Geodata in nonprofit sector research

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Introduction: Geodata in nonprofit sector research

- Can nonprofit organisations reduce spatial inequalities?
  - **Yes!** Nonprofits exist because they supply goods and services which are under-supplied by other institutions (Weisbrod, 1975); community-based organisations are more responsive to local needs than large, hierarchical government organizations (Savas, 1987)
  - **No!** Nonprofit failure (especially a lack of resources) can lead to uneven nonprofit supply across space (Salamon, 1995).
  - Empirical evidence: Determinants of the location choice of nonprofit organisations: local need, the availability of local resources, other organisations' locations (e.g. Clifford, 2012, Peck, 2008, Yan et al., 2014). Poorer areas have been found to exhibit lower prevalence rates of nonprofits
- ⇒ Ideal data prerequisites: small-scaled geodata

Empirical application

- Empirical application:
  Inequalities in spatial access to child care: public-nonprofit disparities (with Dieter Pennerstorfer)
- Geodata:
  - location of child care institutions in Vienna (Child care supply)
  - Small scaled grid data at 250m × 250m level (Population data – demand)

⇒ **Research questions:**

1. Can we observe socioeconomic disparities in local accessibility to day care in Vienna?

2. Do public and nonprofit providers behave differently in creating any observed disparities?

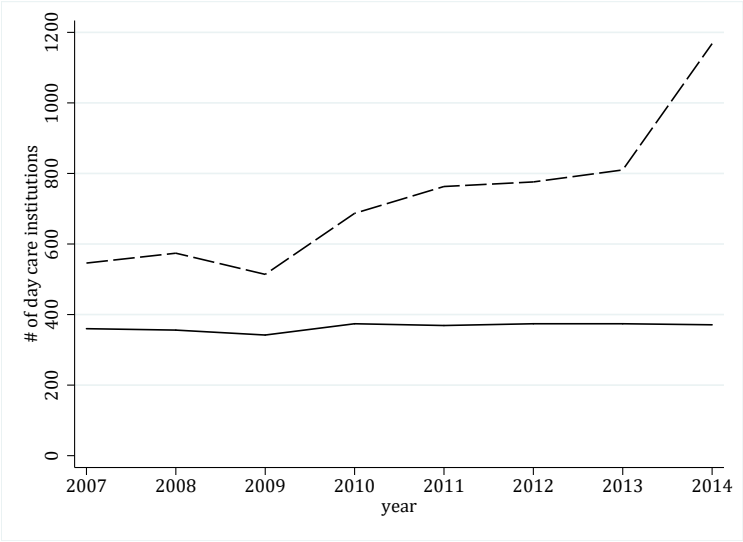
Equal access to child care

- Children from a **more disadvantaged background benefit more from childcare participation** than children from a higher socioeconomic status (e.g., Felfe and Lalive, 2018).
- **Unequal childcare participation rates** along socioeconomic backgrounds (Van Lancker and Ghysels, 2016).
- Main reasons: differences in availability and affordability (Abrassart and Bonoli, 2015, Pavolini and Van Lancker, 2018).
- The availability of childcare services incorporates various dimensions ⇒ **spatial dimension** is a key factor
  - Spatial proximity is an important choice factor for parents (e.g., Kim and Fram, 2009, Teszenyi and Hevey, 2015)
  - Childcare markets are geographically very small (e.g., Cleveland and Krashinsky, 2009, Hotz and Xiao, 2011)
  - Market entry of an institution depends on the number of children in the vicinity, but the effect diminishes very quickly (and is 0 if the distance >500m)(Pennerstorfer and Pennerstorfer, 2018).

Context: Child care in Vienna

- Mixed market: nonprofit and public day care providers
- Increase in the number of day care institutions by 70% between the years 2007 and 2014
- Increase in day care use:
  23.1% (children<3), and 83.1% (3-5) (2007)⇒
  40.2% (children<3), and 92.6% (3-5) in formal day-care (Statistik Austria, 2015, p. 85).
- Policy changes in 2009:
  - Introduction of cost-free day care to all parents
  - Compulsory day care use for children in their pre-school year of at least 16 hours a week
  - Massively extended role of nonprofit organisations in service provision

Context: Growth of day care institutions

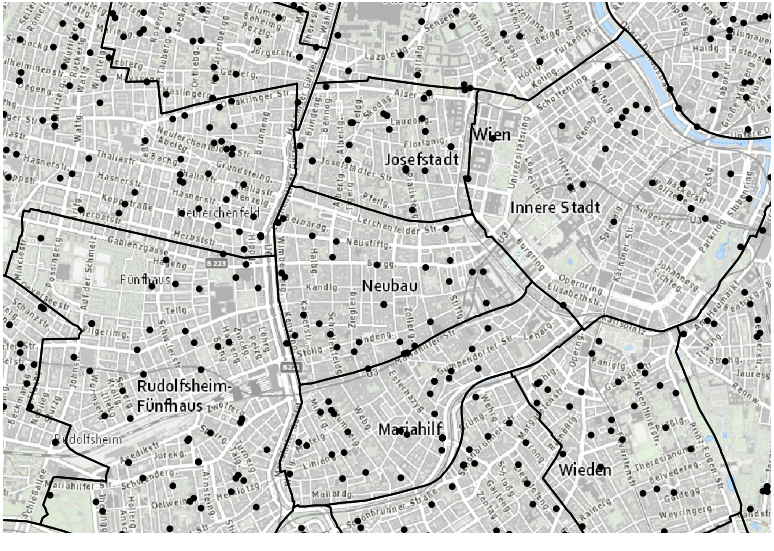


Note: Solid line: public; dashed line: nonprofits

Data

- Supply side: Information on all day care facilities in Vienna
- Annual data from the City administration
  - between 2007 and 2014 regarding
  - ownership, number and types of groups, number of children, opening hours, closure days, lunch, ...
- Open government data (`https://www.data.gv.at/`): list of all child care facilities including name, address, and X and Y coordinates

Data (example from 2014)



Data

- Demand side indicators:
  - Population in Vienna (source: Statistics Austria): grid data at 250m × 250m level
    - residential population divided in (11) age groups, including age 0-2 years and 3-5 years (annual data between 2007 and 2015)
    - number of jobs in a grid cell (15.05.2001 and 30.10.2011)
    - educational attainment (31.10.2011)
    - country of birth (31.10.2006)
    - employment status and sex (31.10.2006)
  - average income per district (each year)
  - estimated housing rents per registration district (1,364 admin. units) (2015)
  - Infrastructure: # of subway stations (source: data.gv.at; annual data)
- point data on day care centres are linked to grid cells and aggregated at the grid cell level (using QGIS)

Data (example from 2014)

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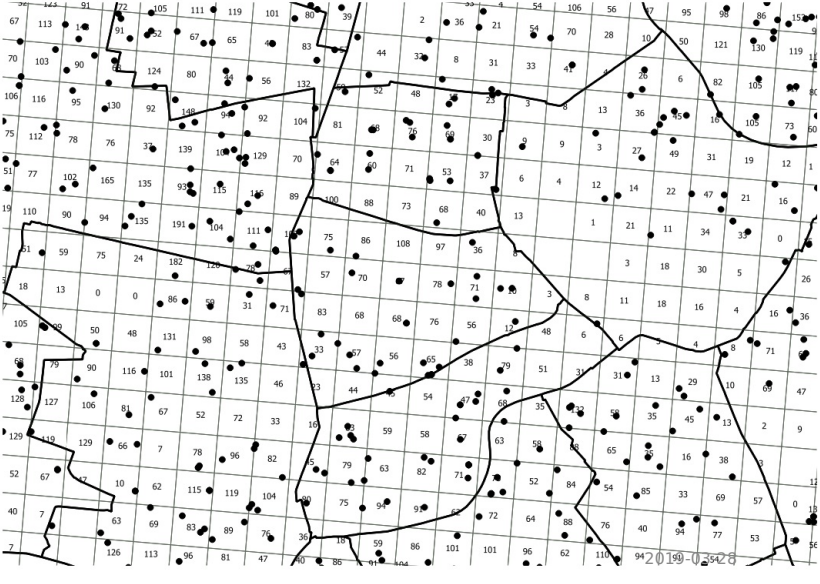
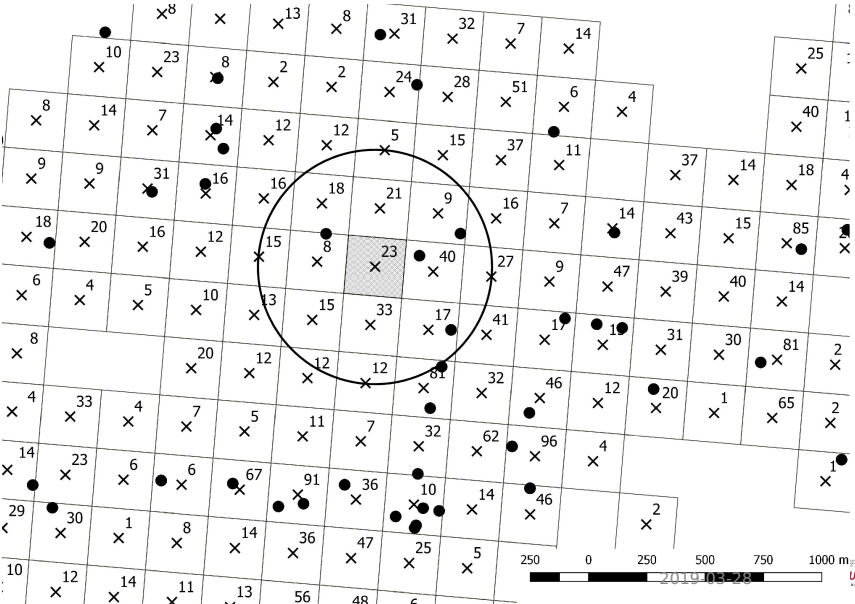


Empirical strategy

- Goal: Measure **accessibility to day care** for each child in Vienna and analyze whether children living in a neighbourhood with a lower **socioeconomic background** have lower spatial accessibility
- Calculate accessibility measure A_c for each child c (Variant of the two-step floating catchment area method (2SFCA) (e.g. Radke and Mu, 2000, Luo and Wang, 2003, Delamater, 2013))
- Socioeconomic differences between neighbourhoods:
  - share of residents with university degree (grid level)
  - average district income (23 districts)
  - estimated housing rents (1,364 admin.units)
- Descriptive results
- OLS regression

$$A^t_{cy} = \alpha + \beta D_{cy} + X_{cy}\theta + \mu_y + \epsilon_{cy} \quad (1)$$

Construction of accessibility measure



Construction of accessibility measure

- **Step 1**

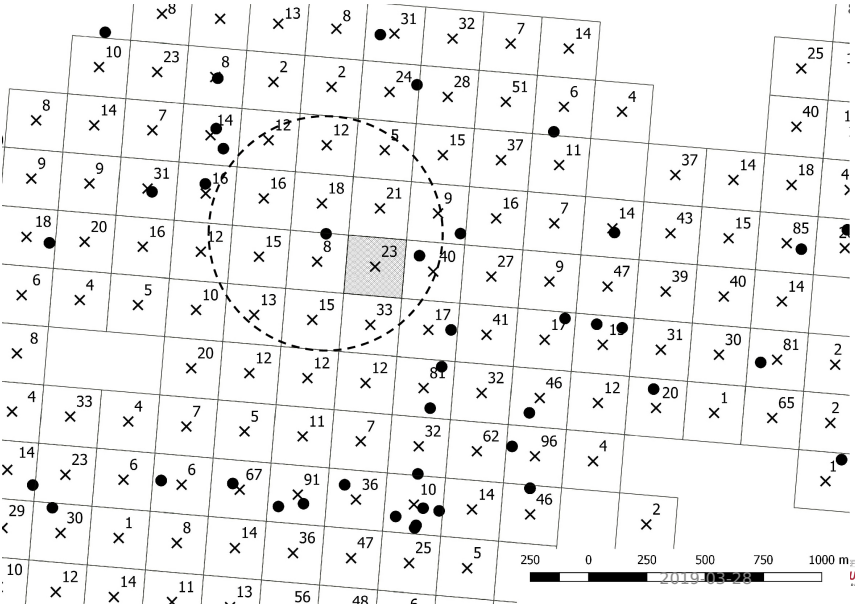
$$R_d^t = \frac{1}{\sum_c f(dist_{d,c})}, \quad \text{with } f(dist_{d,c}) = 0 \text{ if } dist_{d,c} > dist_{max} \tag{2}$$

- **Step 2**

$$A_c = \sum_d k_d R_d^t f(dist_{c,d}), \quad \text{with } f(dist_{c,d}) = 0 \text{ if } dist_{c,d} > dist_{max} \tag{3}$$

c	child c
d	day care center d
t	type of provider with $t \in$ {public, NPO}
k_d	capacity (# of groups) of day care center d
$dist_{c,d} = dist_{d,c}$	Euclidean distance between location of child c and day care center d
$dist_{max}$	size of catchment area
$f(dist_{c,d})$	distance decay function with $f(dist_{c,d}) \geq 0$ and $\frac{\partial f(dist_{c,d})}{\partial dist_{c,d}} \leq 0$
R_d^t	indicator for the degree of capacity utilization of day care center d
A_c	accessibility level of child c

Construction of accessibility measure



Construction of accessibility measure

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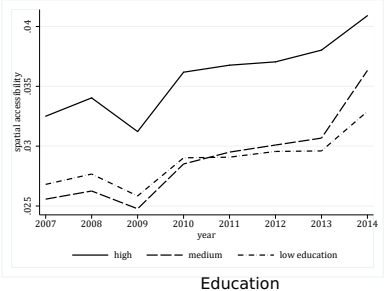
Empirical strategy: Accessibility measure

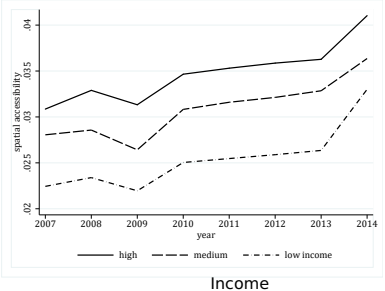
- Accessibility is higher if
  - there are more day care centres in the child's neighbourhood
  - the facilities are located closer to the child's place of residence
  - centres are bigger
  - there are fewer children within the facilities' catchment areas

- Accessibility measure can be split by the type of provider ⇒ Disentangle how much each type of provider contributes to the spatial accessibility of each child

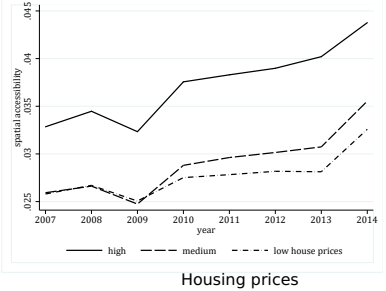
Results: Accessibility disparities between socioeconomic groups



Education



Income



Housing prices

Results: OLS

Dependent variable	A_{cy}	A_{cy}^{pub}	A_{cy}^{NPO}
Accessibility based on	All	Public	NPO
Measure of deprivation: education			
Share of residents with college degree (in percent)	0.000178***	−0.000274***	0.000452***
	(0.000063)	(0.000040)	(0.000050)
Constant	−0.003246	−0.004367	0.001121
	(0.004876)	(0.003512)	(0.003373)
# observations	805,327	805,327	805,327
R^2	0.036	0.056	0.082
Measure of deprivation: income			
Average income (in 1,000 Euros / year)	0.001372***	−0.000128	0.001500***
	(0.000329)	(0.000237)	(0.000270)
Constant	−0.019559***	0.004775	−0.024334***
	(0.006758)	(0.004573)	(0.006043)
# observations	805,327	805,327	805,327
R^2	0.046	0.041	0.080
Measure of deprivation: house prices			
Price of flat (in 1,000 Euros per sqm)	0.005994***	−0.000407	0.006401***
	(0.000835)	(0.000460)	(0.000736)
Constant	−0.018370***	0.004416	−0.022786***
	(0.005694)	(0.003697)	(0.004289)
# observations	805,327	805,327	805,327
R^2	0.060	0.041	0.104

Results: Change over time

Dependent variable	A_{cy}		A_{cy}^{pub}		A_{cy}^{NPO}	
Accessibility based on type of institution:	All		Public		NPO	
	Coeff.	Sign.	Coeff.	Sign.	Coeff.	Sign.
Measure of deprivation: education						
Education	0.000129	**	−0.000273	***	0.000402	***
	(0.000060)		(0.000039)		(0.000047)	
Education × time	0.000014	**	0.000000		0.000014	***
	(0.000005)		(0.000002)		(0.000005)	
Constant	−0.002435		−0.004389		0.001955	
	(0.004892)		(0.003530)		(0.003374)	
# observations	805,327		805,327		805,327	
Residuals clustered at	grid cell		grid cell		grid cell	
R^2	0.036		0.056		0.082	

Discussion

- Main results
  - Substantial and persistent differences in accessibility between more and less deprived locations
  - Nonprofit organisations drive this result
  - ⇒ Policy change undermines universalistic character of the child care system
- Further applications...
  - Uneven access to services also interesting for other nonprofit activity fields – care homes, advice centres, etc.
  - Geodata should be relatively easy to obtain
  - Small-scaled population data have become available in a number of countries (e.g., Finland, Norway and Sweden) and will become more widespread in the future

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