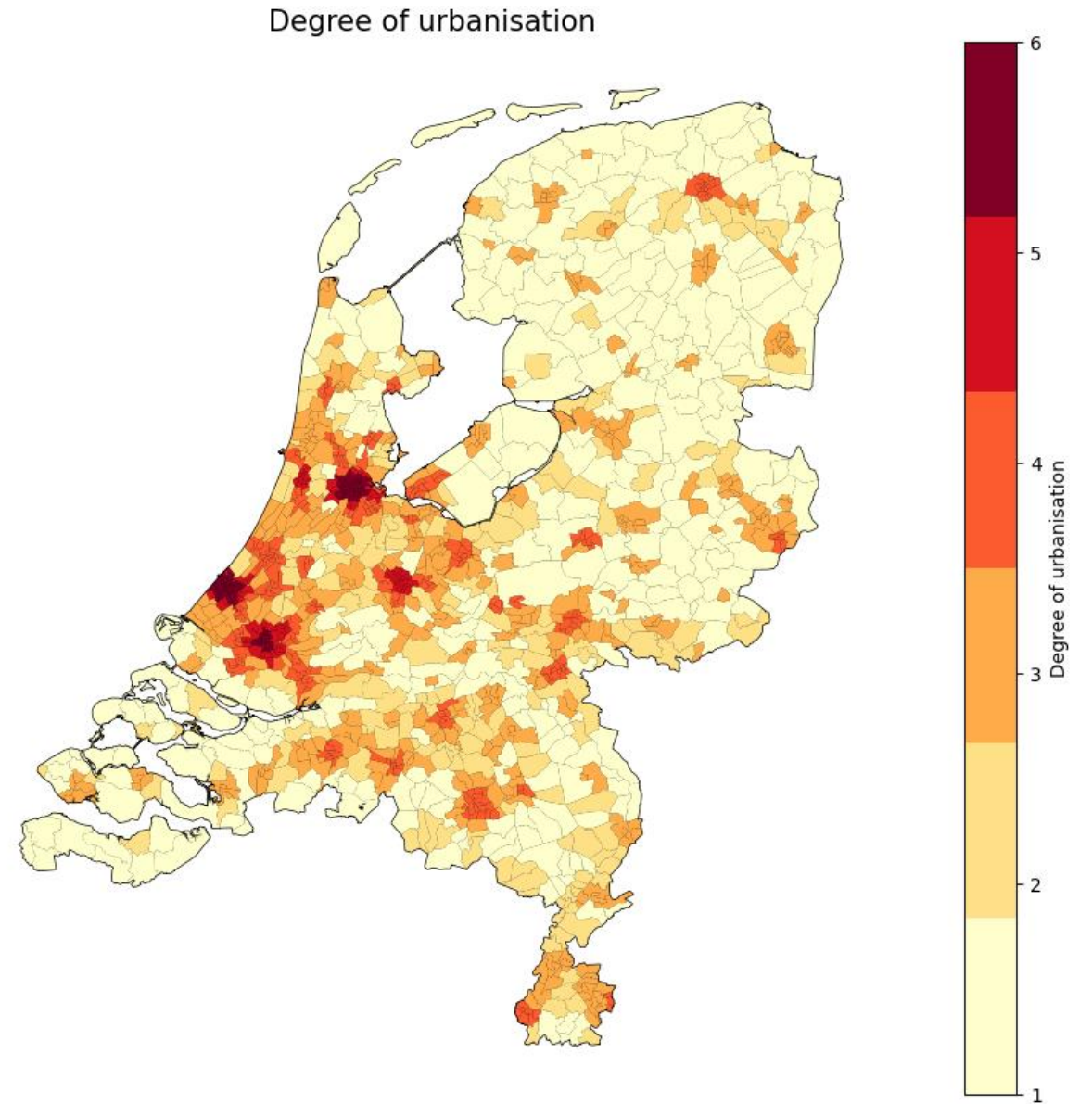


Resultaten: Onderzoekende analyse

Dezelfde stedelijkheidsgraad \neq dezelfde modal split

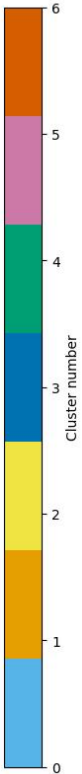
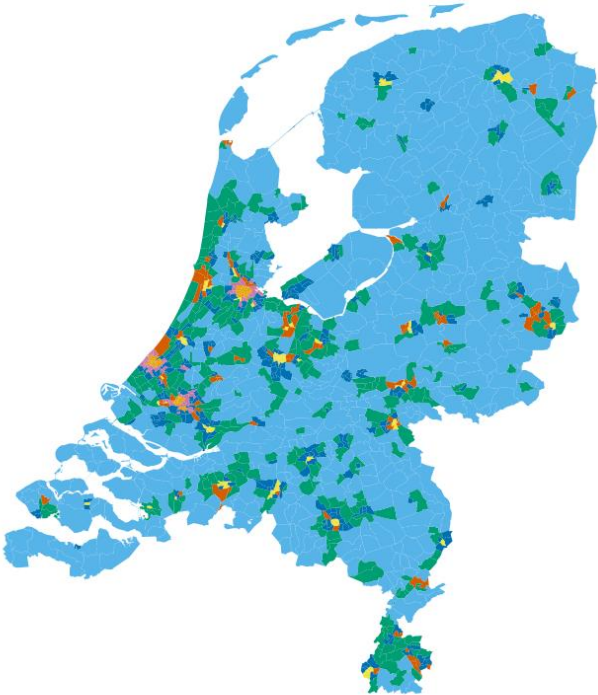


Resultaten: Cluster analyse

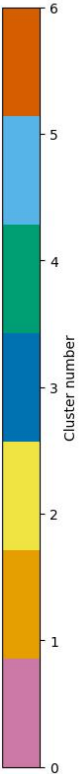
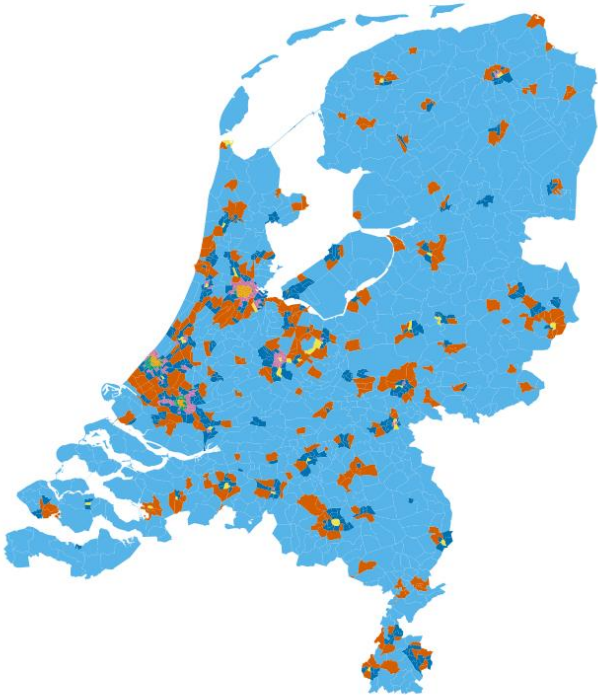


Resultaten: Cluster analyse

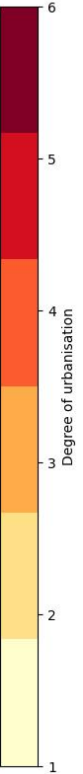
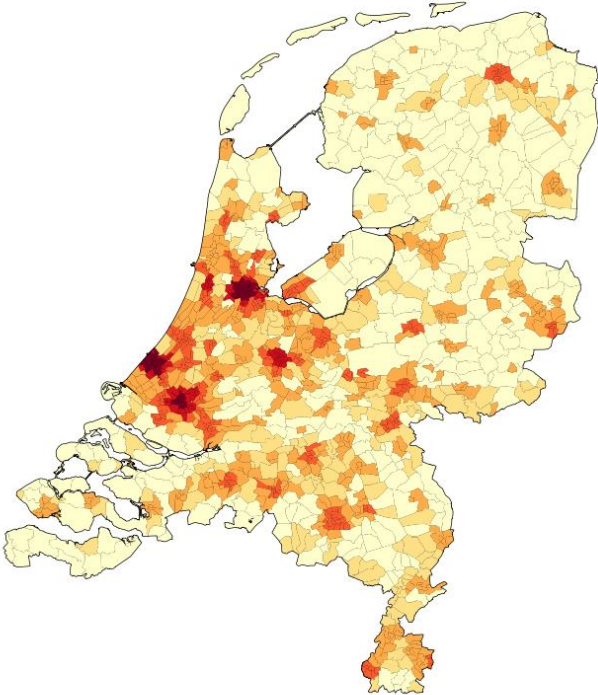
Weighted cluster set



Unweighted cluster set



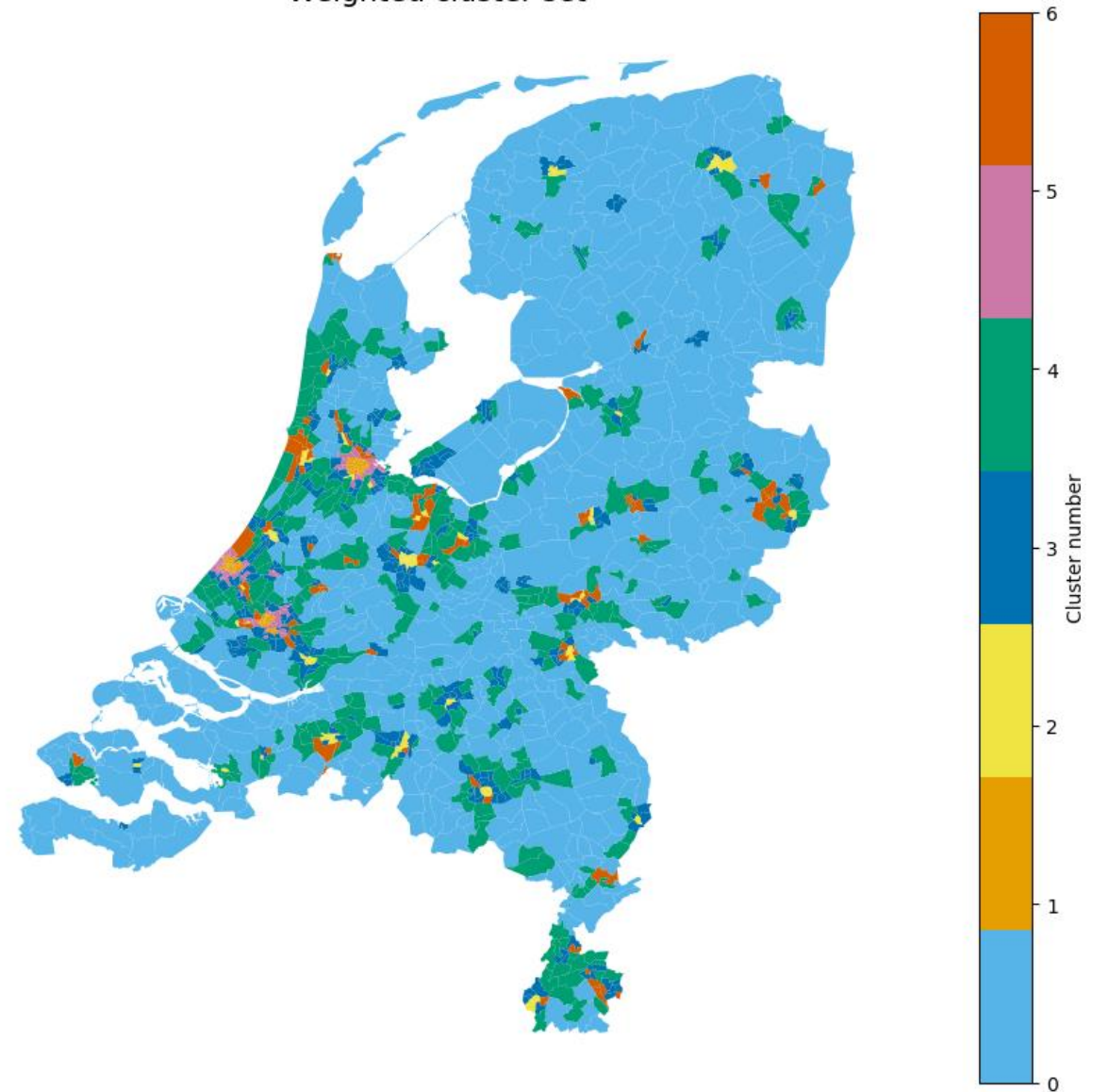
Degree of urbanisation



Resultaten: Cluster analyse

D-variable	Variable	Weight
Density	Population density	1
	Population density, including surrounding zones	1
	Job density	1
	Job density, including surrounding zones	1
Diversity	Share of service land use	2
	Houses built before 1945 ratio	2
Design	Road density	4
Destination accessibility	Distance to point of interest	4
Distance to transit	Number of bus stops	2
	Number of tram/metro stops	2
Demand management	Parking fare	4

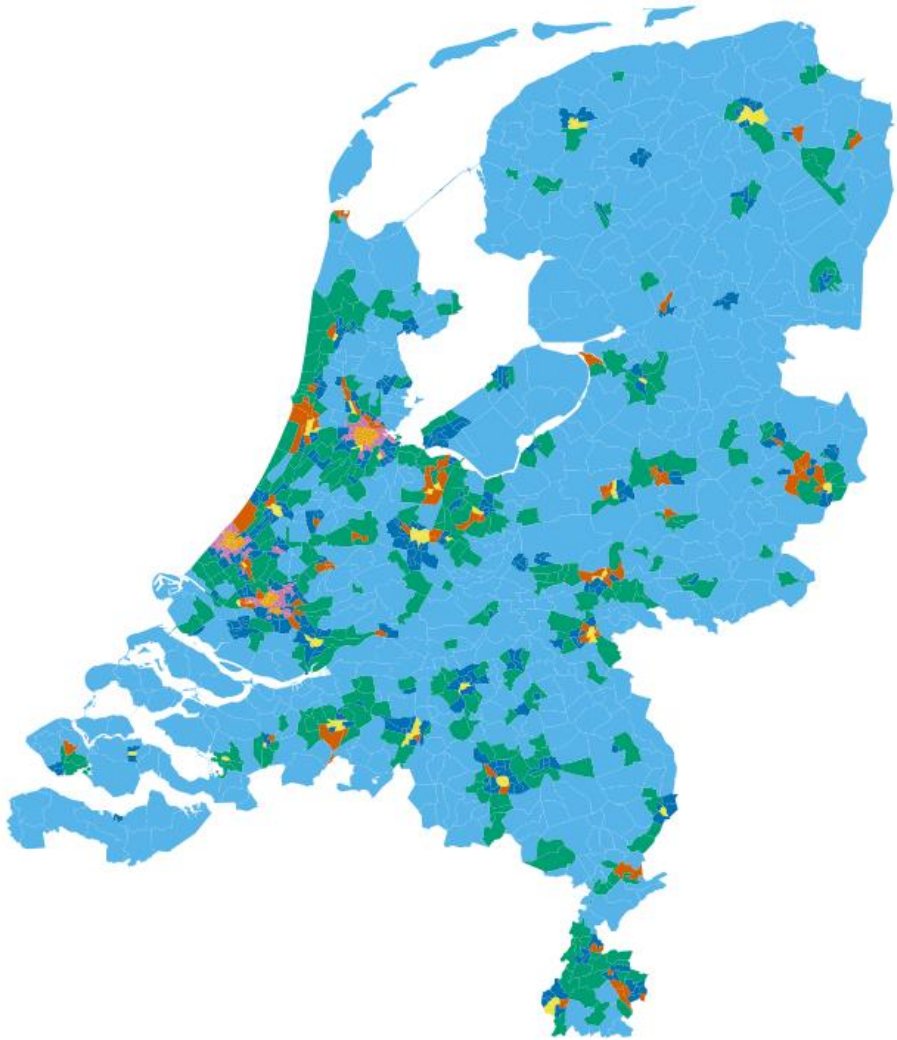
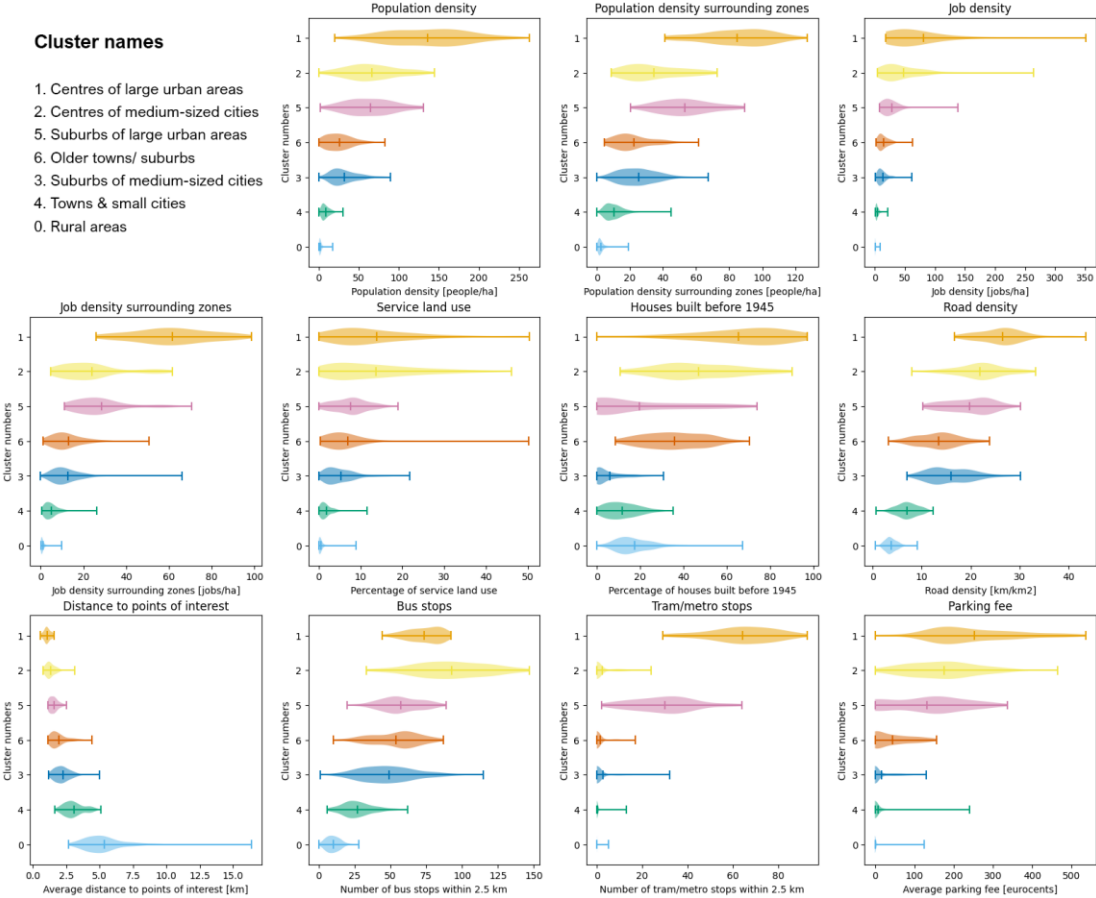
Weighted cluster set



Resultaten: Cluster analyse

Cluster names

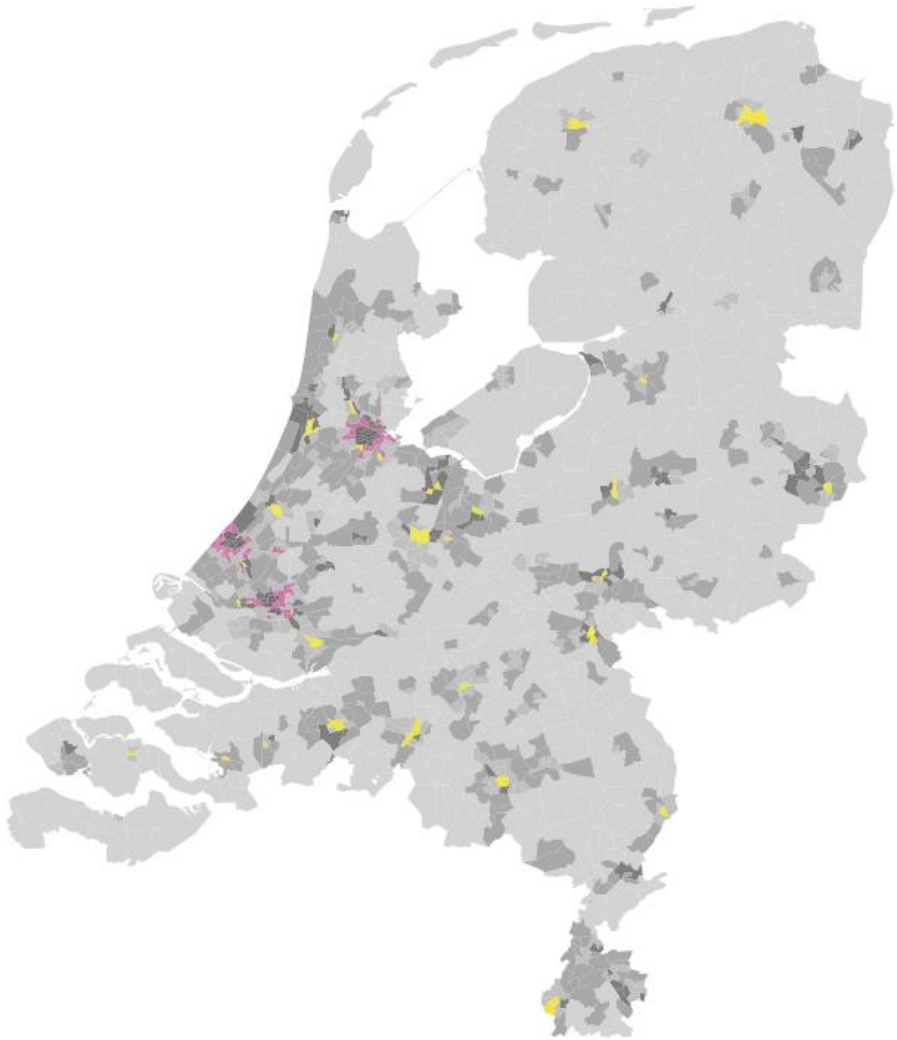
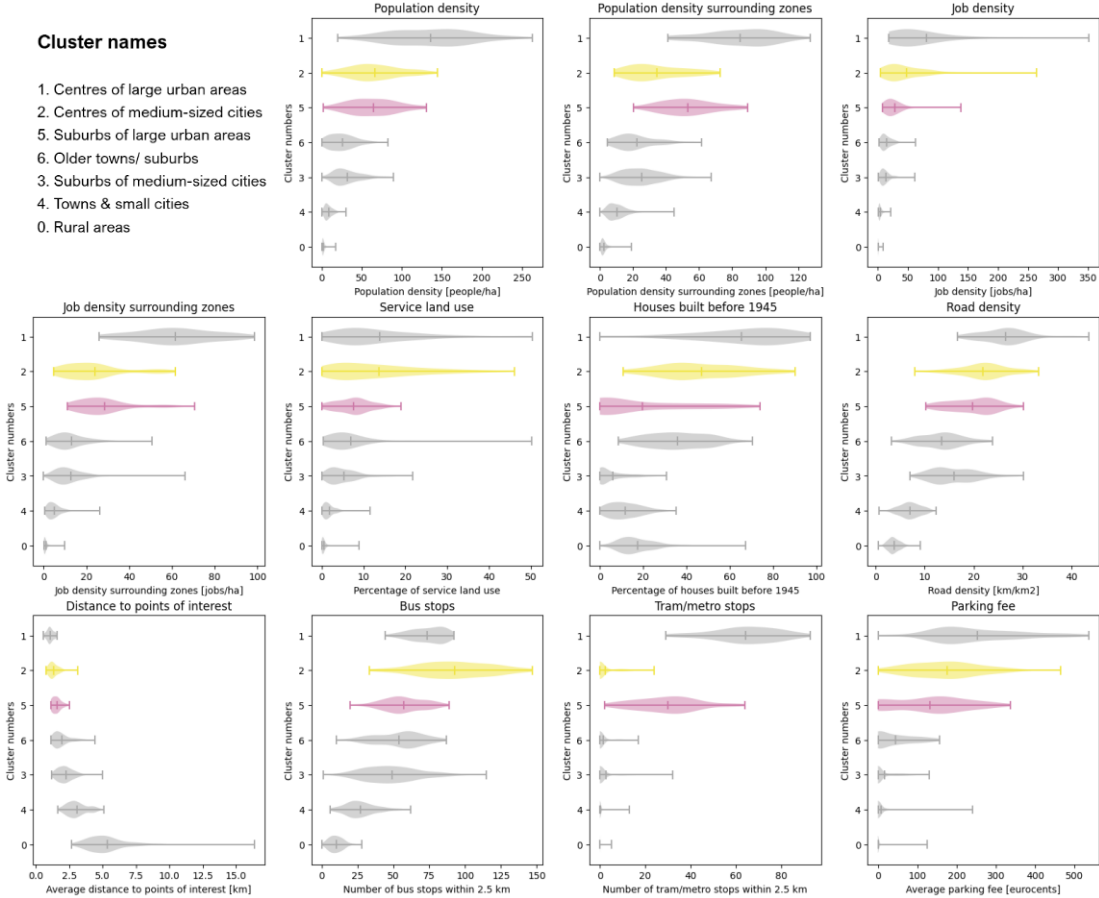
- 1. Centres of large urban areas
- 2. Centres of medium-sized cities
- 5. Suburbs of large urban areas
- 6. Older towns/ suburbs
- 3. Suburbs of medium-sized cities
- 4. Towns & small cities
- 0. Rural areas



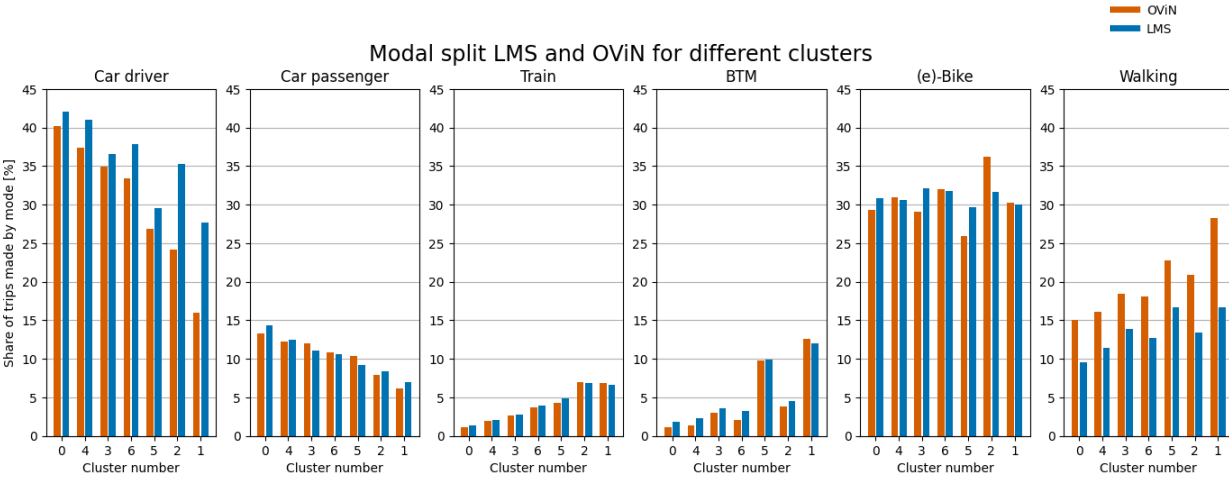
Resultaten: Cluster analyse

Cluster names

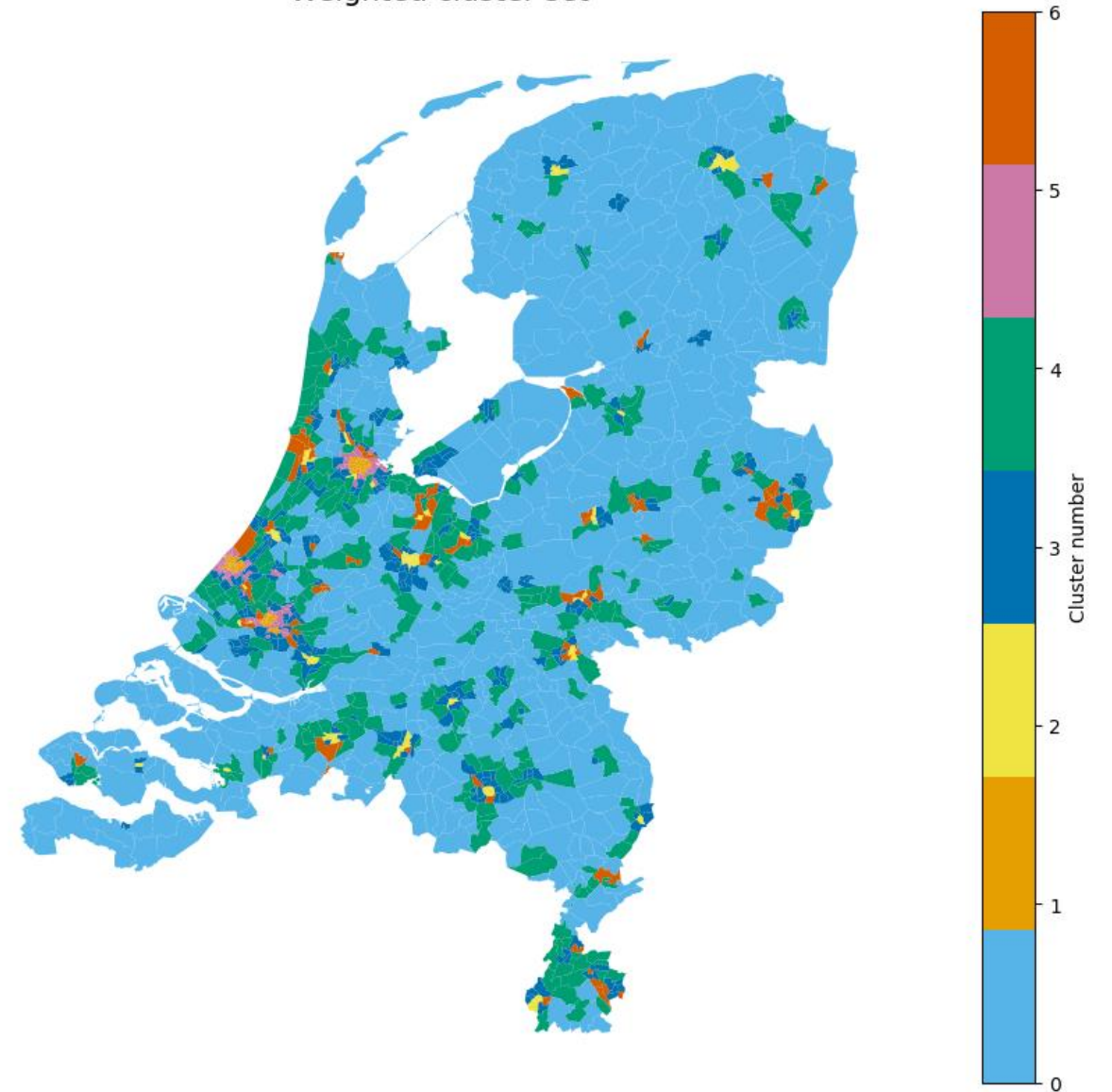
- 1. Centres of large urban areas
- 2. Centres of medium-sized cities
- 5. Suburbs of large urban areas
- 6. Older towns/ suburbs
- 3. Suburbs of medium-sized cities
- 4. Towns & small cities
- 0. Rural areas



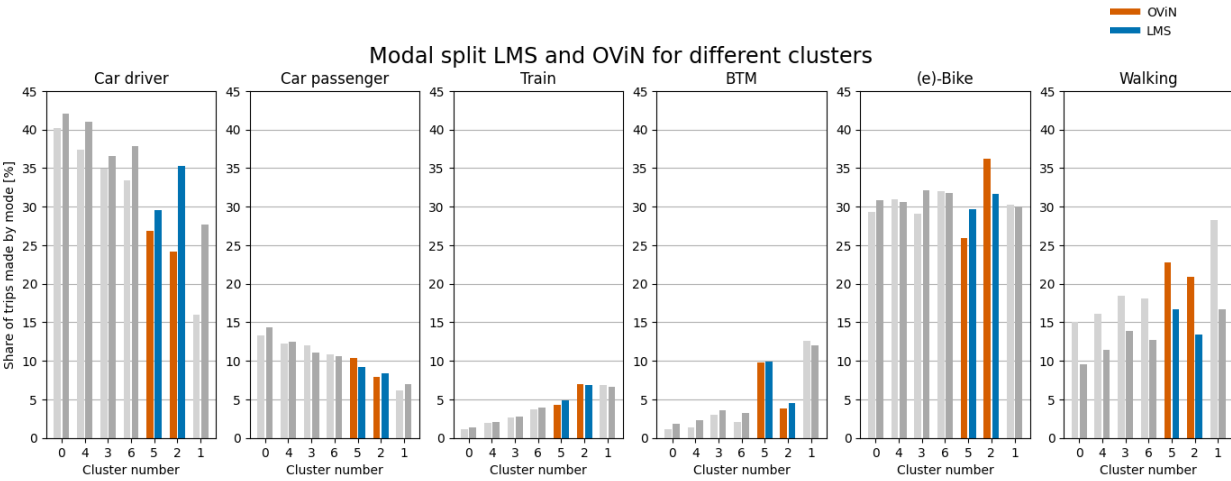
Resultaten: Cluster analyse



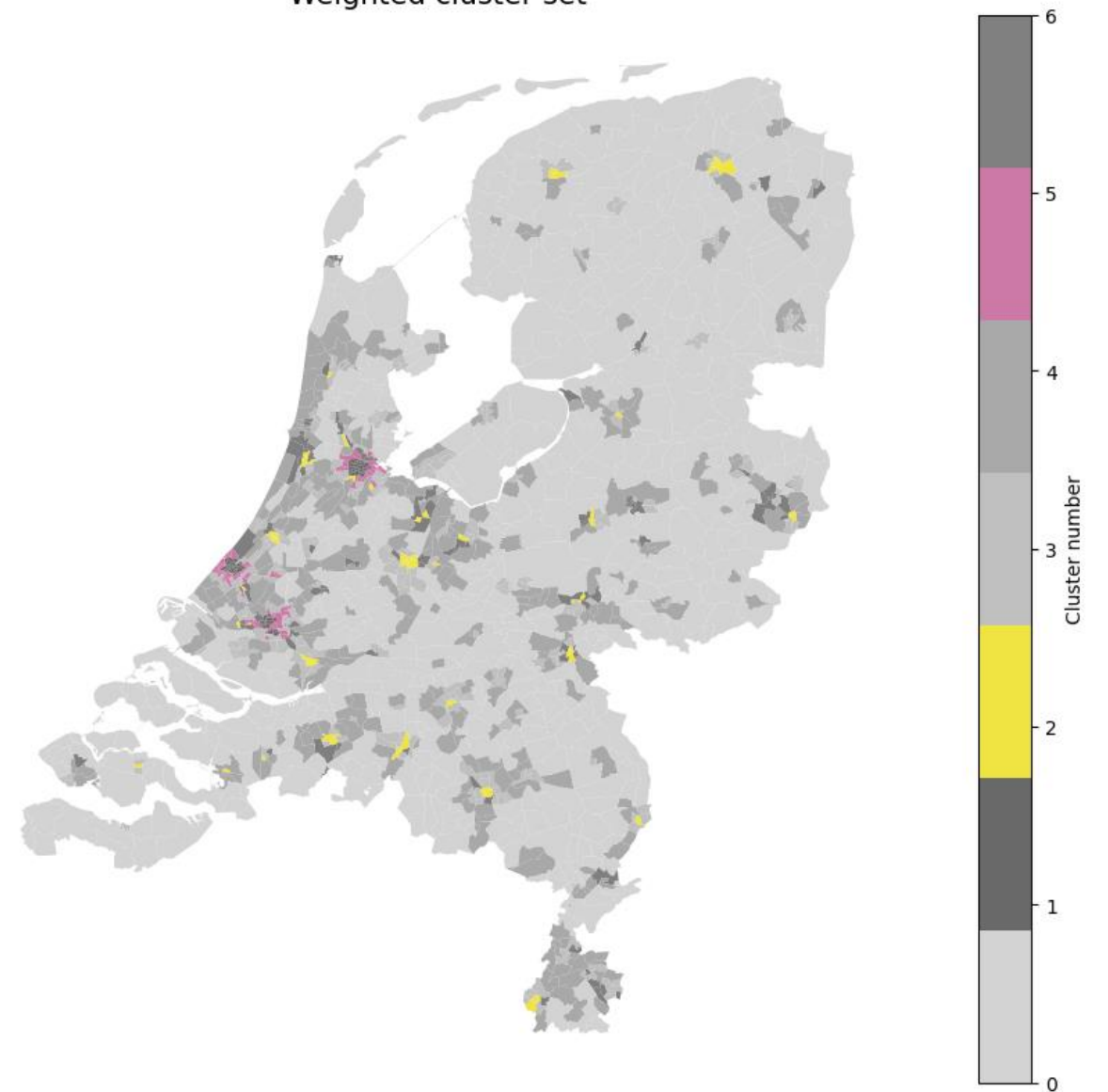
Weighted cluster set



Resultaten: Cluster analyse



Weighted cluster set

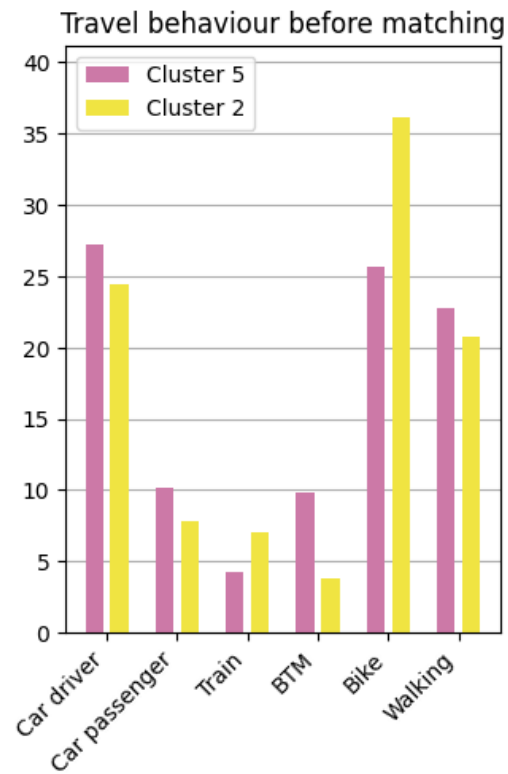


Resultaten: Propensity score matching

- Twee verschillende populaties
- **Echte** effect ruimtelijke omgeving?

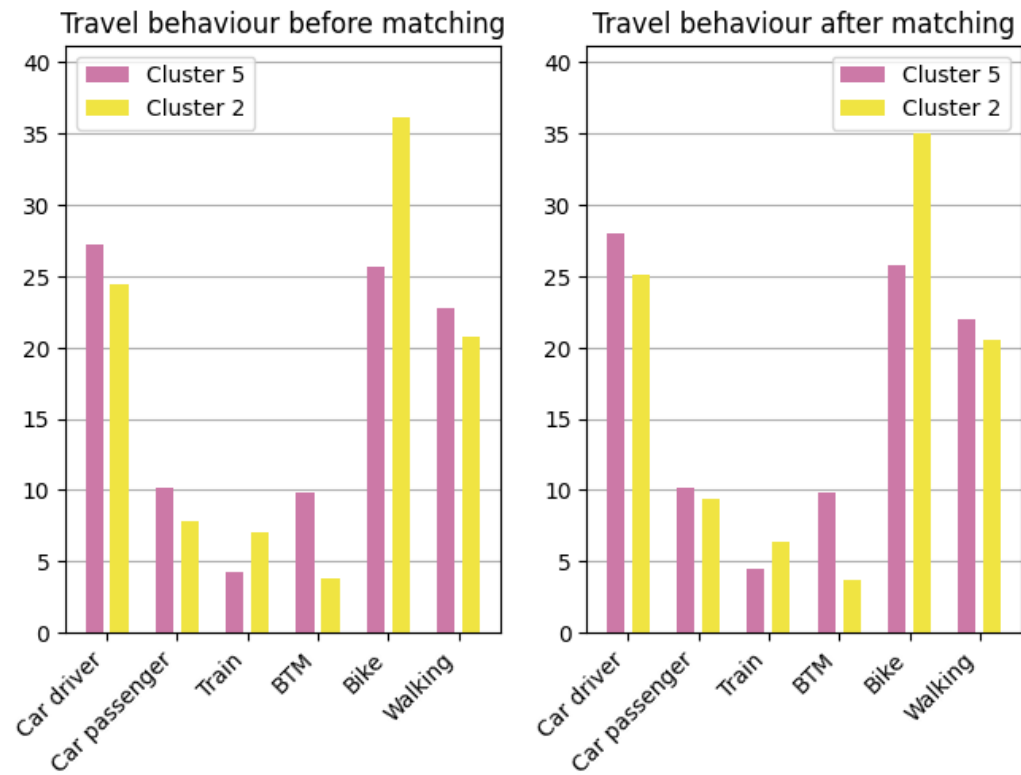
Resultaten: Propensity score matching

- Clusters kunnen worden vergeleken!



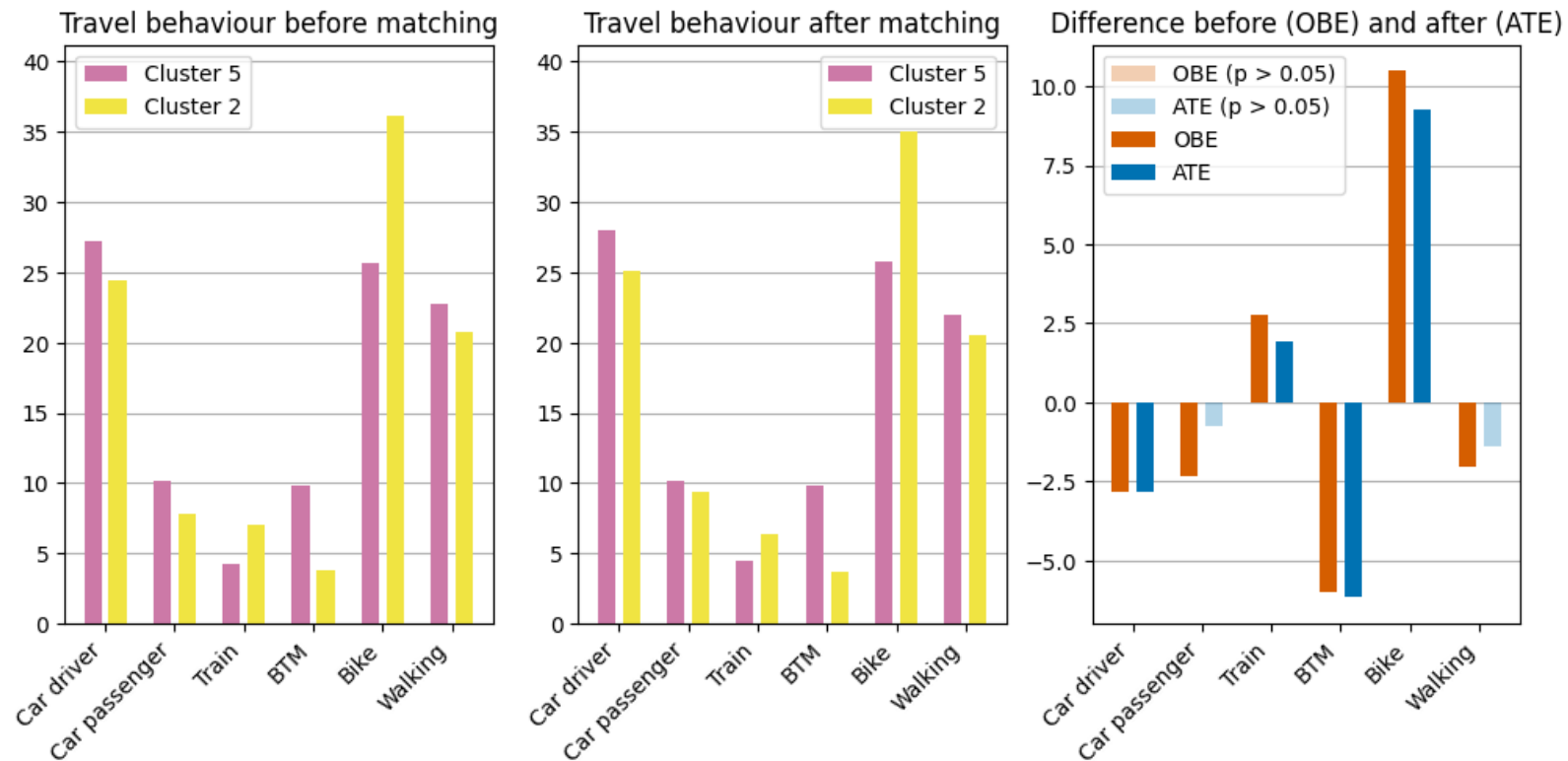
Resultaten: Propensity score matching

- Clusters kunnen worden vergeleken!



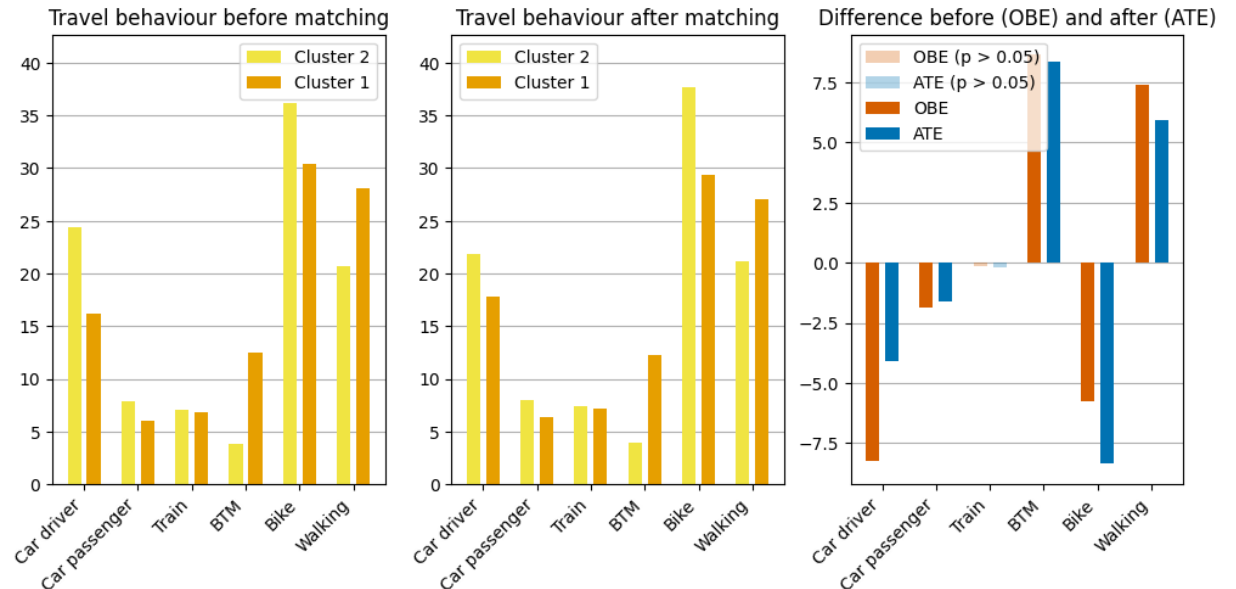
Resultaten: Propensity score matching

- Clusters kunnen worden vergeleken!



Resultaten: Propensity score matching

- Effect ruimtelijke omgeving:
 - > 50%
 - Groter voor BTM, fiets en lopen
 - Groter voor cluster sets dan stedelijkheidsgraad
- Verschillende gebieden worden op een verschillende manier beïnvloed



Conclusies

In hoeverre is de stedelijkheidsgraad in staat om verschil in reisgedrag in verschillende gebieden mee te nemen in transportmodellen en hoe kunnen deze verschillen realistischer worden meegenomen in dezelfde transportmodellen?

Conclusies

In hoeverre is de stedelijkheidsgraad in staat om verschil in reisgedrag in verschillende gebieden mee te nemen in transportmodellen en hoe kunnen deze verschillen realistischer worden meegenomen in dezelfde transportmodellen?

- De stedelijkheidsgraad is een logische proxy
- *Maar*, dezelfde stedelijkheidsgraad \neq dezelfde modal split
- Autobestuurder en fiets hebben de meeste verbetering nodig

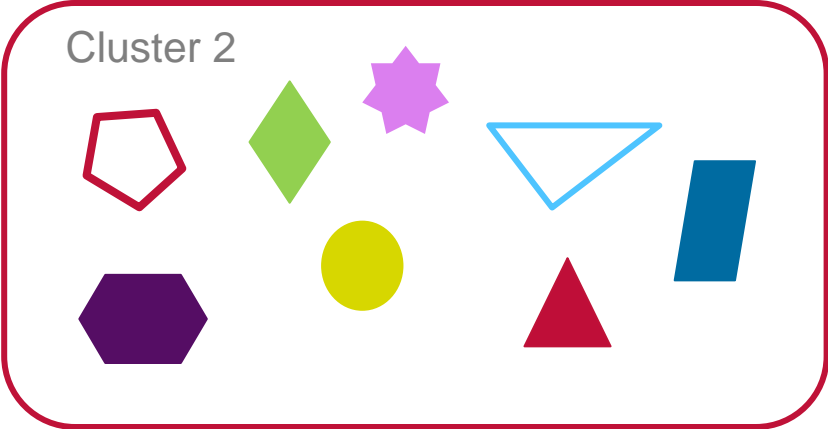
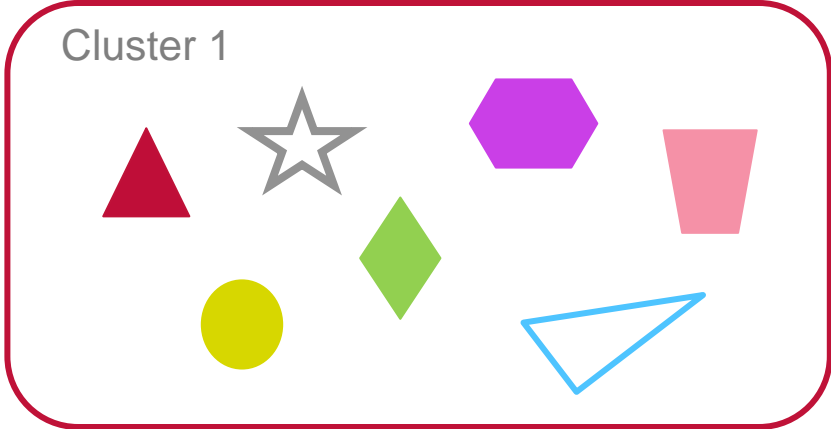
Conclusies

In hoeverre is de stedelijkheidsgraad in staat om verschil in reisgedrag in verschillende gebieden mee te nemen in transportmodellen en hoe kunnen deze verschillen realistischer worden meegenomen in dezelfde transportmodellen?

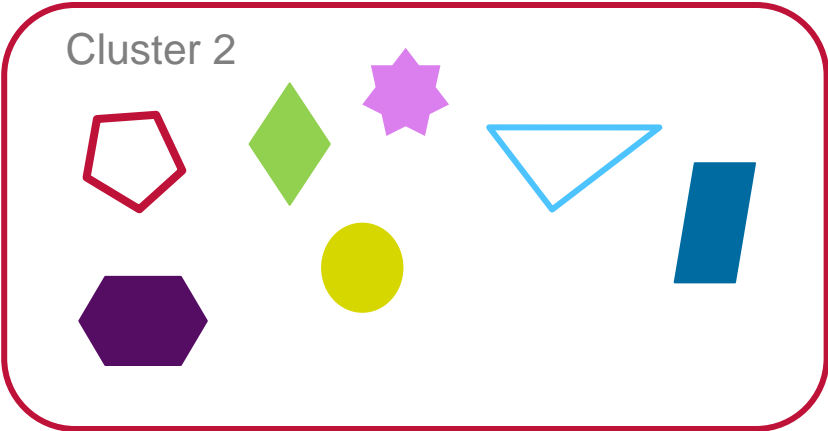
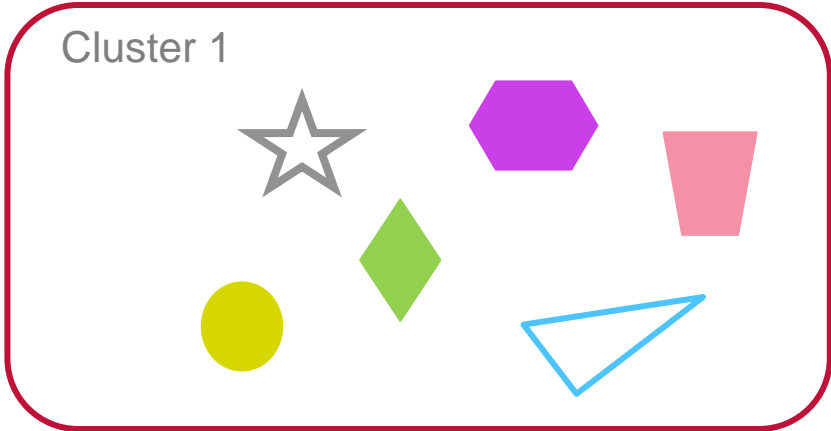
- D-variabelen
- Clusters

Bedankt voor het luisteren

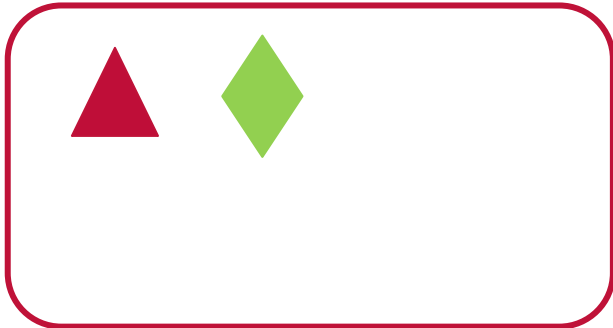
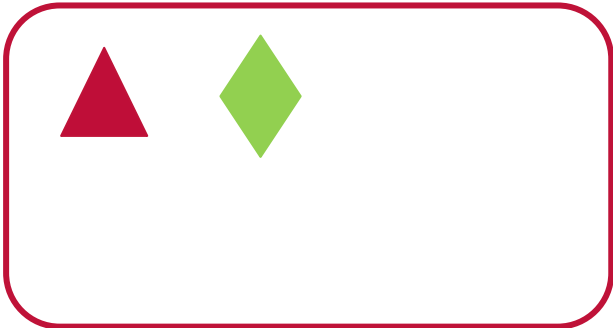
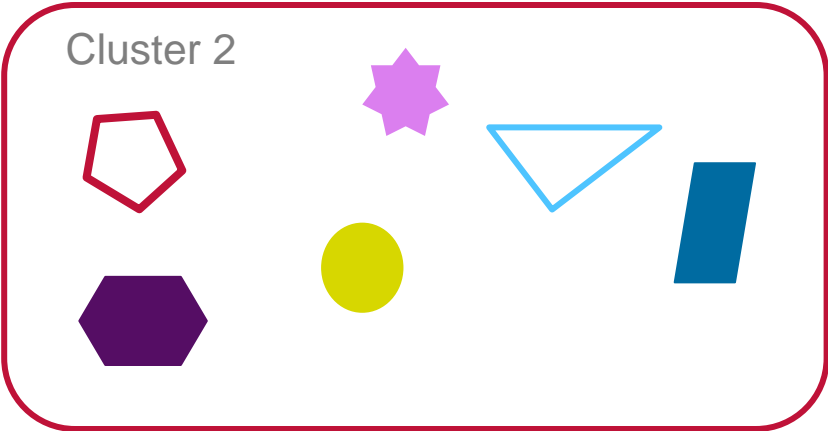
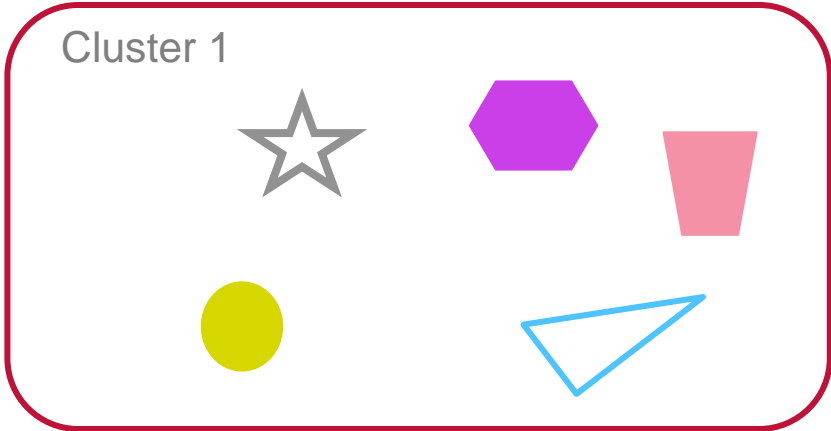
Uitleg: Propensity score matching



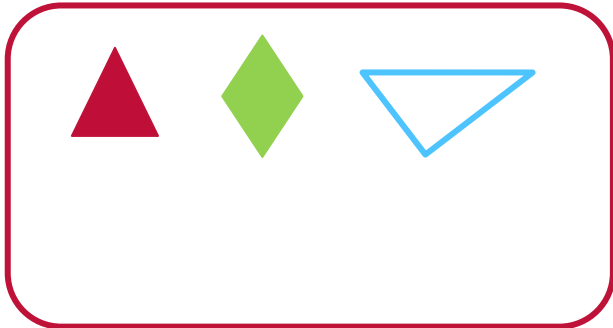
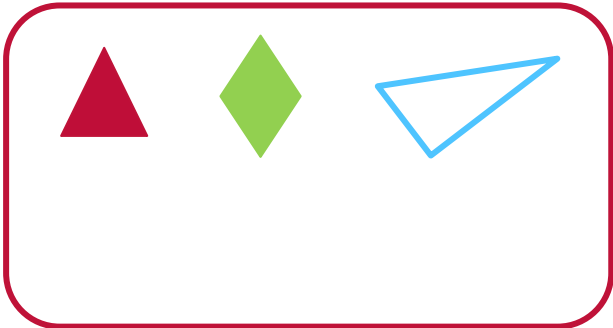
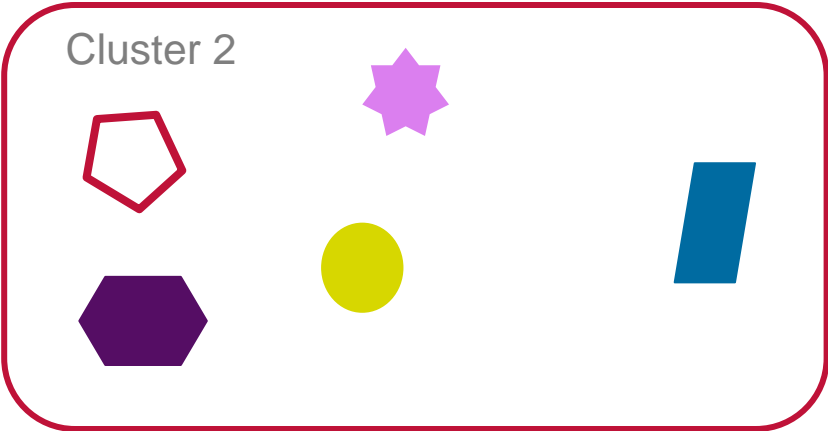
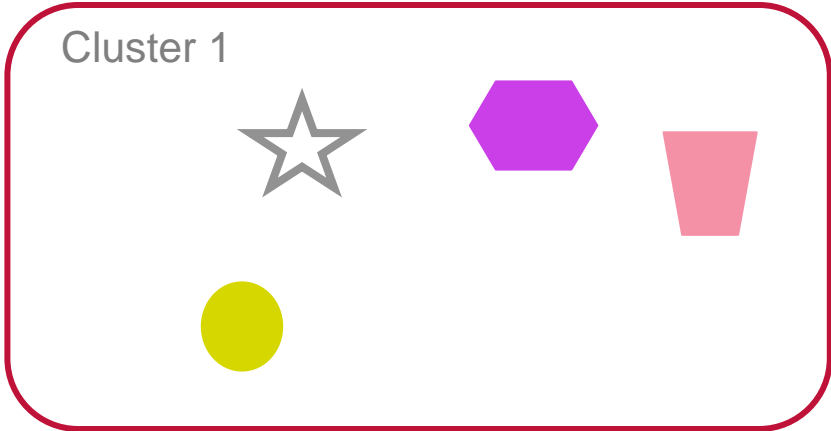
Uitleg: Propensity score matching



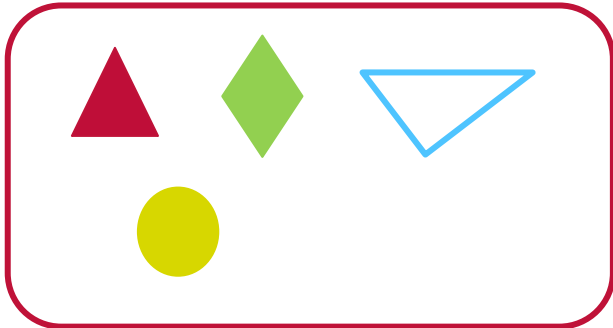
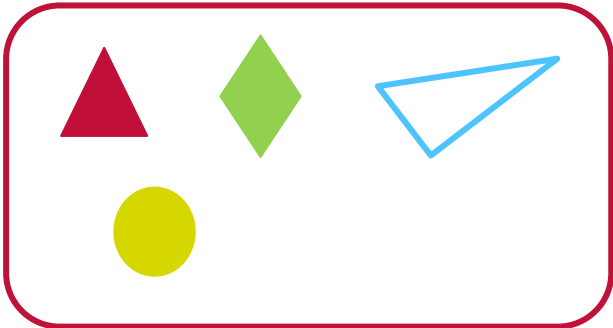
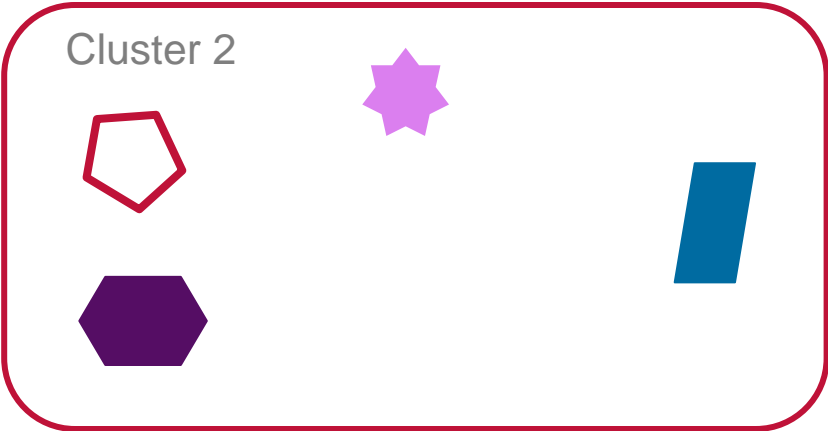
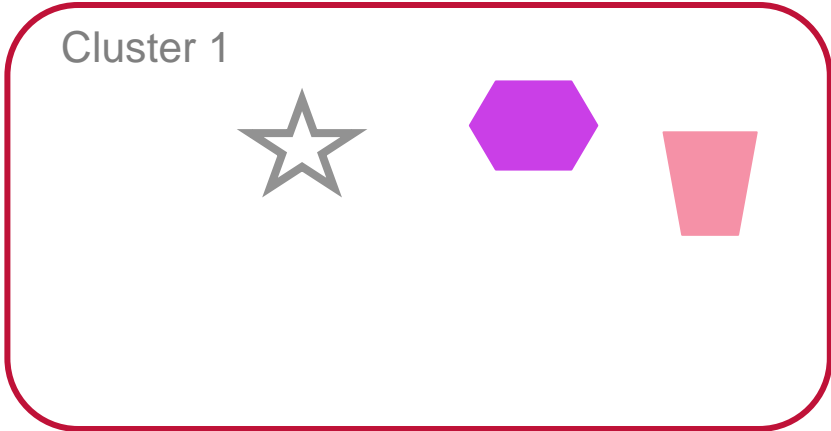
Uitleg: Propensity score matching



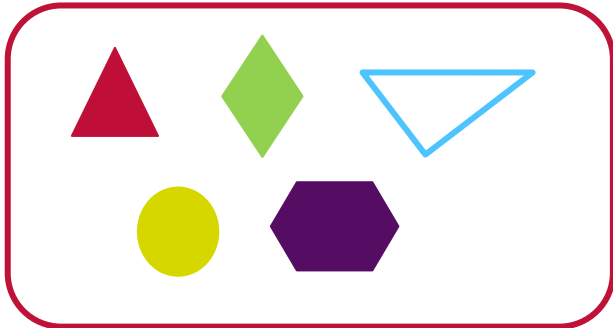
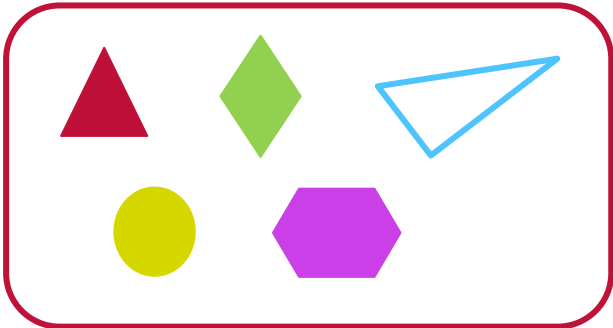
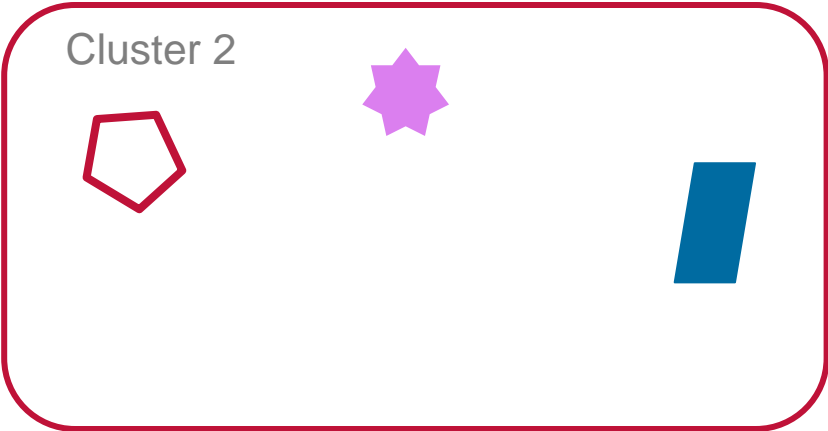
Uitleg: Propensity score matching



Uitleg: Propensity score matching



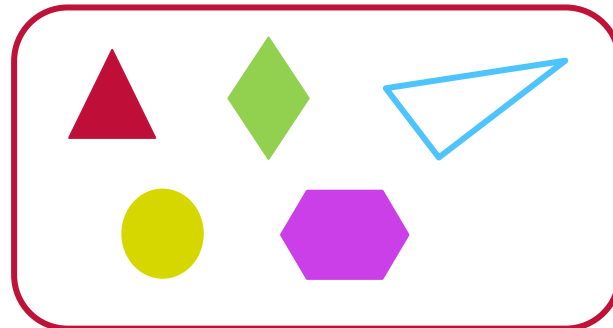
Uitleg: Propensity score matching



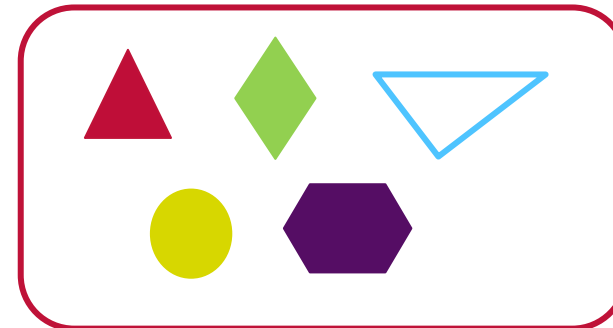
Uitleg: Propensity score matching

- Clusters kunnen worden vergeleken!

Cluster 1



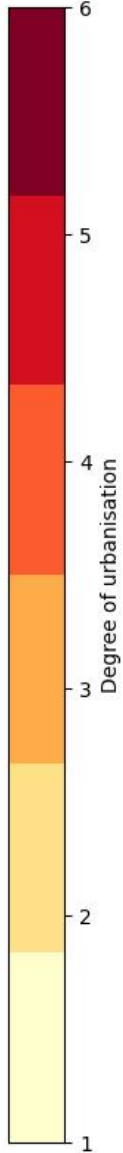
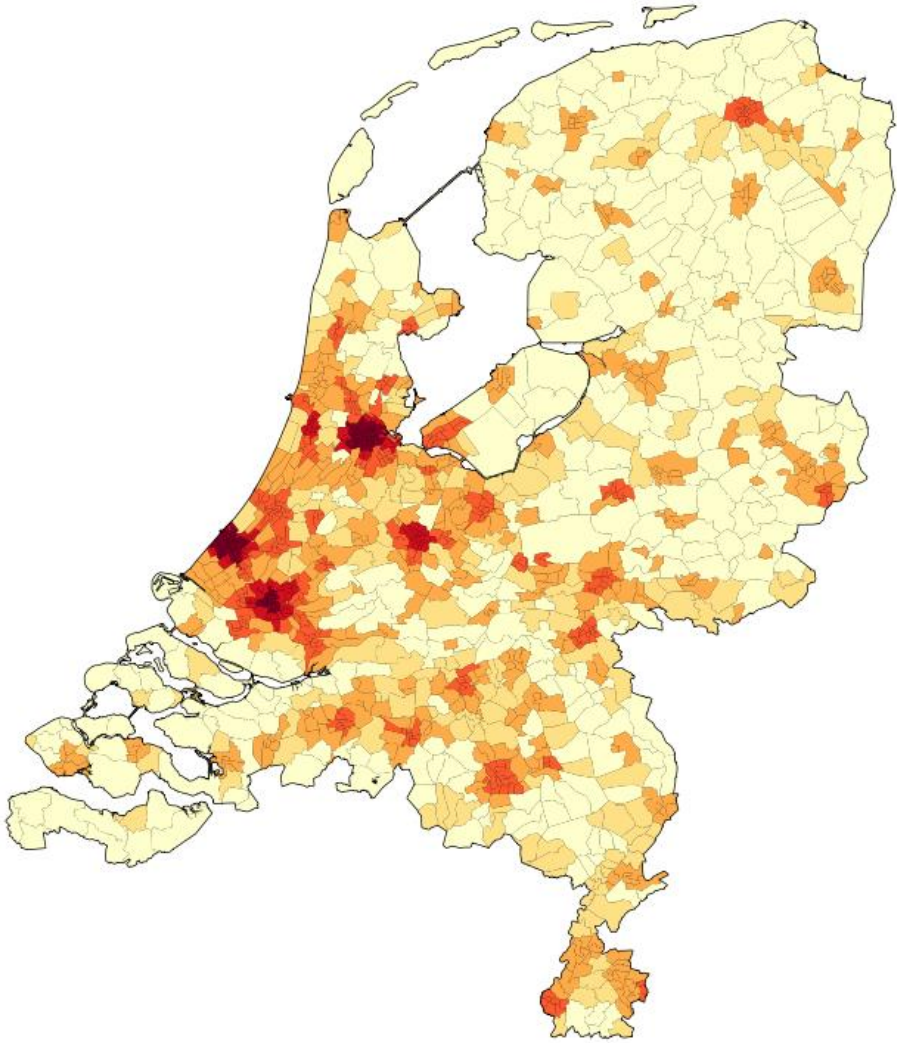
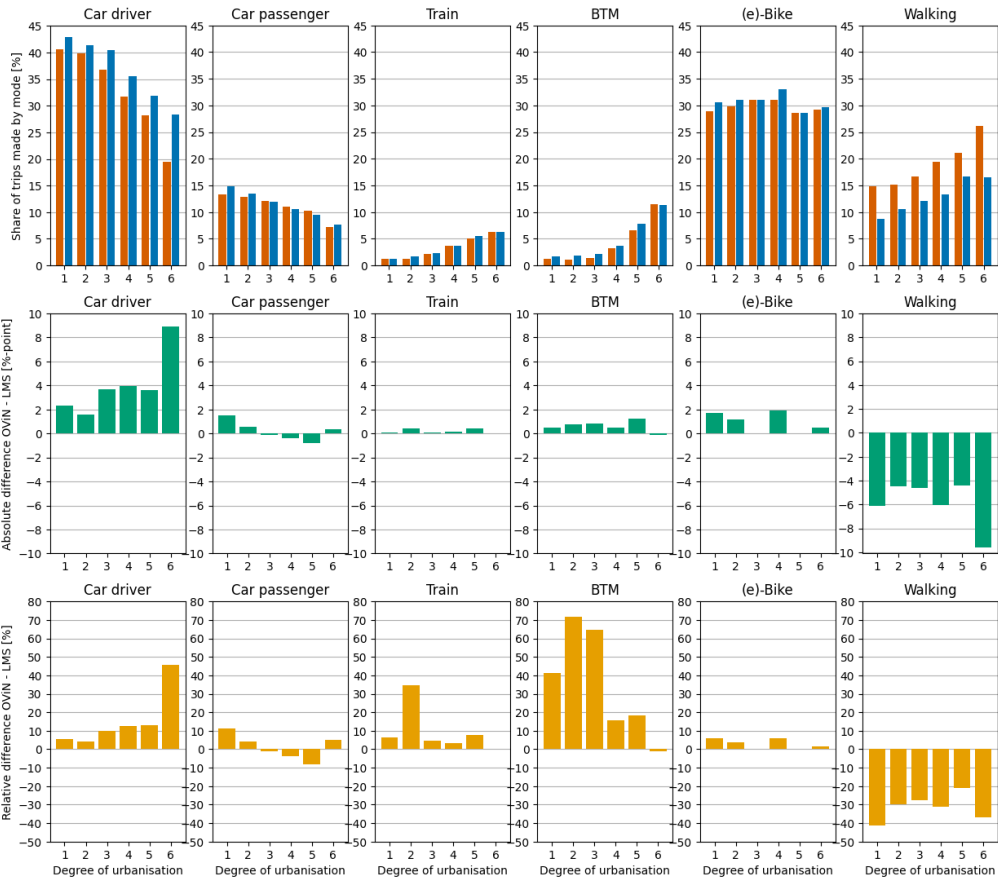
Cluster 2



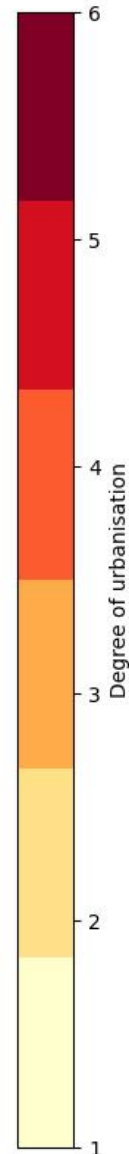
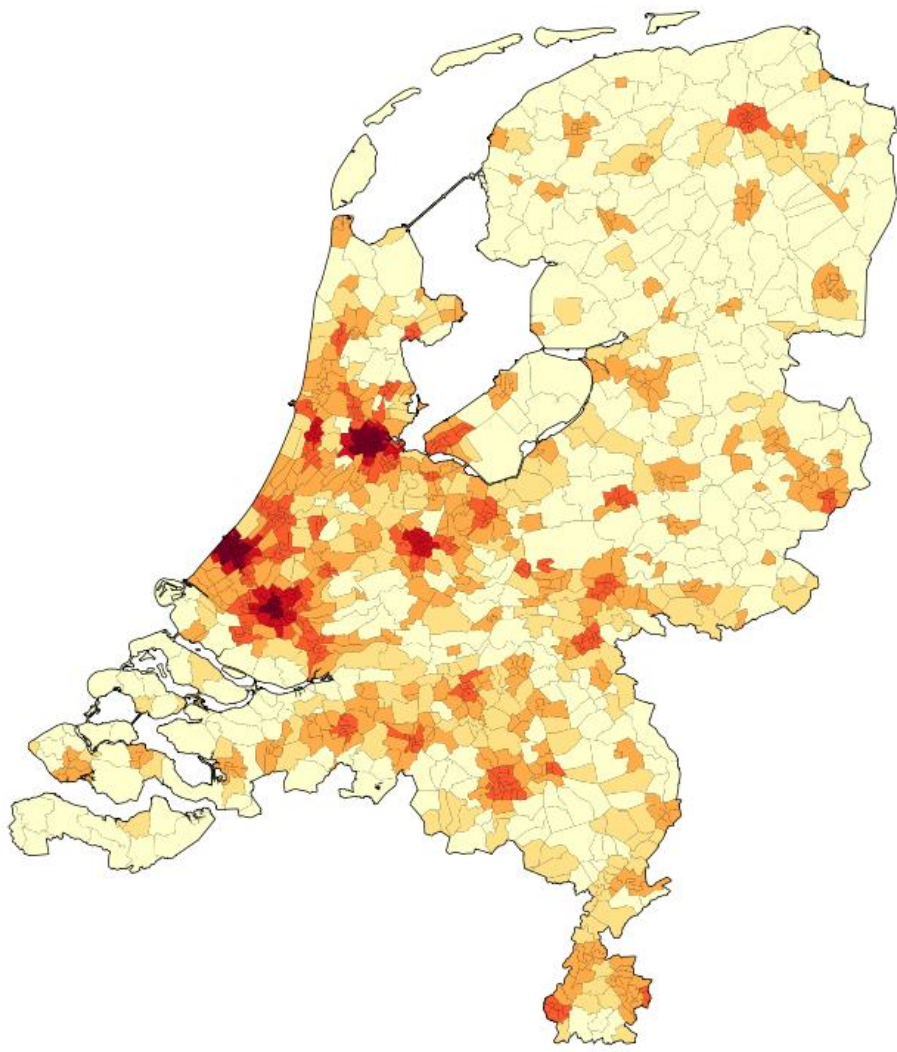
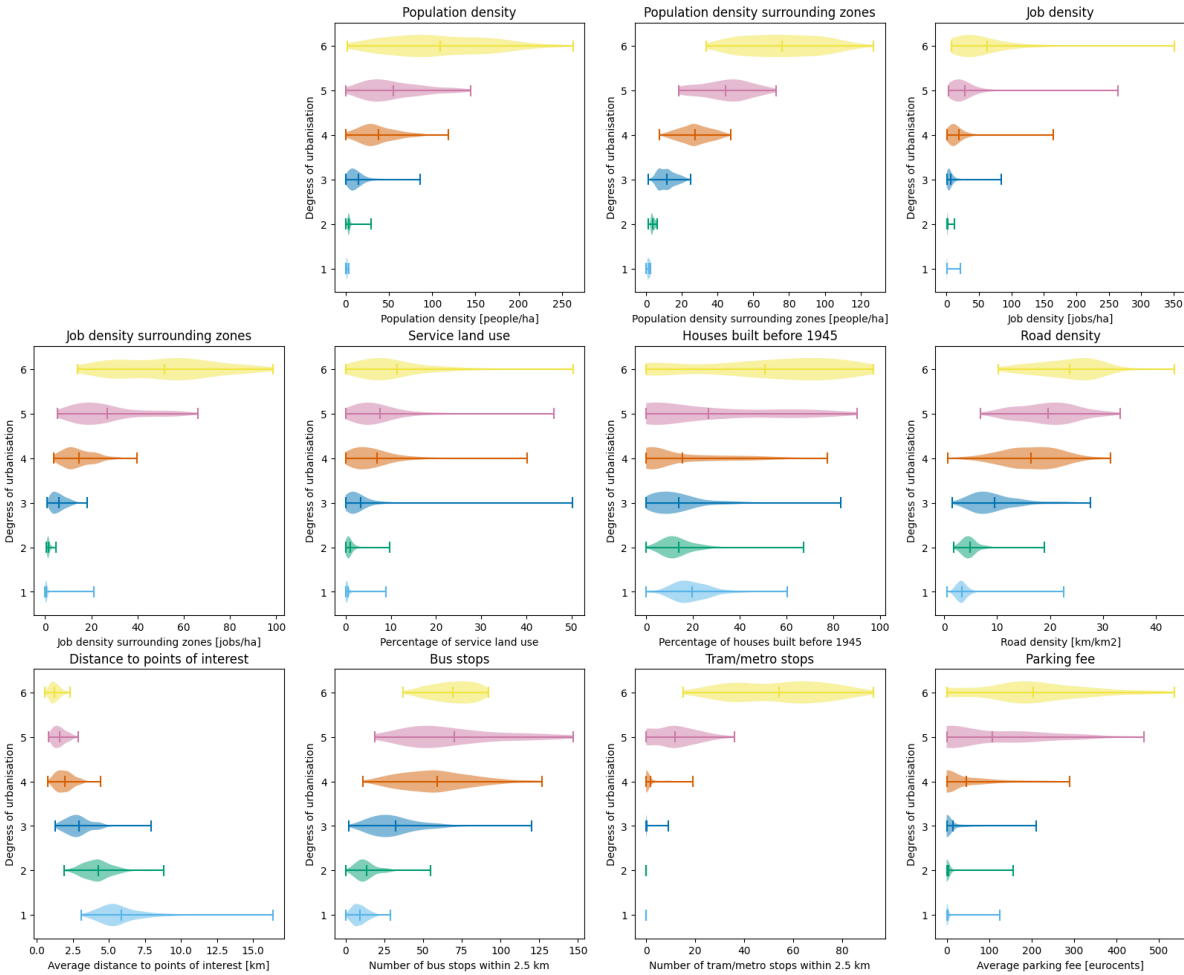
Stedelijkheidsgraad

(Difference in) modal split LMS and OVIN for degree of urbanisation of the origin zone

- OVIN
- LMS
- Absolute difference OVIN - LMS
- Relative difference OVIN - LMS



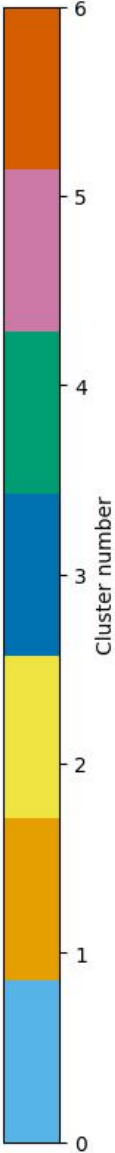
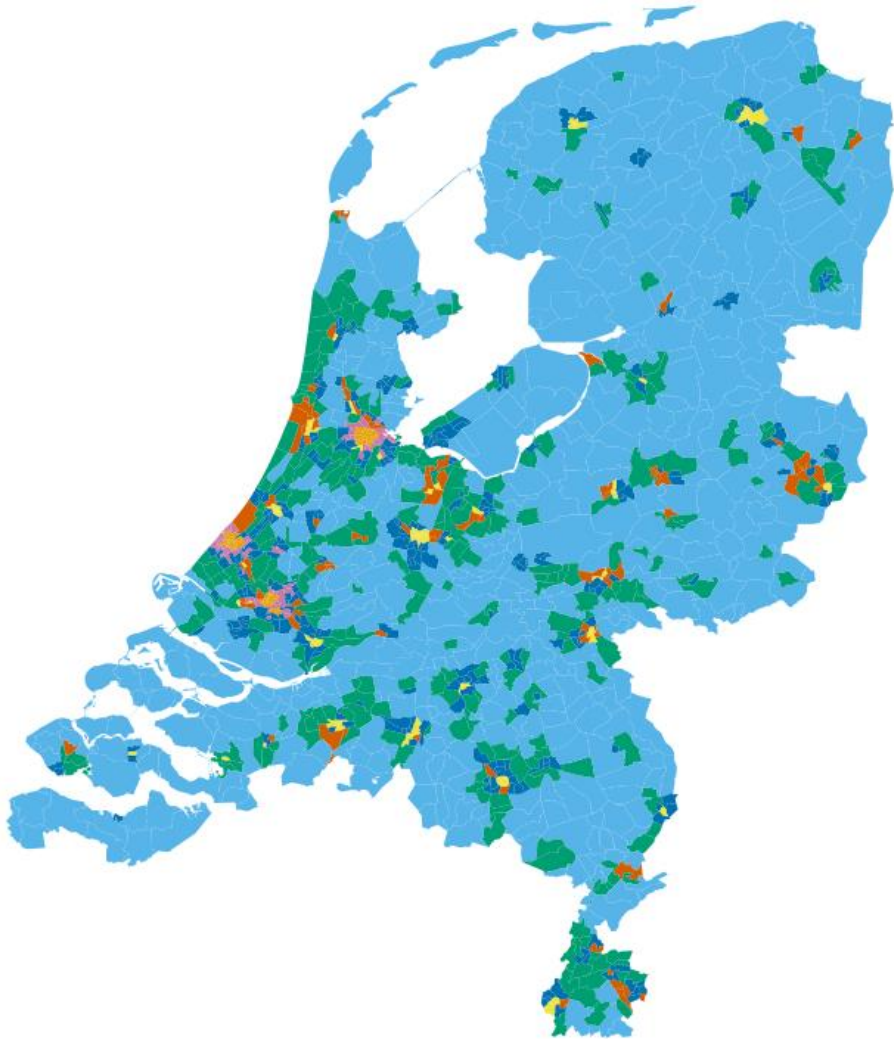
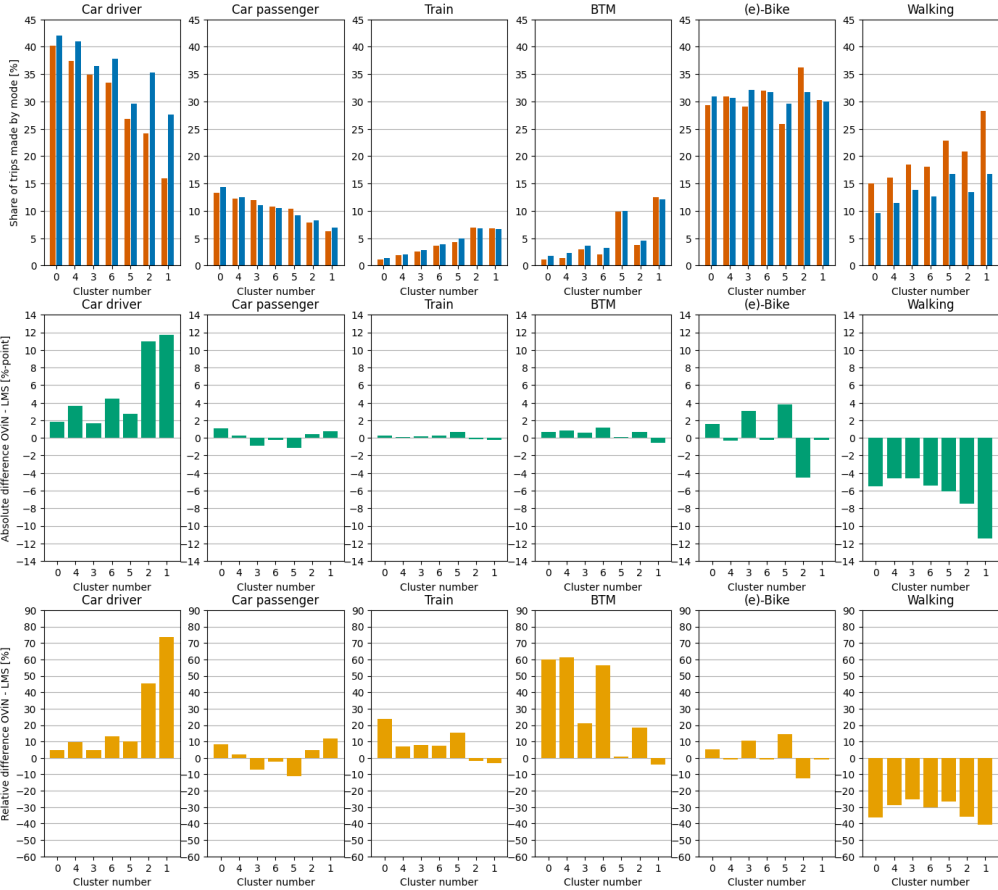
Stedelijkheidsgraad



Gewogen clusterset

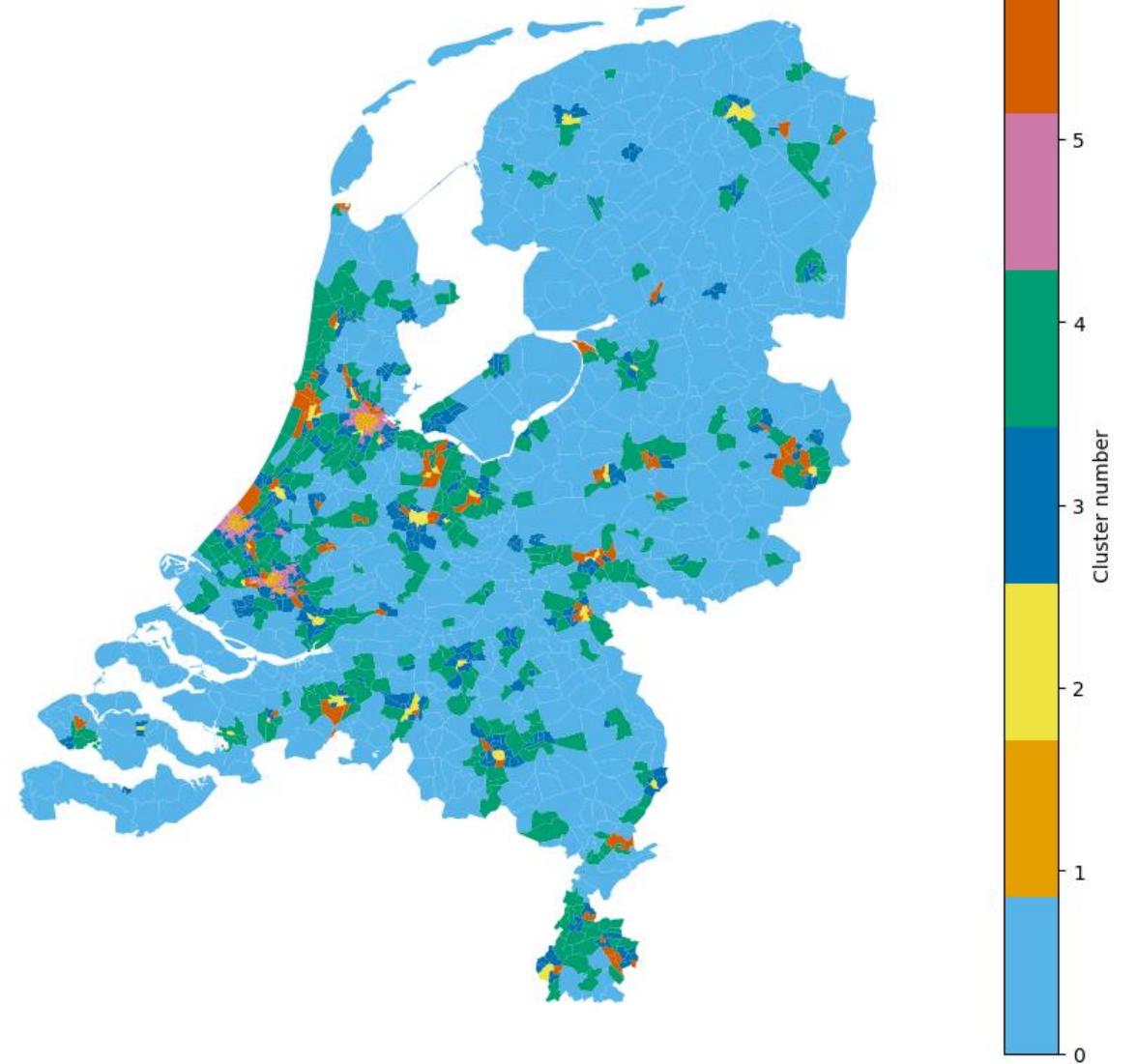
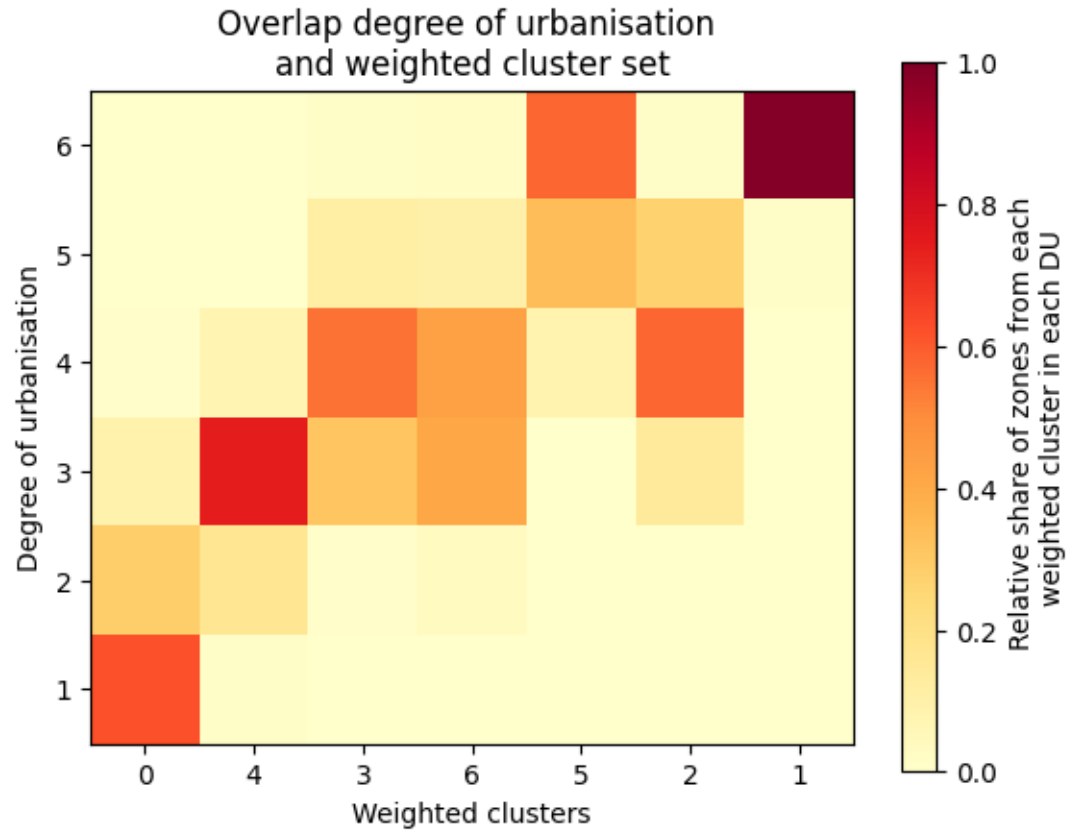
Top: Modal split LMS and OVIn for different clusters
Middle and bottom: Difference OVIn LMS

- OVIn
- LMS
- Absolute difference OVIn LMS
- Relative difference OVIn LMS



Gewogen clusterset

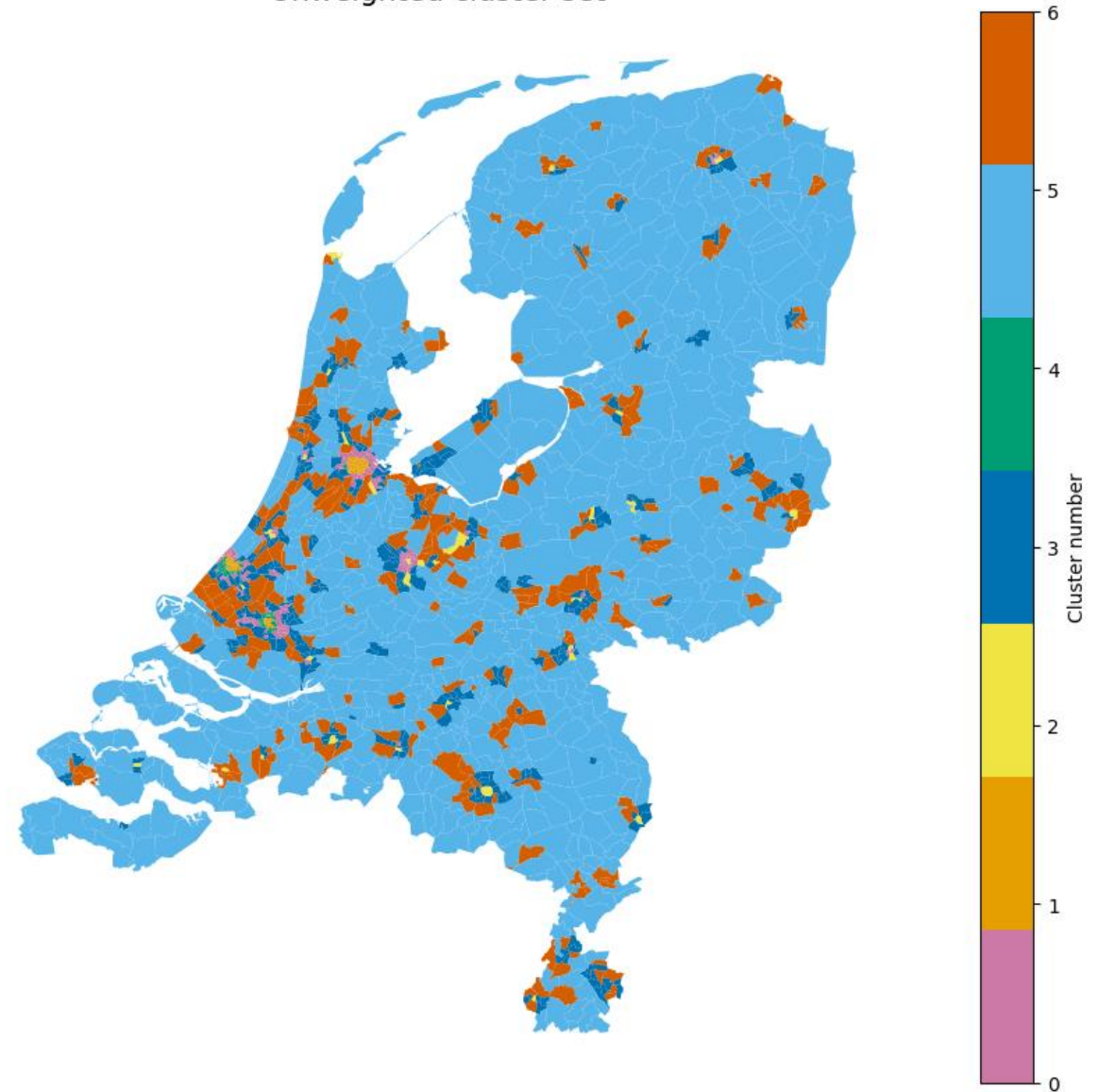
Weighted cluster set



Ongewogen cluster set

D-variable	Variable
Density	Population density
	Population density, including surrounding zones
	Job density, including surrounding zones
Diversity	Share of service land use
Design	Road density
Distance to transit	Number of tram/metro stops
Demand management	Parking fare

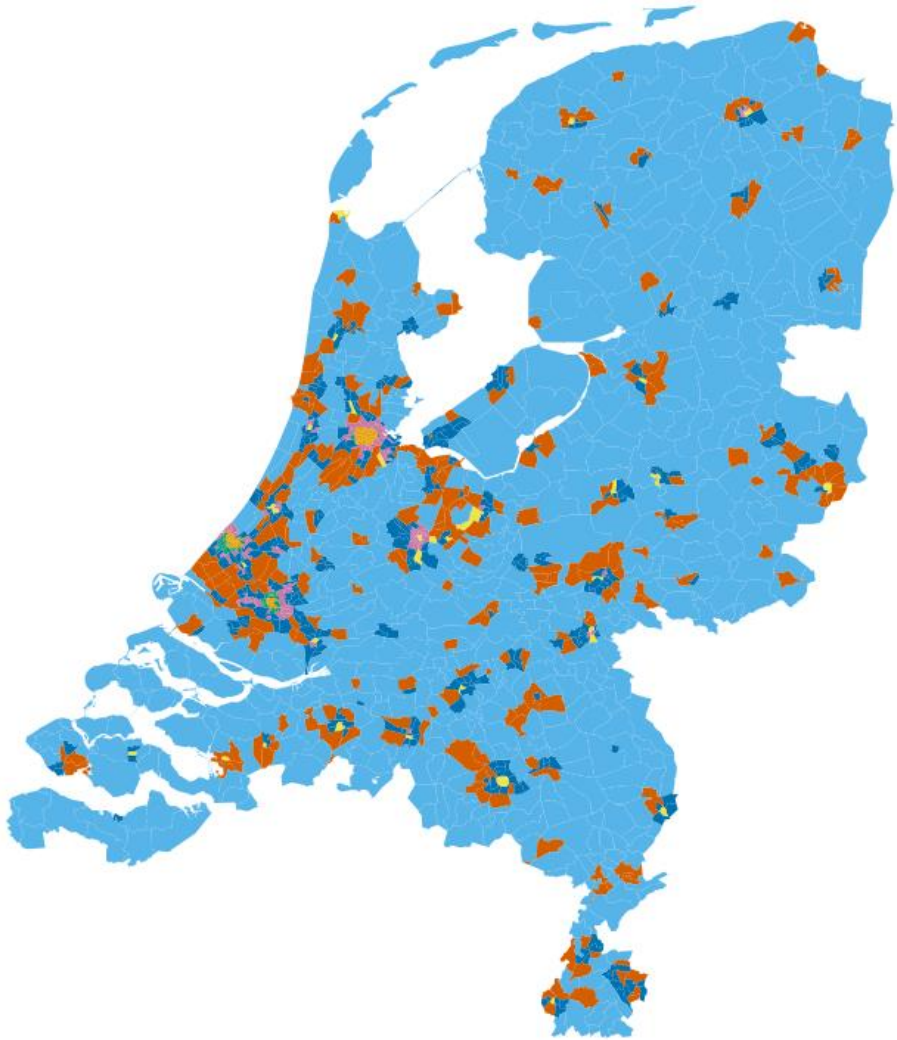
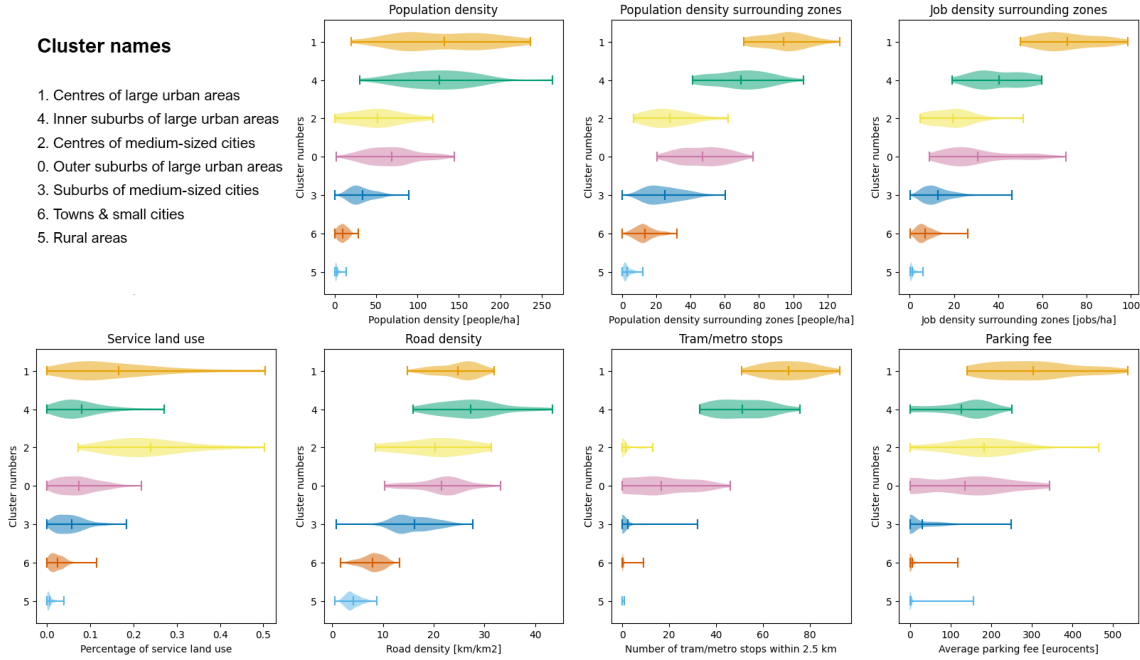
Unweighted cluster set



Ongewogen cluster set

Cluster names

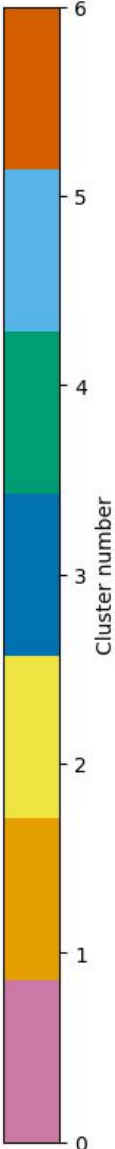
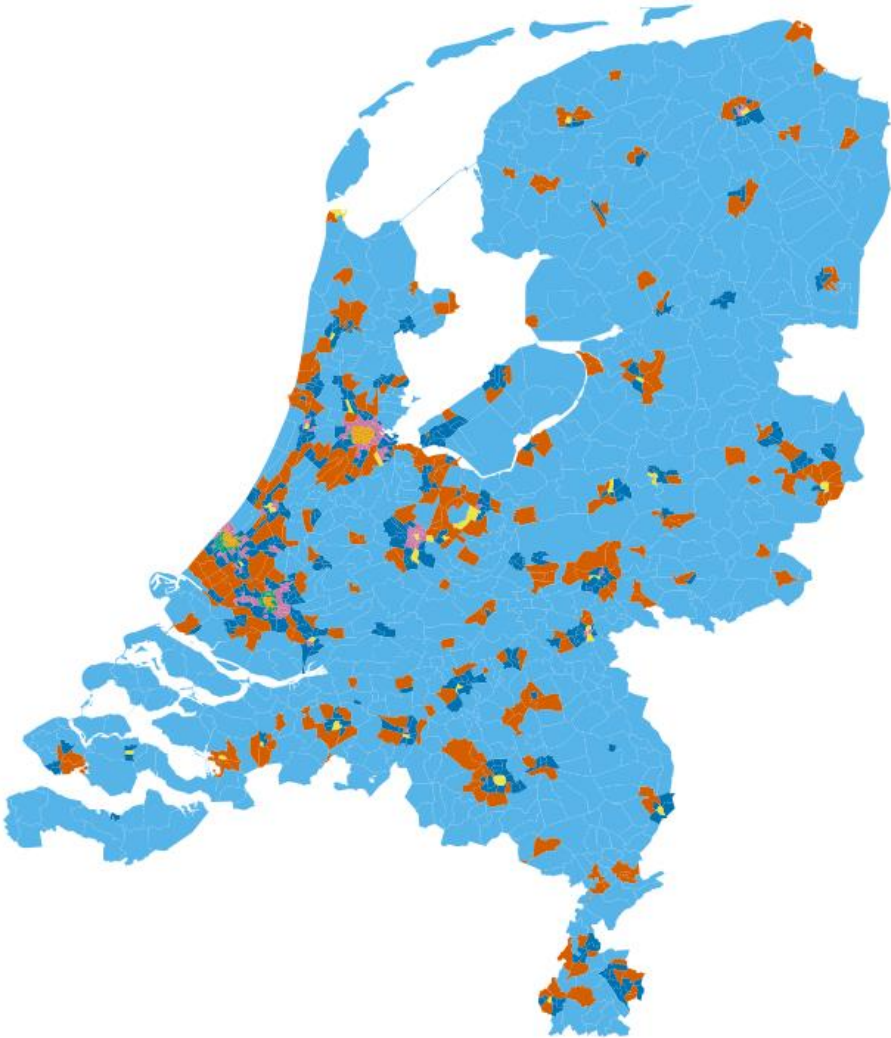
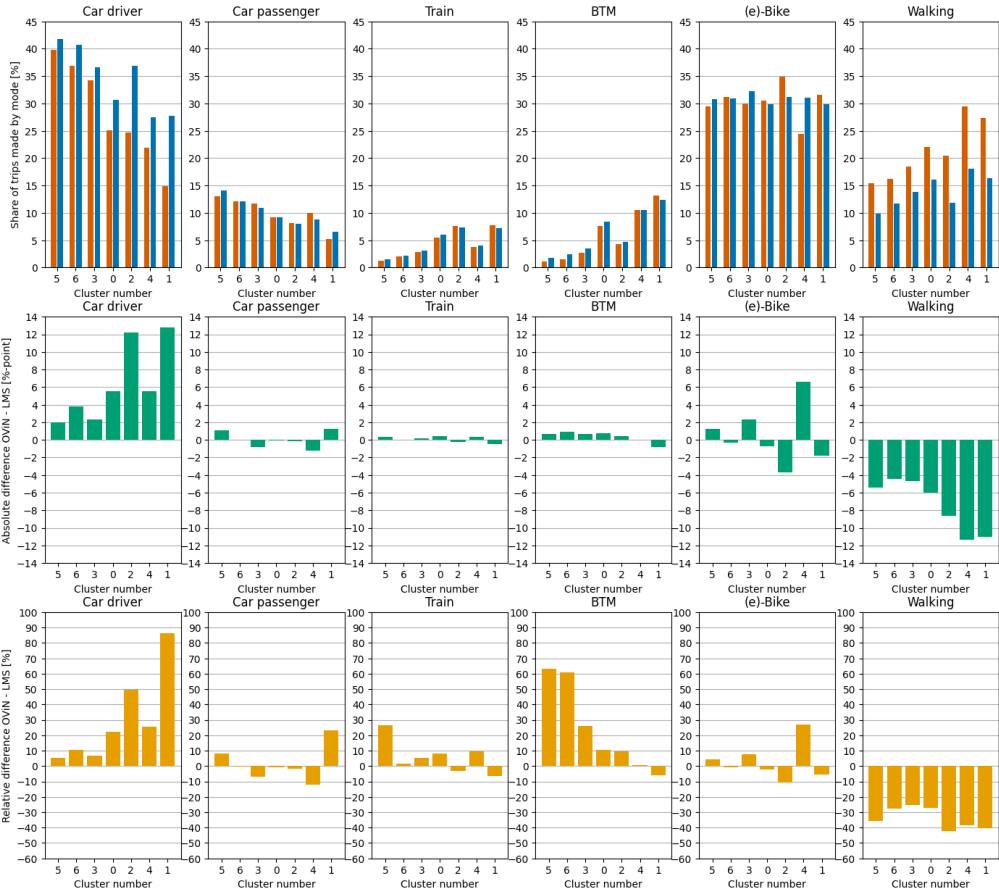
- 1. Centres of large urban areas
- 4. Inner suburbs of large urban areas
- 2. Centres of medium-sized cities
- 0. Outer suburbs of large urban areas
- 3. Suburbs of medium-sized cities
- 6. Towns & small cities
- 5. Rural areas



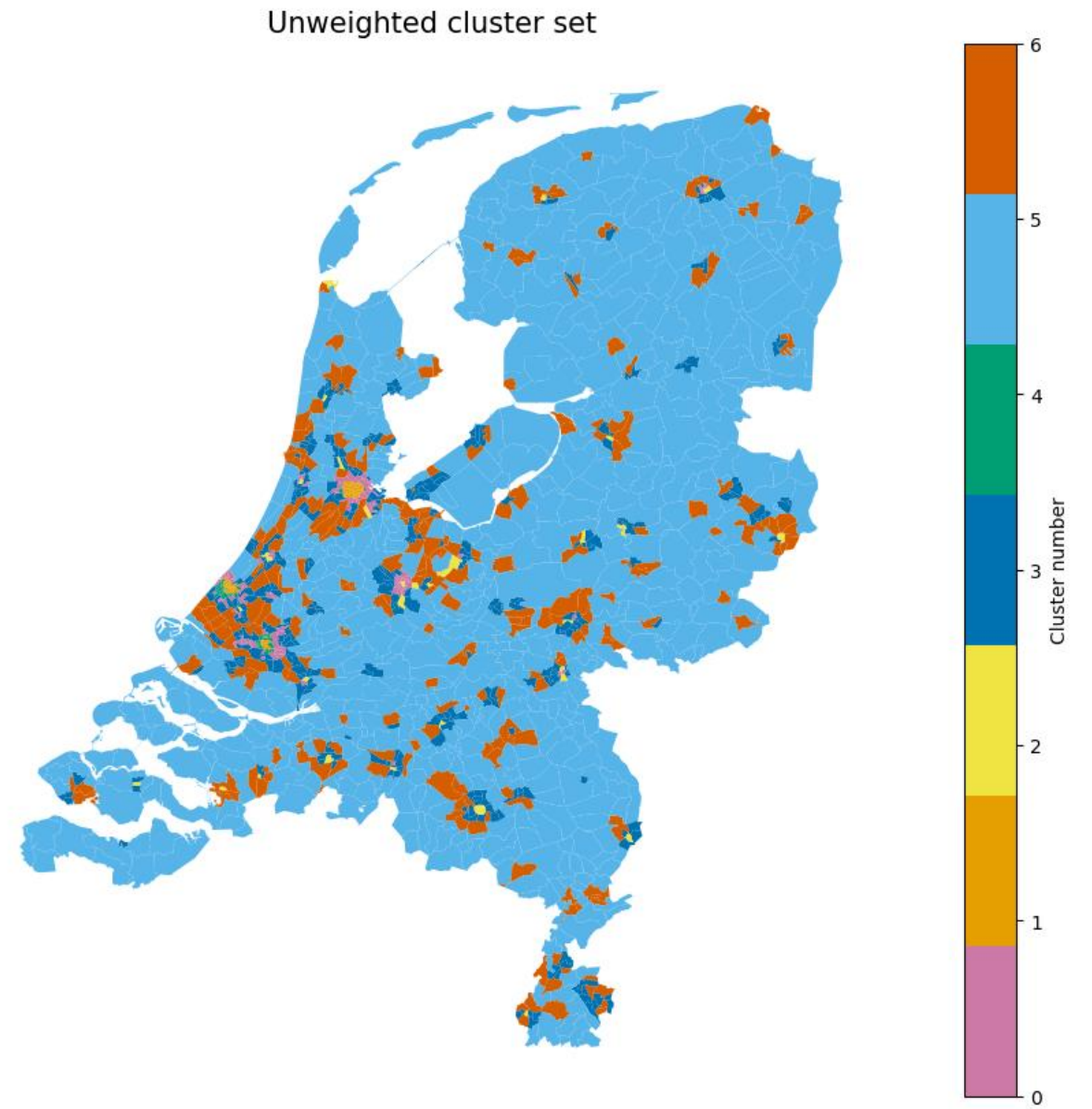
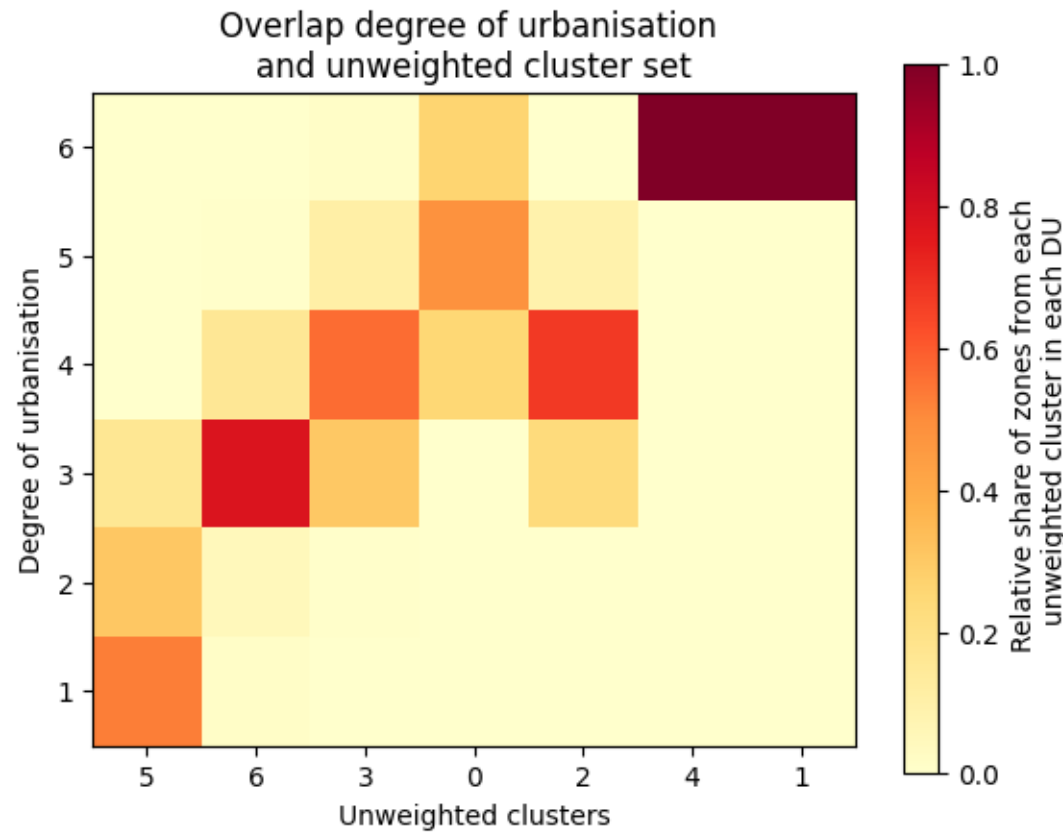
Ongewogen cluster set

Top: Modal split LMS and OVIN for different clusters
Middle and bottom: Difference OVIN LMS

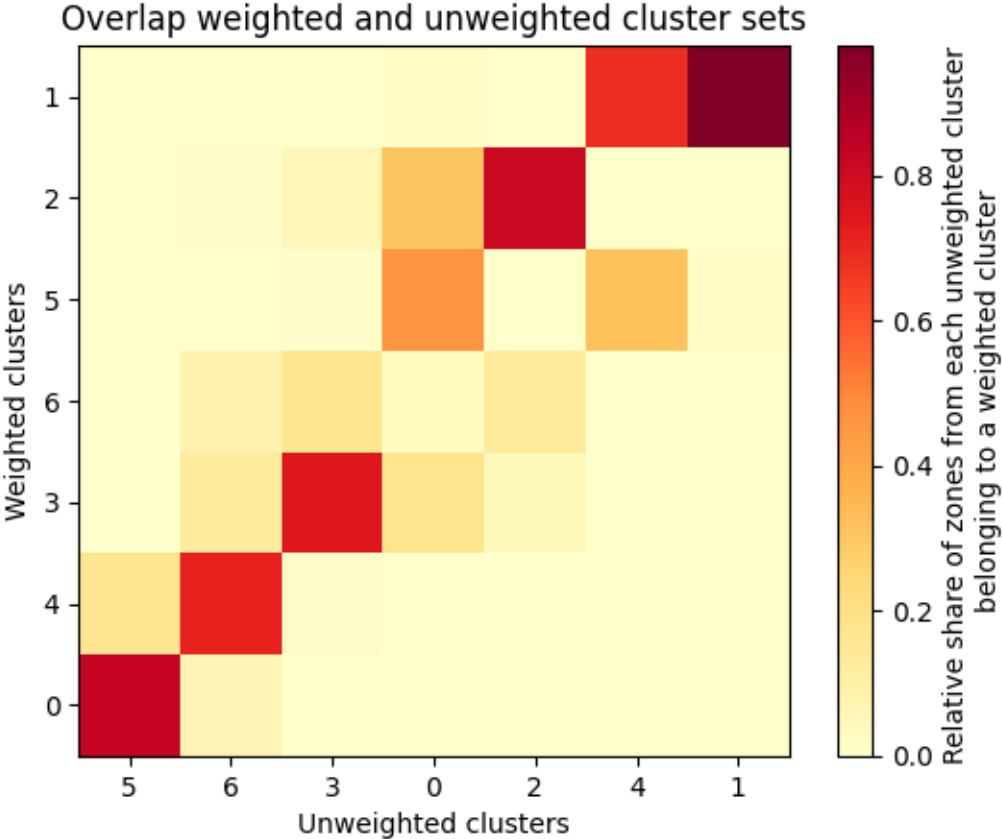
- OVIN
- LMS
- Absolute difference OVIN LMS
- Relative difference OVIN LMS



Ongewogen clusteraset

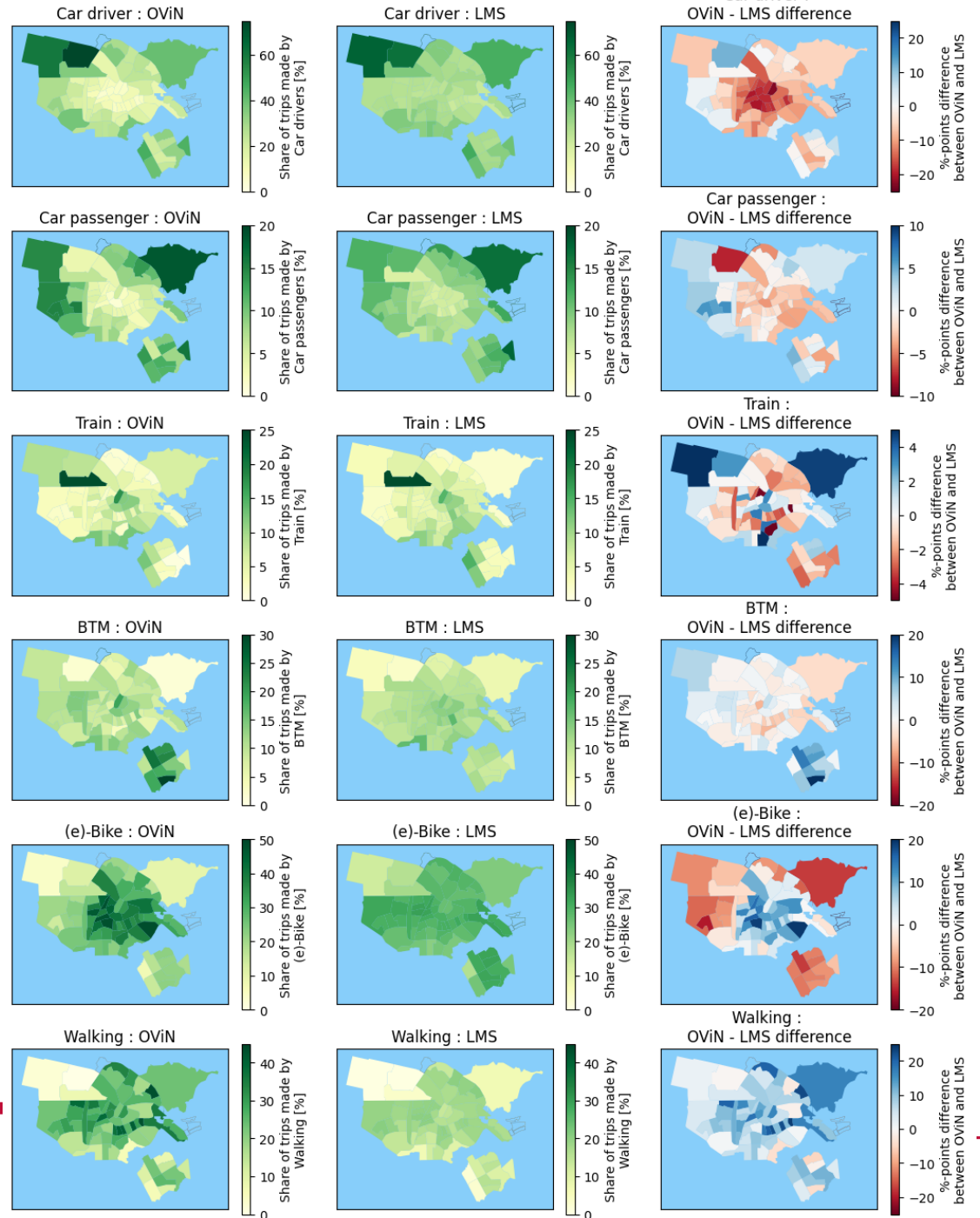
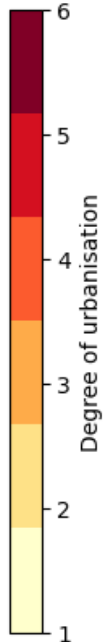
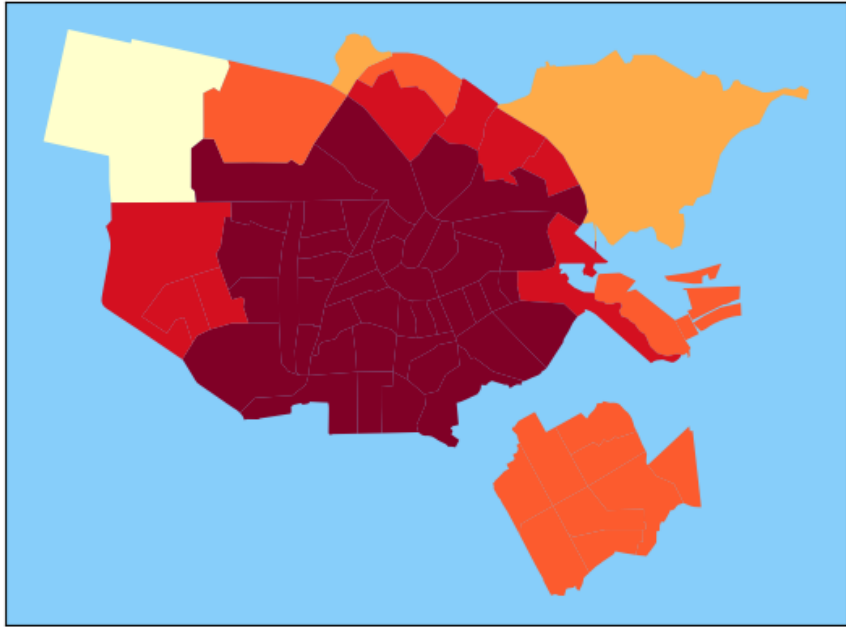


Gewogen vs ongewogen clusteraset



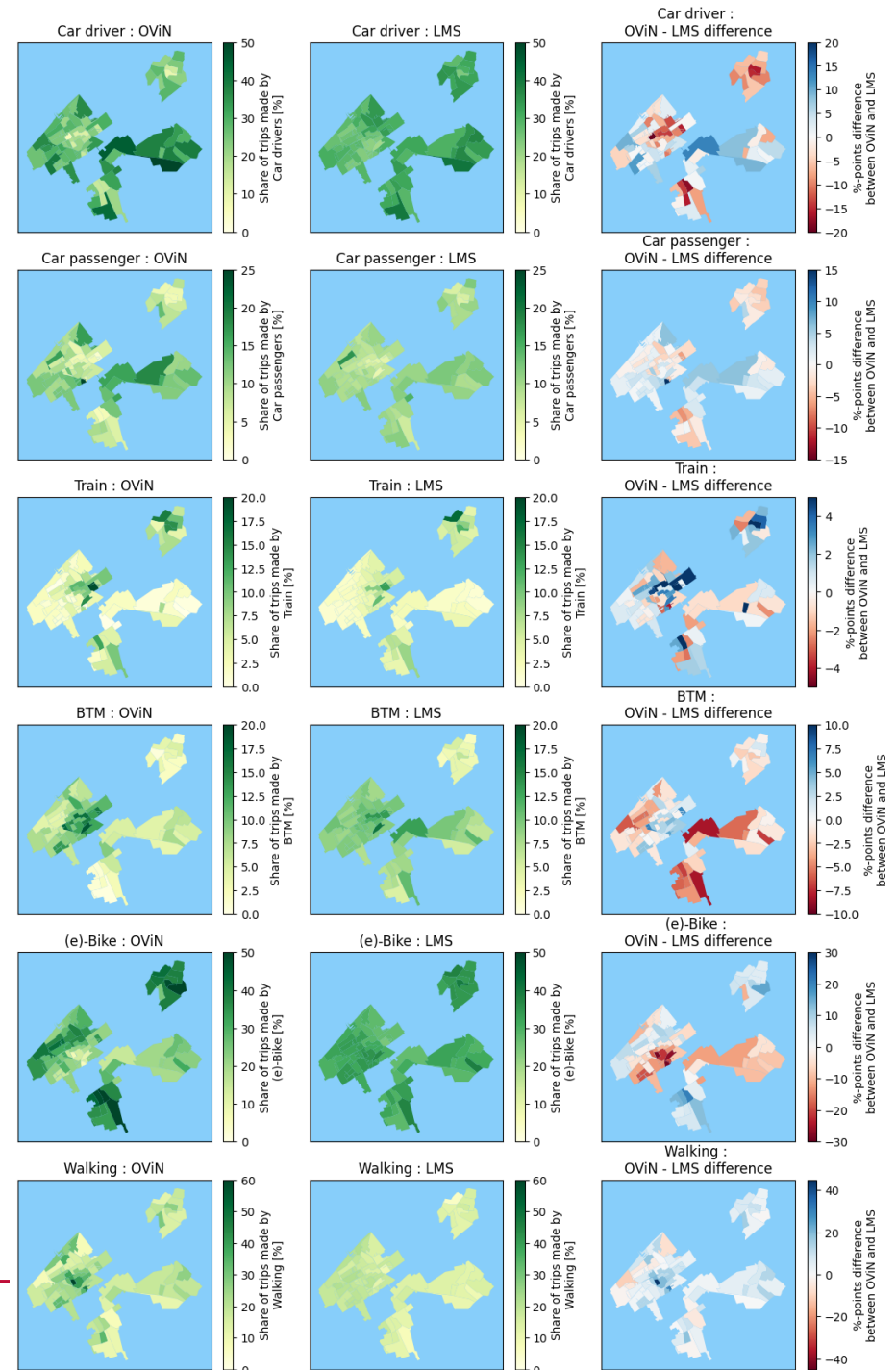
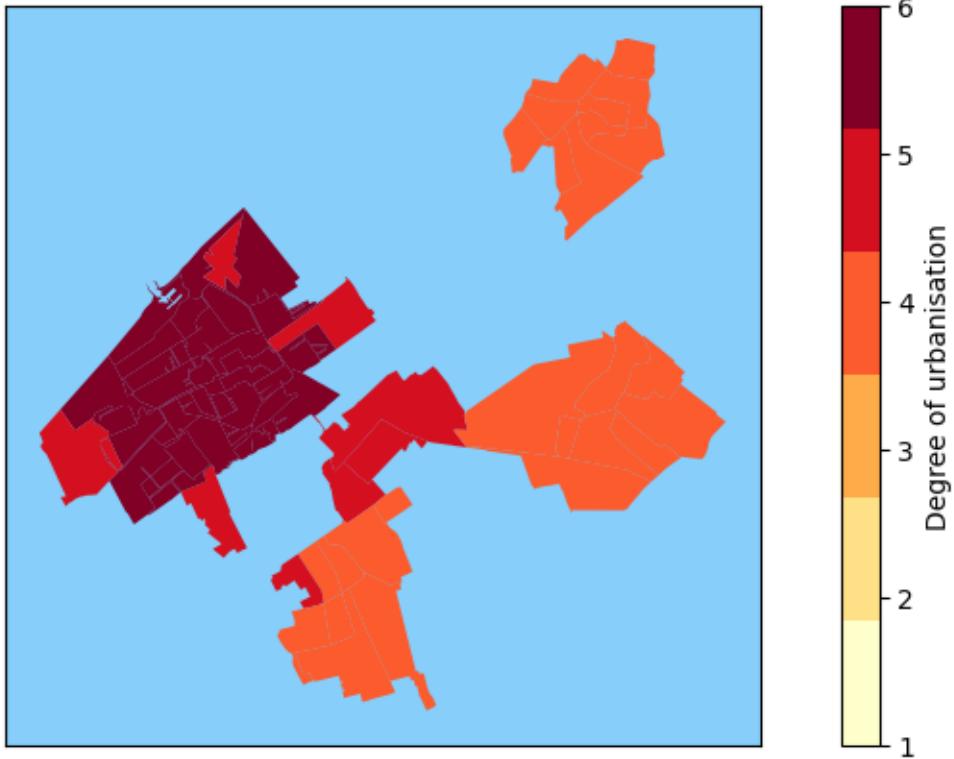
Amsterdam

Degree of urbanisation for Amsterdam



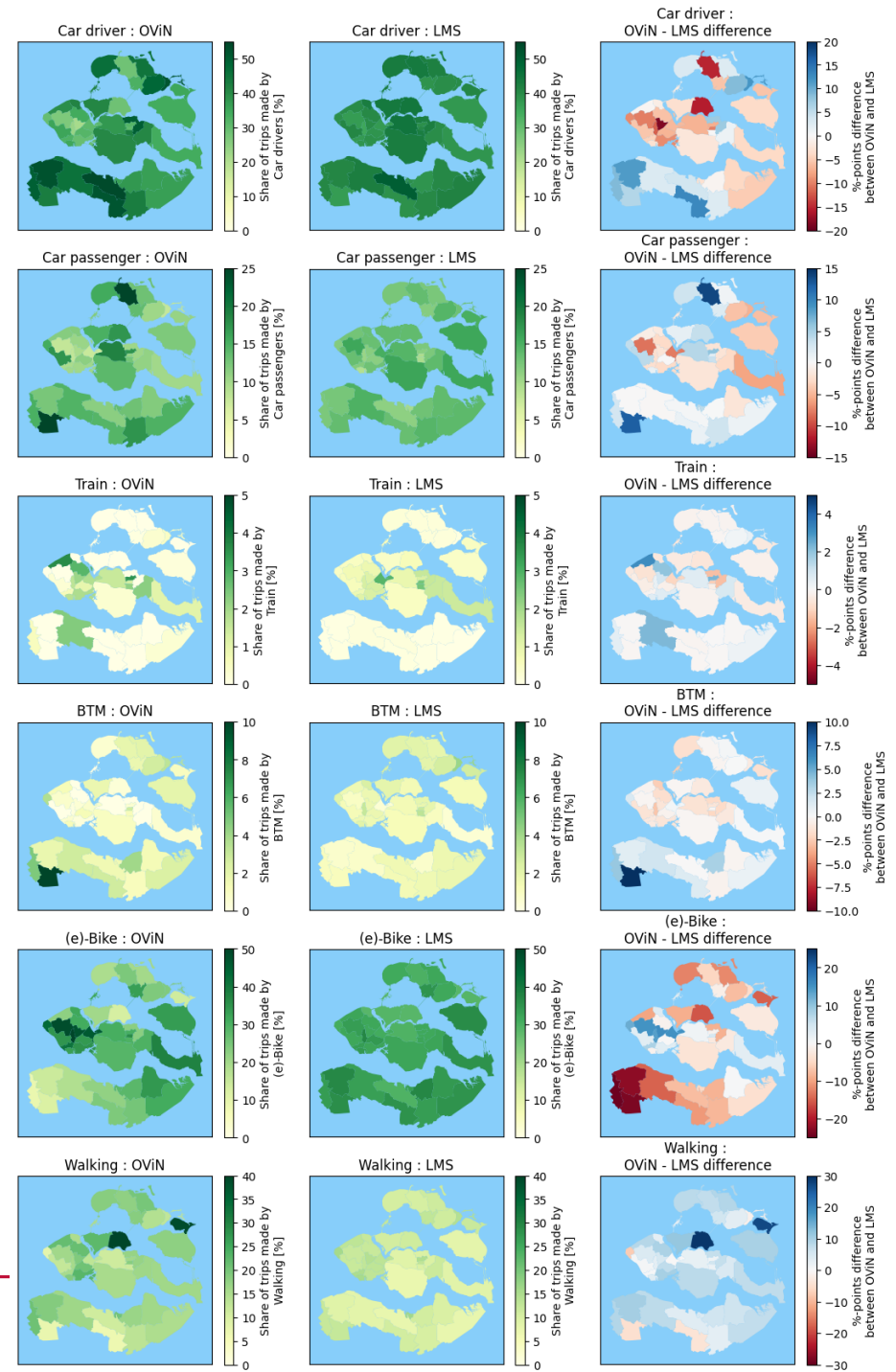
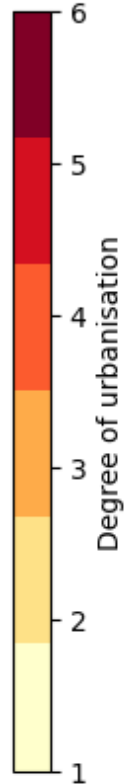
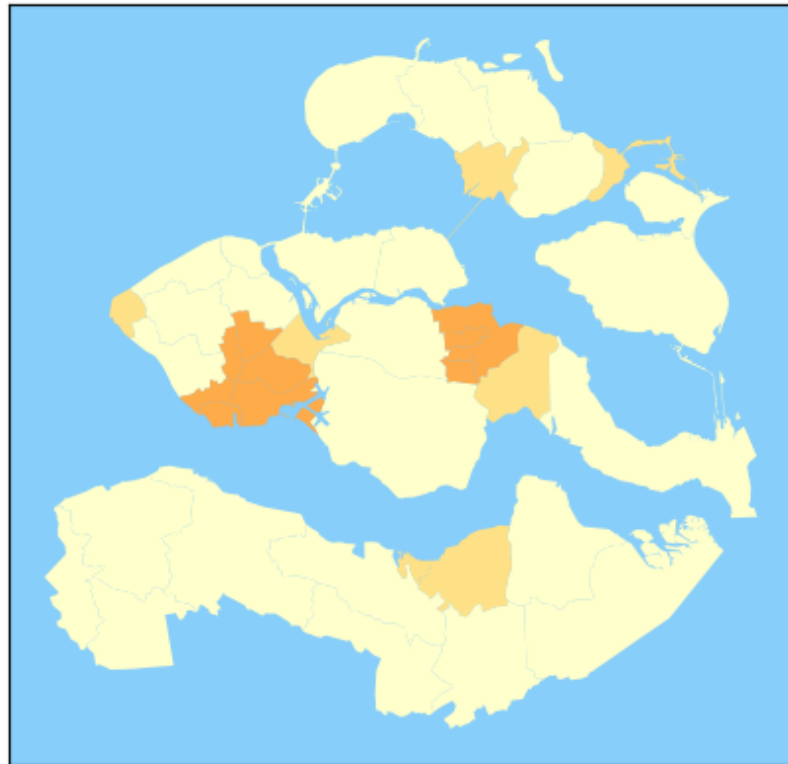
Den Haag, Zoetermeer, Delft, Leiden

Degree of urbanisation for Den Haag, Zoetermeer, Leiden and Delft



Zeeland

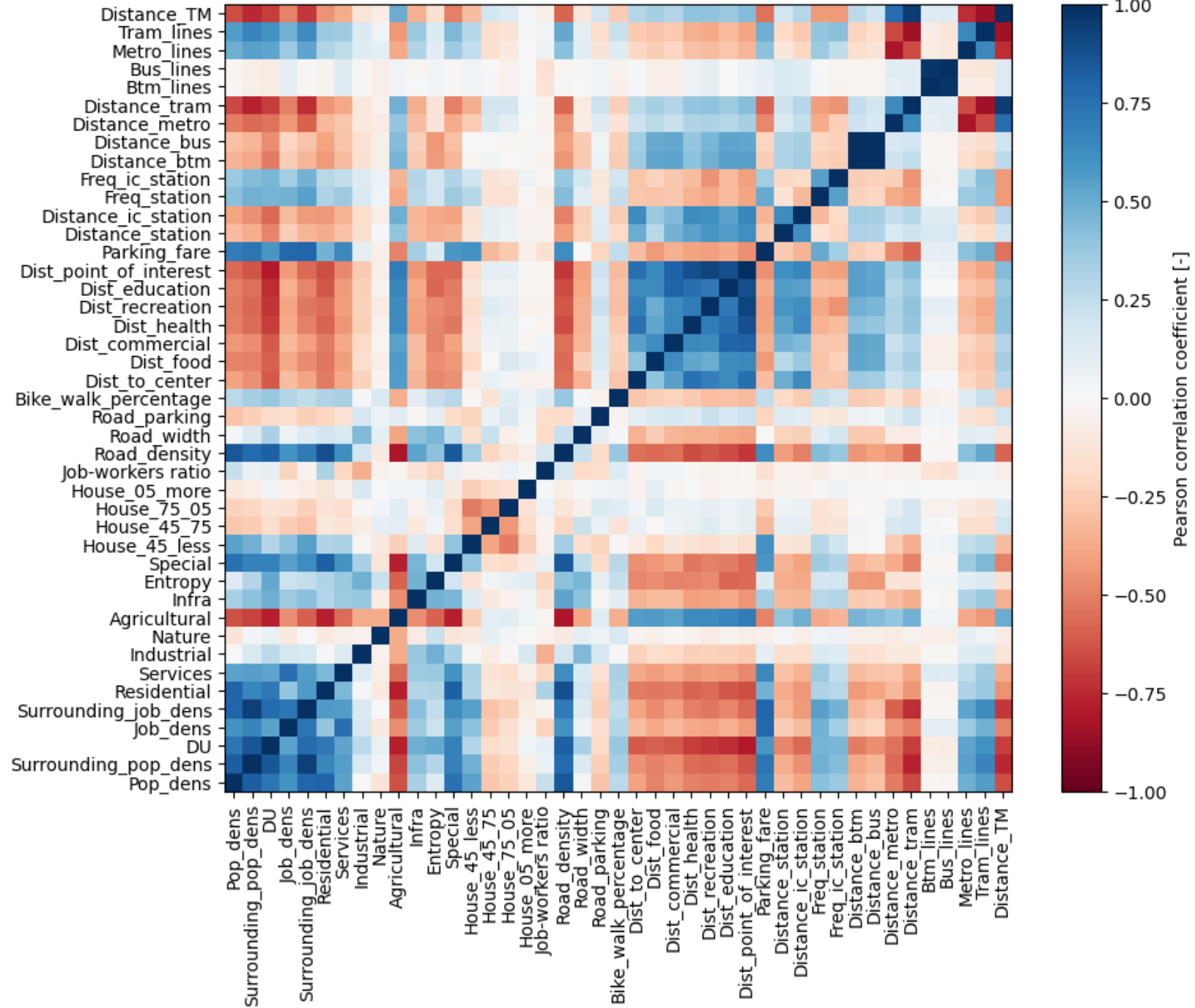
Degree of urbanisation for Zeeland



D-variables	Examples from literature	Variables in the LMS	LMS counts
Density	Population density	Degree of urbanisation	22
	Job density	Population density (including surrounding area)	3
	Address density	Job density (including surrounding area)	4
	Proximity index (Puylaert et al., 2022)	Job density detail sector	2
		DU in combination with demographic variable	2
Diversity	Entropy measure (Kockelman, 1997)	Ratio of agriculture jobs	1
	Land use diversity indices (Limtanakool et al., 2006; Harts et al., 1999)	Share of high educated work	4
	Historical development city (Van De Coevering & Schwanen, 2006)		
	Job to workers ratio Ewing and Cervero, 2010		
Design	Road network density (Sung & Eom, 2024)		
	Road ratio (Sung & Eom, 2024)		
	Road width (Sung & Eom, 2024)		
	Intersection density (Ewing & Hamidi, 2015)		
	Height-width ratio (L. Liu et al., 2023)		
	Continuity street wall (L. Liu et al., 2023)		
Destination accessibility	Distance to city centre (Næss et al., 2017)	Number of jobs in several sectors	4
	Average distance to points of interest (Thao & Ohnmacht, 2020)	Number of student places in special education	1
Distance to transit	Distance to transit stops (Ewing & Cervero, 2010)	Distance (to and of) access and egress for several modes	9
	Frequency of transit (Kent et al., 2023)	Ratio parking places station bike/car to frequency station	3
	Quality network (Kent et al., 2023)	Access and egress constants	16
	Development transit network (Sung & Eom, 2024)	Transfer penalties and waiting times	5
Demand management	Parking restriction (Kent et al., 2023)	Parking fare	4
	Parking fare (Kent et al., 2023)	Parking permits	2
	Commuter allowance (Sung & Eom, 2024)		
other		logsum: measure of accessibility of a zone	1
		Distance coefficients	7
		Accessibility of OD pairs	

Correlatie D-variablen

Correlation matrix based on pearson correlation coefficient



ProRail

ATE - OBE ratios

	Weighted cluster set			Unweighted cluster set			Degree of urbanisation		
	Average	Min	Max	Average	Min	Max	Average	Min	Max
Car driver	0.65	0.34	1.00	0.62	0.33	1.02	0.51	0.39	0.69
Car passenger	0.60	0.45	0.85	0.61	0.34	1.06	0.51	0.31	0.64
Train	0.56	0.35	0.78	0.55	0.33	0.75	0.49	0.32	0.69
BTM	0.81	0.5	1.23	0.83	0.47	1.33	0.78	0.54	0.90
Bike	1.03	0.58	1.51	1.05	-0.99	2.34	1.07	-2.03	3.34
Walking	0.83	0.52	1.13	0.81	0.54	1.27	0.83	0.76	0.96

SMD Gewogen clusteraset

A: Age; B: Gender; C: Income; D: Household size; E: 1 person household; F: 2+ person household; G: 1 parent household; H: Part time worker; I: Full time worker; J: Student; K: Primary education or less; L: lbo, vmbo; M: mbo, havo, vwo; N: other education; O: Younger than 15; P: Number of household cars; Q: Driver's licence; R: Student OV

