Identifying, mapping and modelling trajectories of neighbourhood poverty in metropolitan areas: The case of Montreal

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Neighbourhood impoverishment: Two types of explanations

1) **Features of the built environment**: obsolescence of some architectural styles or types of residential environment and valorisation of others (Gribsby et al., 1987; Knox et McCarty, 2005)

- Housing in inner city neighbourhoods (1960's, 1970's) **(urban decline)**
- The typical small bungalow in inner suburbs (1990's, 2000's) **(suburban decline)**
- Lower maintenance and investment in obsolete housing structures, notably among landlords (Knox et McCarthy, 2005; Dansereau et L'Écuyer, 1987).

Neighbourhood impoverishment: Two types of explanations

2) Socio-demographic characteristics: precariousness of individuals living in the neighbourhood or change in the composition of households (mobility) (Kitchen et Williams, 2009; Lee, 2009; Lee et Leigh, 2007; McConville et Ong, 2003; van Ham et Clark, 2009)

Notion of population 'at-risk' of poverty, based on their socio-demographic characteristics, e.g. low education, unemployment, lone parents, older adults, one-person household, recent immigrants, etc. (Noble et al. 2006)

→ Both types of explanations are interdependent

Types of neighbourhood trajectories:

→ Improvement

- **Gentrification** of some central city areas: young professionals, highly educated population, higher income (Ley, 1986 et 1992; DeGiovanni, et Paulson, 1984; Alonso 1980)

→ Decline – filtering down

- Impoverishment due to incoming of 'at-risk' population in middle class inner suburbs (Cooke and Marchant, 2006; Lee et Leigh, 2007; McConville et Ong, 2003)

→ Stability

- Persistently poor neighbourhoods (same levels of poverty through time)

Research objectives

Objective I : Identifying, describing and mapping trajectories of relative poverty concentration in Montreal over a 20-year period, from 1986 to 2006.

Objective II : Modelling the identified trajectories according to:

-socioeconomic characteristics of the population within census tracts (CTs) at the start of the period (1986);

-socioeconomic changes between 1986 and 2006.

Data and Methods

- Poverty measured using LICO (before tax)

Census year	1986	1991	1996	2001	2006
Total population	2,826,270	3,019,350	3,125,545	3,208,860	3,363,975
Low-income Population	609,175	666,680	863,745	723,670	728,220
%	21.55	22.08	27.64	22.55	21.65

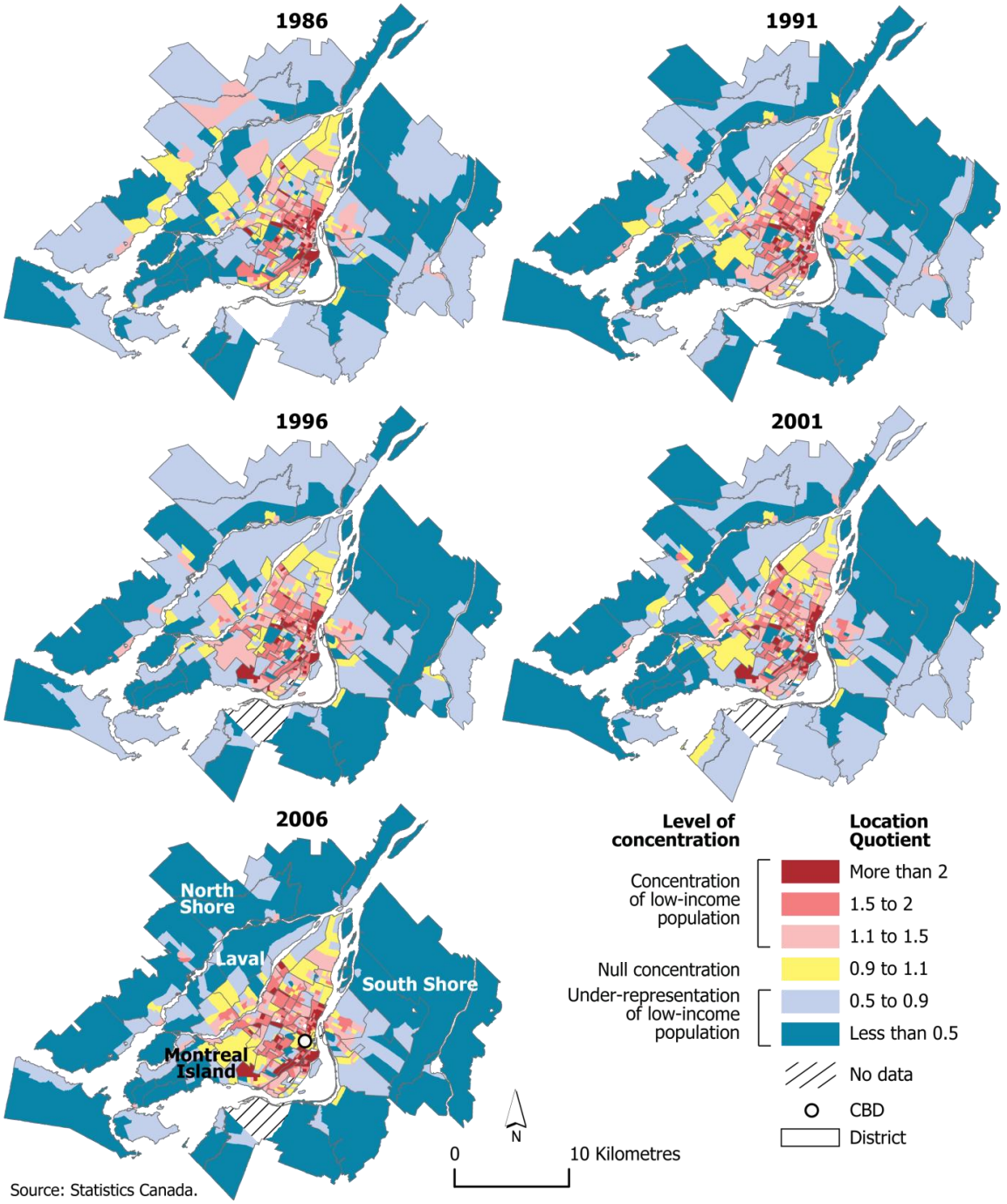
- Relative concentration of poverty: **Location quotient**

$$LQ_i = (x_i / z_i) / (X / Z)$$

Where:
x_i= low income pop. in the census tract *i*;
z_i= total pop. in the census tract *i*;
X= Total low income pop. in the CMA;
Z= Total pop. in the CMA.

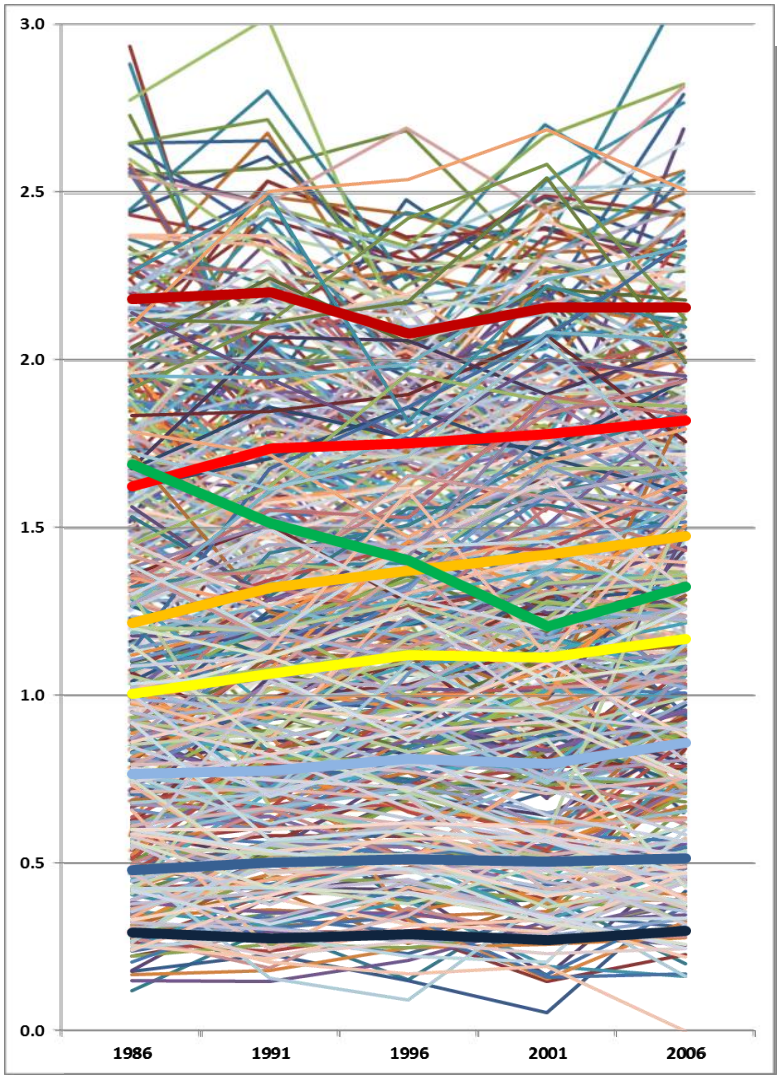
- Census tracts (n=611)
  - Boundaries harmonised across census years.

Evolution of relative deprivation levels in the Montreal CMA 1986-2006



Identifying trajectories of relative poverty concentration: K-means clustering

K-means clustering	
Approaches to classification	Use of allocation/re-allocation algorithm (and ad-hoc distance measure) to optimally reassign objects to nearest cluster centre.
Identification of number of optimal clusters	Lowest average distance to cluster centre; cubic clustering criterion; pseudo-F statistic.
Types of variables and standardization	Interval scale and dichotomous variables for which Euclidean distance measures can be calculated. Variables 'must' be standardized.

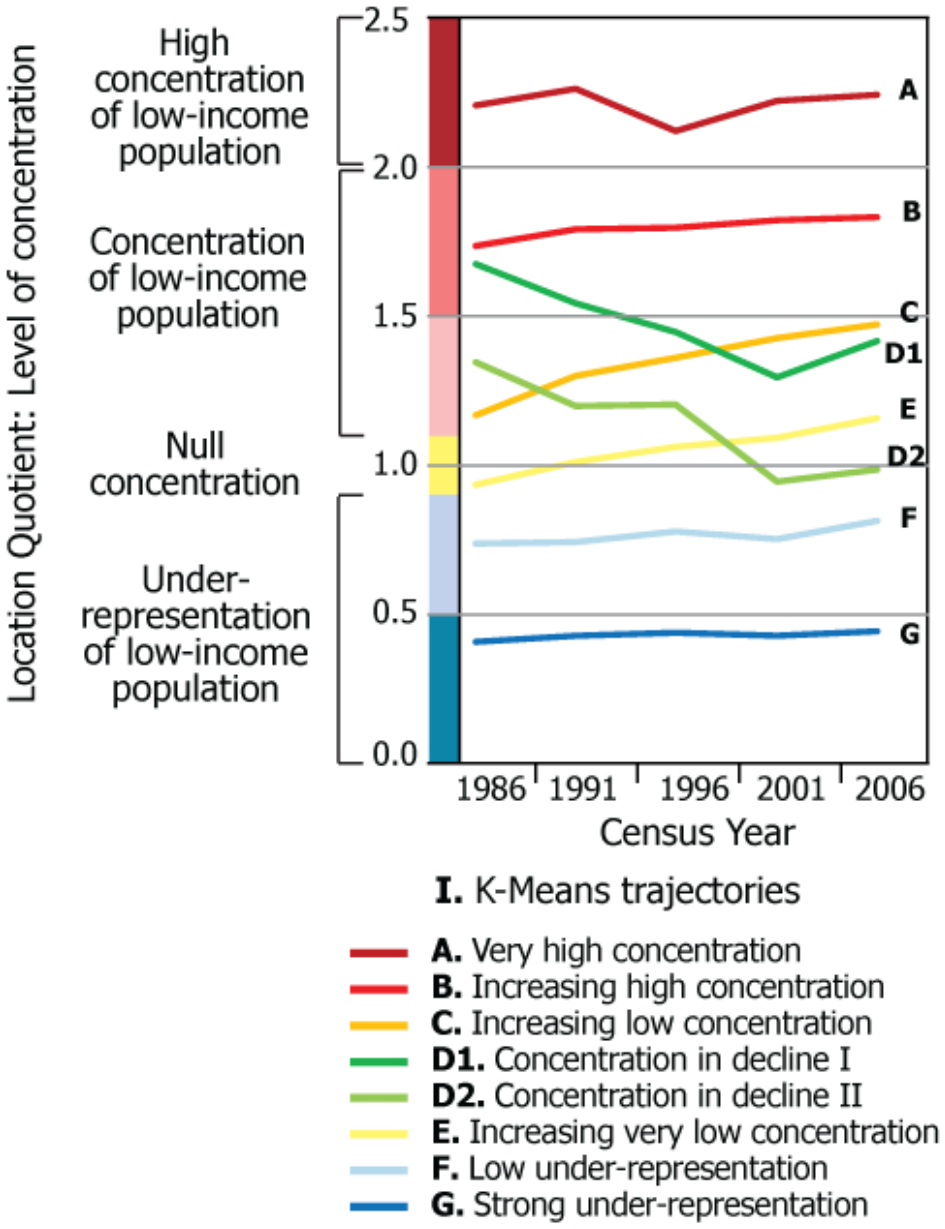


Modelling trajectories of relative poverty concentration

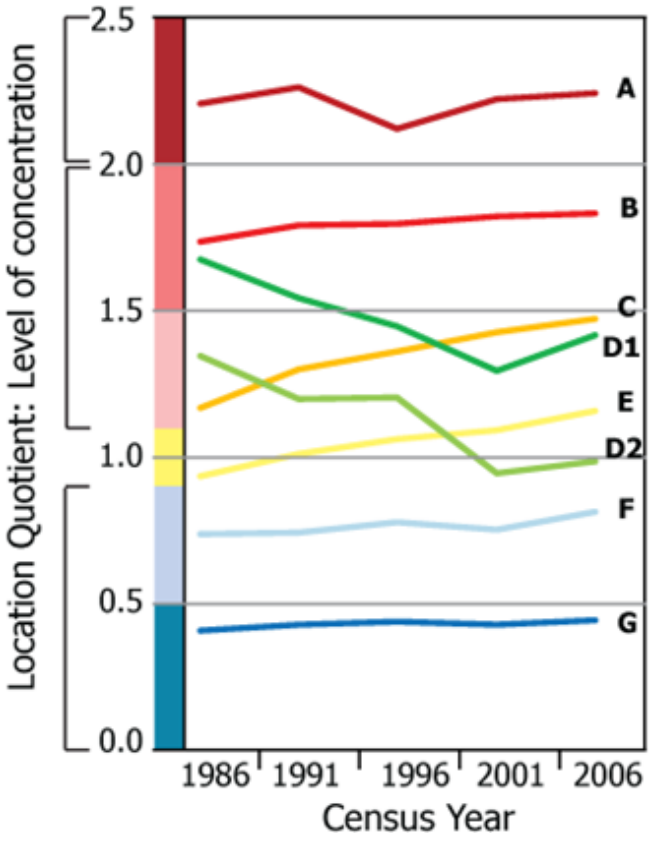
- ***Dependent variable:*** Trajectories as a categorical (nominal) variable obtained by the K-means clustering
- ***Independent variables:*** Baseline 1986 and 1986-2006 change (variation)
- ***Model:*** Multinomial logistic regression

Census year	1986	1991	1996	2001	2006
Unemployment (%)	11.32	11.69	11.22	7.52	7.01
Lone parent families (%)	15.92	15.73	17.55	18.23	18.24
One-person household (%)	25.31	27.34	29.55	31.19	31.99
People aged ≥ 65 years (%)	9.26	10.26	11.09	11.97	12.7
Recent immigrants (%)	1.27	2.73	4.21	3.46	4.77
Population without diploma (%)	39.76	34.96	31.51	25.87	17.59
University education (%)	20.74	13.42	26.05	26.27	29.52
Renters (%)	55.54	53.65	52.19	50.45	47.51

Results I. Identifying trajectories of relative poverty concentration

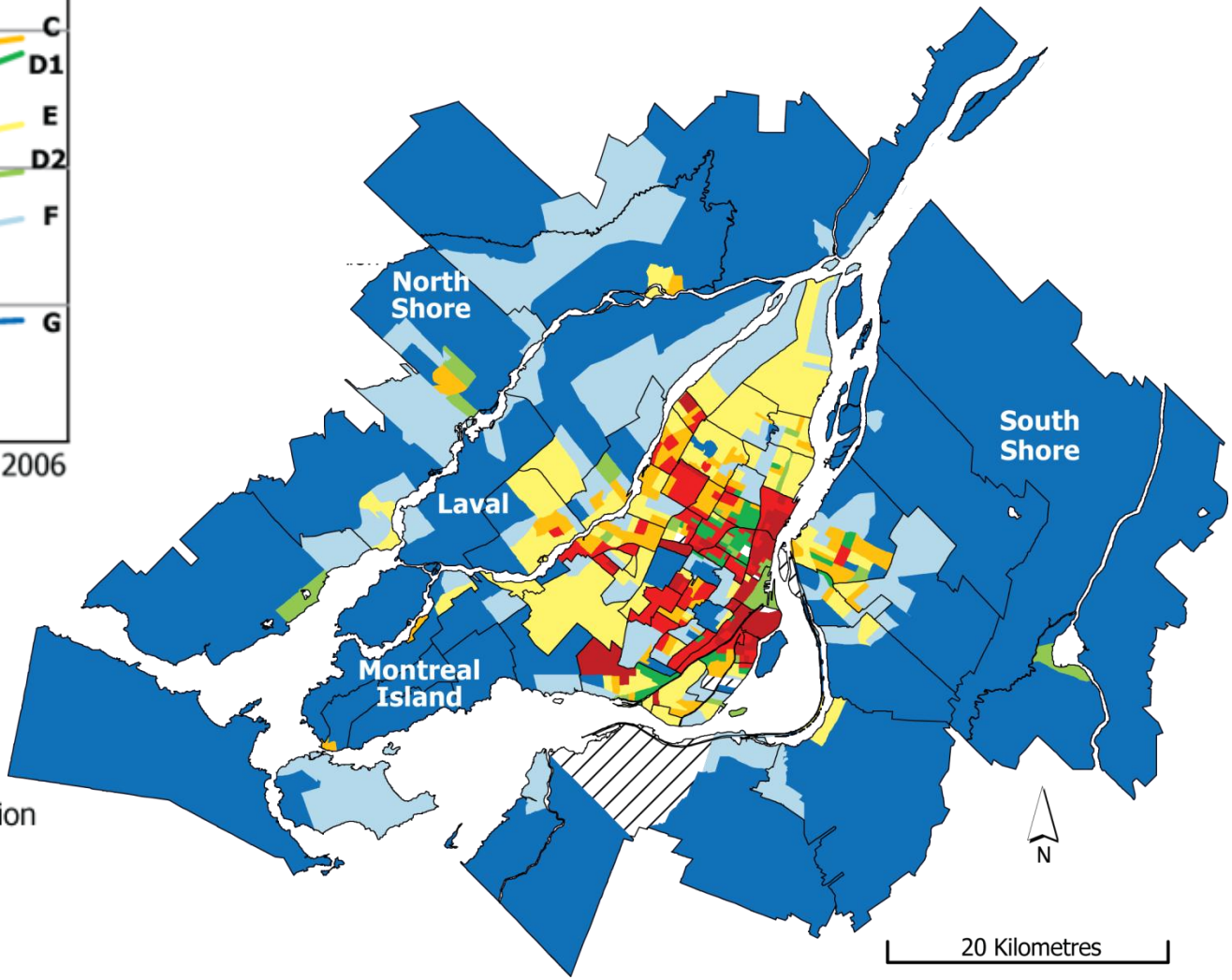


Results I.
Identifying trajectories of relative poverty concentration



I. K-Means trajectories

- **A.** Very high concentration
- **B.** Increasing high concentration
- **C.** Increasing low concentration
- **D1.** Concentration in decline I
- **D2.** Concentration in decline II
- **E.** Increasing very low concentration
- **F.** Low under-representation
- **G.** Strong under-representation



Results II.
Modelling trajectories of poverty

I. K-Means trajectories

- **A.** Very high concentration
- **B.** Increasing high concentration
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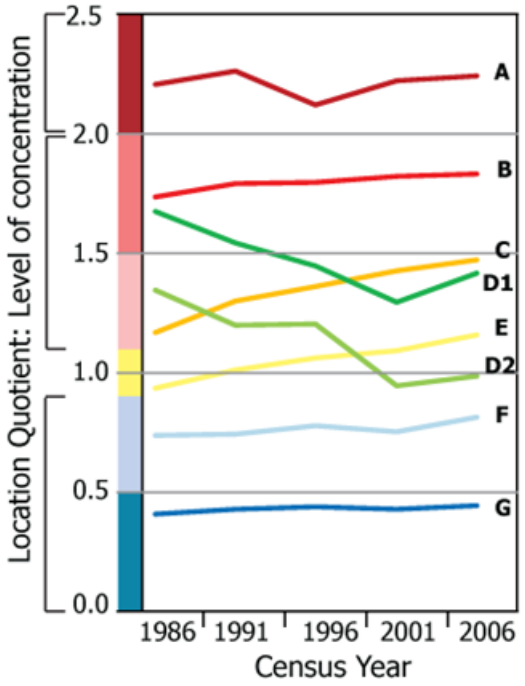
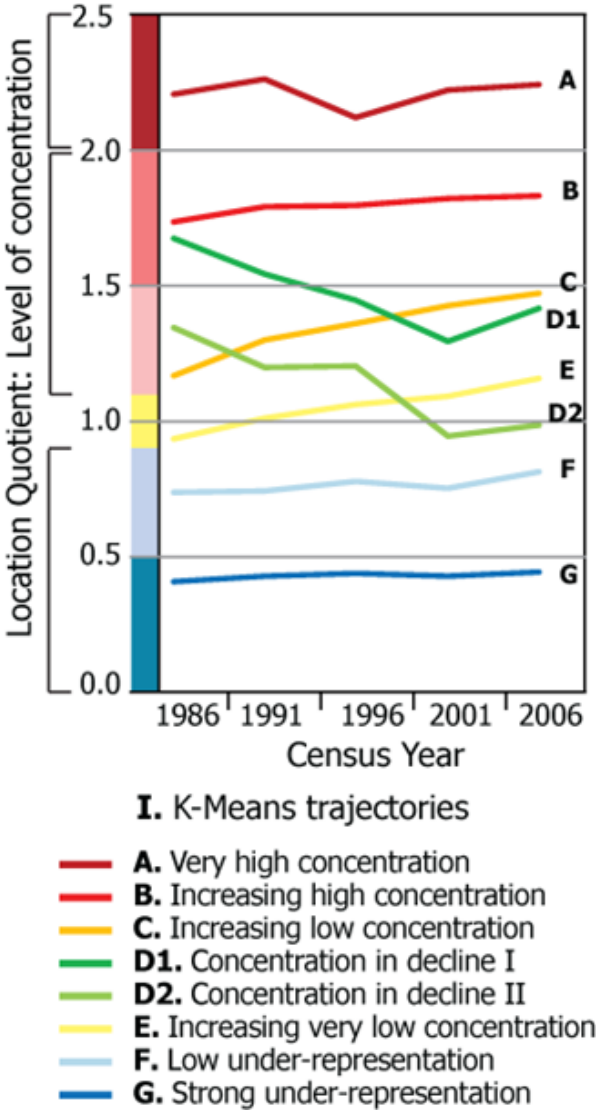


Characterisation of the trajectories in 1986

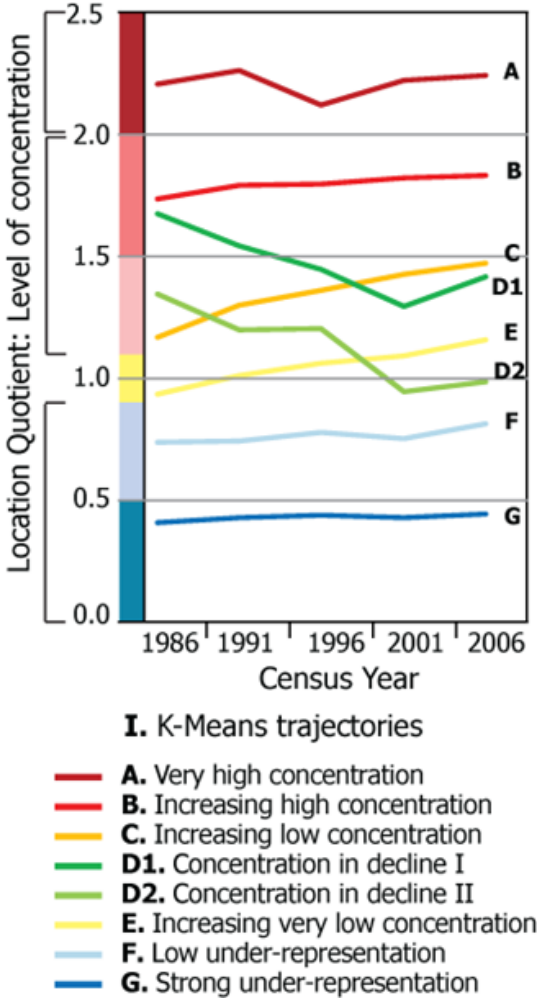
Trajectories*	A	B	C	D1	D2	E	F	G
Census tracts (N)	65	82	75	47	26	85	96	135
%	10.64	13.42	12.27	7.69	4.26	13.91	15.71	22.09
1986 (Z-Score except LQ)								
Location quotient	2.21	1.73	1.17	1.68	1.35	0.93	0.73	0.41
Unemployment	1.58	0.77	0.04	0.74	0.11	-0.30	-0.60	-0.91
Lone parent families	1.53	0.79	0.15	0.79	0.29	-0.23	-0.53	-1.10
One-person household	0.93	0.67	0.21	0.81	0.33	-0.08	-0.39	-1.00
65 years and older	0.27	0.20	0.28	0.25	0.15	0.11	0.03	-0.62
Recent immigrants	0.74	0.74	-0.02	-0.02	-0.28	-0.19	-0.29	-0.41
Pop. without diploma	1.10	0.51	0.32	0.39	0.17	0.02	-0.39	-0.91
University education	-0.43	-0.15	-0.30	0.01	-0.10	-0.17	0.13	0.49
Renters	1.12	0.89	0.47	0.79	0.30	0.10	-0.48	-1.40

Multinomial logistic regression: Most significant predictors of trajectories



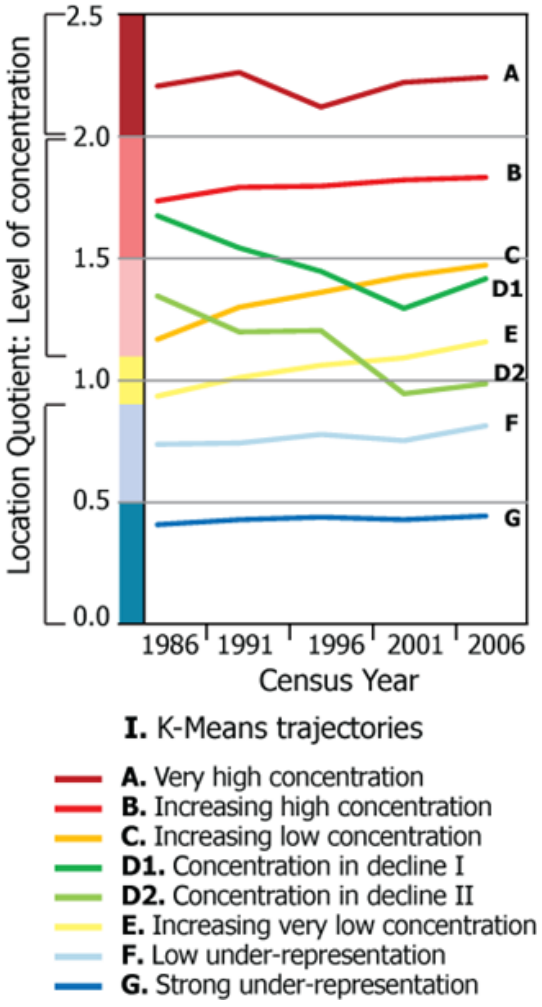
Most significant predictors	Wald χ^2	Pr
% Pop without diploma, 1986	83,04	<0,001
% Unemployment, 1986	63,83	<0,001
% Lone parent families, 1986	59,54	<0,001
% Recent immigrants, 1986	56,25	<0,001
% Recent immigrants, variation 1986-2006	47,93	<0,001
% Renters in 1986	43,34	<0,001
% Pop without diploma, variation 1986-2006	42,21	<0,001
% Pop with university in 1986	37,75	<0,001
% Unemployment, variation 1986-2006	36,69	<0,001
% One-person households in 1986	34,89	<0,001
% 65 years and older in 1986	22,29	0,002
% 65 years and older, variation 1986-2006	15,78	0,027
Model fit statistics		
AIC	830,481	
BIC	1232,255	
R2 (Cox et Snell)	0,947	
R2 (Nagelkerke)	0,964	

Final multinomial logistic model: Baseline 1986 predictors (reference: trajectory G)



	Unemployment		Recent immigrants		One-person household		University education	
	Coeff	Pr.	Coeff	Pr.	Coeff	Pr.	Coeff	Pr.
A	3.44	<0.001	5.86	<0.001	0.67	<0.001	0.53	0.003
B	2.69	<0.001	5.28	<0.001	0.43	0.001	0.15	0.260
C	2.03	<0.001	4.24	<0.001	0.34	0.005	-0.05	0.643
D1	2.32	<0.001	4.51	<0.001	0.38	0.003	0.08	0.518
D2	1.46	<0.001	3.66	<0.001	0.29	0.020	-0.28	0.022
E	1.41	<0.001	3.65	<0.001	0.27	0.018	-0.20	0.034
F	0.36	0.104	3.05	<0.001	-0.07	0.382	-0.22	0.003
	Lone parent families		**Pop. without diploma**		**65 years and older**		**Renters**	
	Coeff	Pr.	Coeff	Pr.	Coeff	Pr.	Coeff	Pr.
A	1.91	<0.001	2.31	<0.001	-0.26	0.231	0.63	<0.001
B	1.35	<0.001	1.64	<0.001	-0.13	0.460	0.40	<0.001
C	1.01	<0.001	1.15	<0.001	0.06	0.705	0.20	0.000
D1	1.28	<0.001	1.32	<0.001	-0.01	0.974	0.24	0.001
D2	1.01	<0.001	0.58	0.004	-0.18	0.284	0.06	0.272
E	0.77	<0.001	0.70	<0.001	0.05	0.685	0.10	0.027
F	0.59	<0.001	0.09	0.395	0.28	0.009	0.07	0.081

Final multinomial logistic model: Variation of predictors 1986-2006 (reference: trajectory G)



	Coeff	Pr	Coeff	Pr
	Unemployment		**Recent immigrants**	
A	1.79	<0.001	1.76	<0.001
B	1.22	<0.001	1.49	<0.001
C	0.92	0.001	1.28	<0.001
D1	0.93	0.002	1.17	<0.001
D2	0.46	0.127	0.87	0.001
E	0.70	0.008	1.03	<0.001
F	0.02	0.930	0.58	0.003
	65 years and older		**Pop. without diploma**	
A	0.12	0.547	0.77	<0.001
B	-0.18	0.195	0.62	<0.001
C	-0.15	0.165	0.52	0.001
D1	-0.19	0.153	0.41	0.011
D2	-0.44	0.001	0.15	0.323
E	-0.08	0.333	0.35	0.013
F	-0.07	0.255	-0.07	0.497

Concluding remarks

1) Results show:

- Many CTs have followed stable trajectories, especially 'non-poor' CTs
- Evidence for gentrification
- In some CTs, poverty has increased between 1986 and 2006
- Most important factors of change in poverty: recent immigrants, low education, unemployment

Concluding remarks

2) Limits

- Scale of analysis
  - Different geographical scales of poverty, e.g. micro scale (dissemination areas)

3) Future works

- Including variables of the built environment
- Proportion and change in the proportion of working poor as a factor explaining the trajectories