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Commuting to school within Košice functional urban region

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XX. MEZINÁRODNÍ KOLOKVIUM O REGIONÁLNÍCH VĚDÁCH

14. – 16. June 2017

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Objective
Literature review

Main objective:

identify the areas with most **intensive commuting flows** to elementary schools in the functional urban region delineated by Bezák (2014), and to **identify the factors** related to this commuting flow.

Why elementary schools:

- pupils fulfill the legislative requirement of **mandatory schooling**
- establishment and/or abolition of elementary schools belong to the **competencies of municipalities**
- topic for **cooperation** between municipalities, improving public services (capacities, transportation,...)

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Objective
Literature review

Functional urban regions: core $+$ network of relationships
(Bezák, 2014).

Delineation: commuting flows to work *(Coombes, 2010; Halás et al., 2014; Ručinská and Výrostová, 2016)*, to schools *(Hampl, 2005)*, to services *(Halás and Zuskáčová, 2013)*.

Education and disparities: *Kučerová et al. (2011), Lauko et al. (2011), Butler and Hamnett (2007)*.

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Data on the functional urban region of Košice

- **Functional urban region** of Košice as defined by Bezák (2014a), based on 2001 census, 50 FURs.
- **139 municipalities**, classification FUR 01-A
- **core:** Košice, all 22 boroughs
- Data on **commuting flows to schools** from 2011 population and housing census.
- **Measures of commuting intensity:**
    - fraction of pupil commuters to **elementary schools** in Košice to all elementary school commuters from municipality
    - fraction of commuters to **secondary schools** to Košice to all secondary school commuters from municipality

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Econometric model

Dependent variable: share of commuting flows of pupils to elementary schools from municipality to Košice, as a fraction of children between 5 and 16 years of the municipality.

Explanatory variables:

- **duration** of travel, average of both directions
- **work flows** of economically active commuters / number of active inhabitants
- **elementary school dummies:** does the municipality has its own elementary school? (either 1–4 or 1–9)

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Estimation procedures

Simple OLS

$$
\begin{aligned}
PupilsflowKE_i &= \beta_0 + \beta_1 durationKE_i + \beta_3 ActiveflowKE_i \\
&\quad + \beta_4 ELschool(1-4)_i + \beta_5 ELschool(1-9)_i + \varepsilon_i
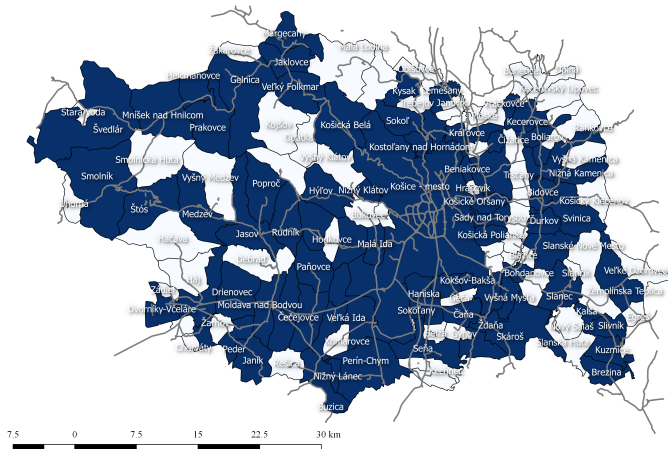\end{aligned}
$$

Spatial lag model

$$
\mathbf{y}^* = \rho \mathbf{W} \mathbf{y}^* + \boldsymbol{X} \boldsymbol{\beta} + \boldsymbol{\varepsilon}, \qquad \boldsymbol{\varepsilon} \sim \boldsymbol{N}\left(\mathbf{0}, \sigma_\varepsilon^2 \mathbf{I}_N\right)
$$

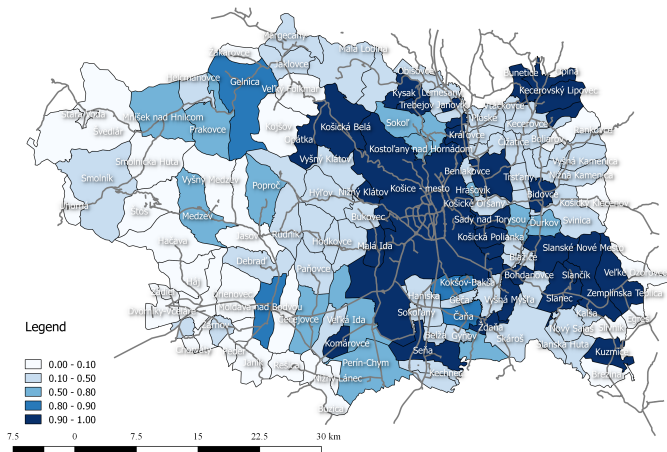### Spatial error model

$$
\mathbf{y}^* = \mathbf{X} \boldsymbol{\beta} + \boldsymbol{u}, \qquad \boldsymbol{u} = \lambda \boldsymbol{W} \boldsymbol{u} + \boldsymbol{\varepsilon}, \qquad \boldsymbol{\varepsilon} \sim \boldsymbol{N}\left(\mathbf{0}, \sigma_u^2 \mathbf{I}_N\right)
$$

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Location of elementary schools

Map source © Úrad geodézie, kartografie a katastra Slovenskej republiky.

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Percentage of pupil commuters to elementary schools

Map source © Úrad geodézie, kartografie a katastra Slovenskej republiky.

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Percentage of pupil commuters to secondary schools

Map source © Úrad geodézie, kartografie a katastra Slovenskej republiky.

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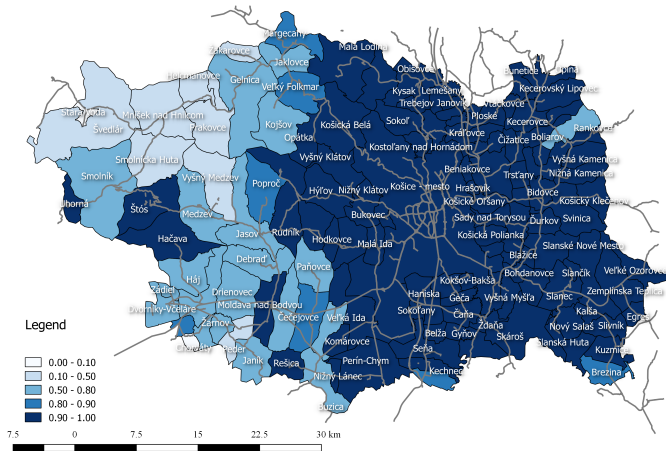
Regression results

	OLS	Spatial lag	Spatial error
Intercept	0.000	-0.022	-0.046
Spatial parameter		0.016	0.064 [***]
Duration KE	0.000	0.000	0.000
Active flow	0.452 [***]	0.462 [***]	0.520 [***]
Elementary school (1-4)	-0.051 [***]	-0.053 [***]	-0.049 [***]
Elementary school (1-9)	-0.059 [***]	-0.065 [***]	-0.063 [***]
AIC	-278.98	-278.28	-283.81
R^2	0.472	0.492	0.512

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Commuting vs. traveling time

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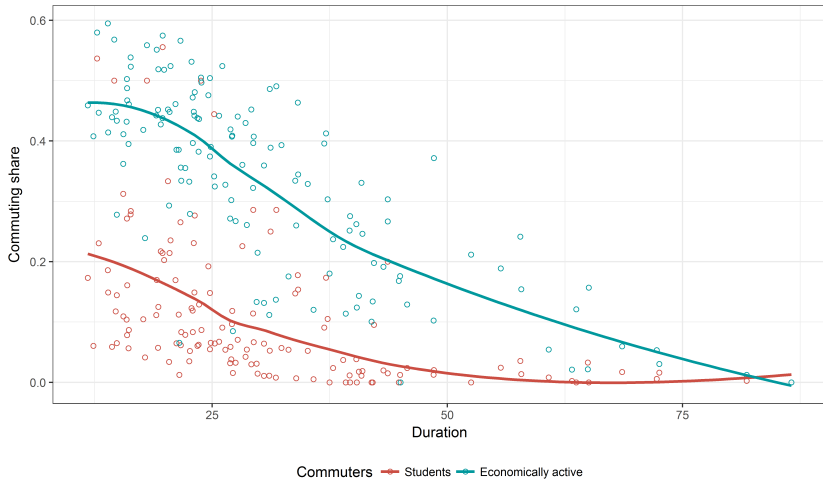
Results on commuting to schools:

- Around 40% of the elementary schools pupils **commute to he core** of Košice.
- Commuting depends on **distance and road network**.
- Positive relationship between commuting of **pupils and economically active** population.
- Commuting not so influenced by **travelling time**.
- Commuting to secondary schools affected by school **density**.

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