



# Size Matters? Spatial Patterns of Metropolitan Functions in Europe's Urban Hierarchy

Prof. Dr. Anna Growe, Faculty of Architecture – Urban Planning – Landscape Planning, Kassel University

Dr. Thomas Terfrüchte, Faculty of Spatial Planning, TU Dortmund

AESOP Thematic Group Small Towns – Lecture Series: SMALL TOWNS IN FOCUS





January 19, 2024

<https://earthobservatory.nasa.gov/images/152693/europe-at-night>

Europe's urban landscape is a patchwork of metropolises, secondary cities, and smaller and medium sized towns.

While big cities dominate with dense concentrations of functions, smaller cities often show more dispersed profiles—but can they complement the metros or are they left behind?

### **Key Question:**

*To what extent do cities of different sizes in Europe exhibit functional complementarities and do potential complementarities differ according to the cities' locations?*

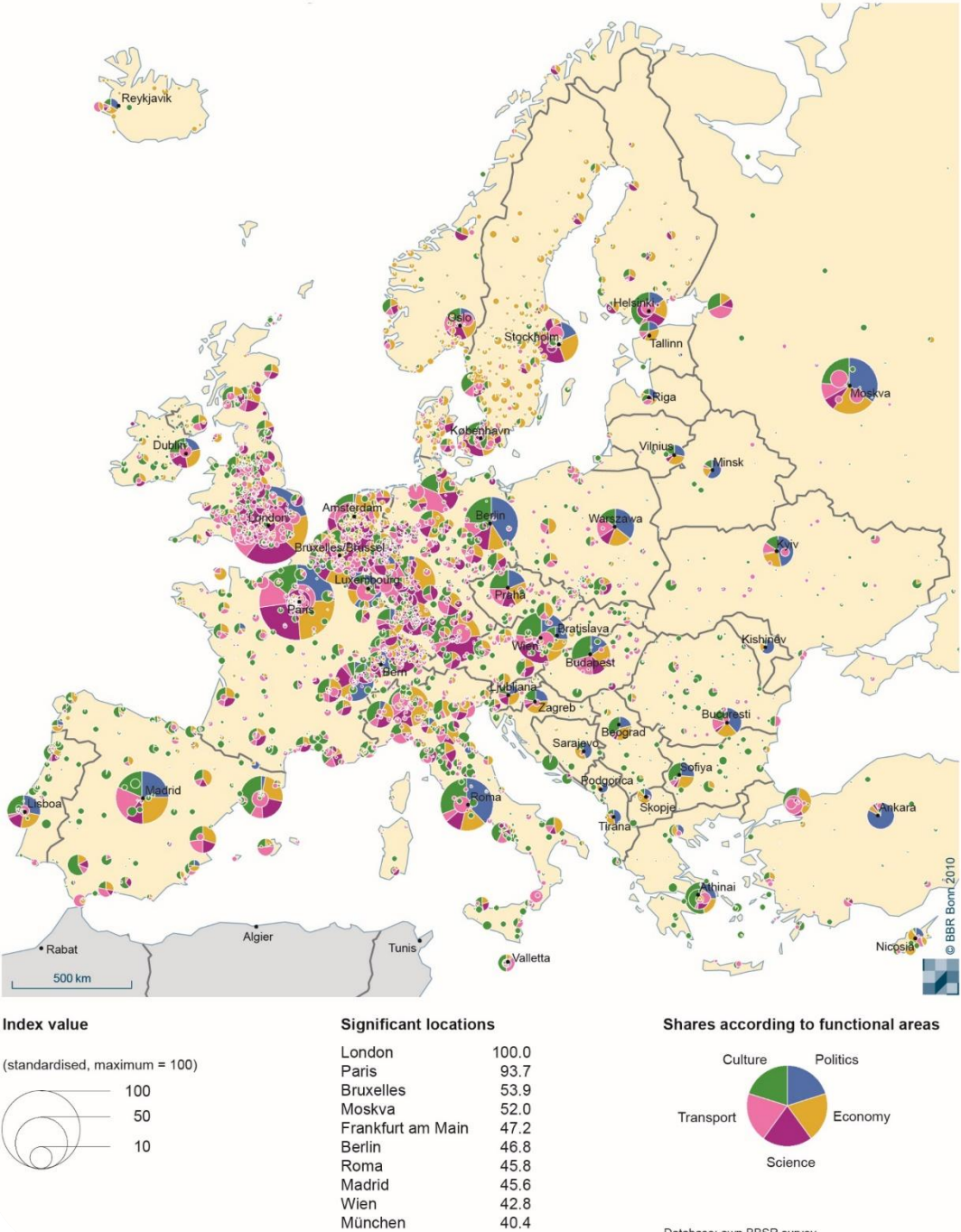
→ Understanding functional distribution is crucial for regional planning, investment strategies, and building resilient, polycentric urban systems.

→ Insights can reveal hidden “borrowed size” effects or highlight regions at risk of economic and political marginalization.



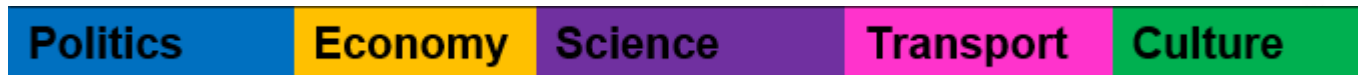
# Metropolitan functions

Politics	Economy	Science	Transport	Culture
National Government	Enterprises	Education and research	Air passenger transport	Arts
Supranational government function	APS	Scientific communication	Air freight transport	Sports
	Banks	Entrepreneurship and innovation	Long-distance passenger rail transport	
	Markets		Maritime goods transport	
			Data traffic	



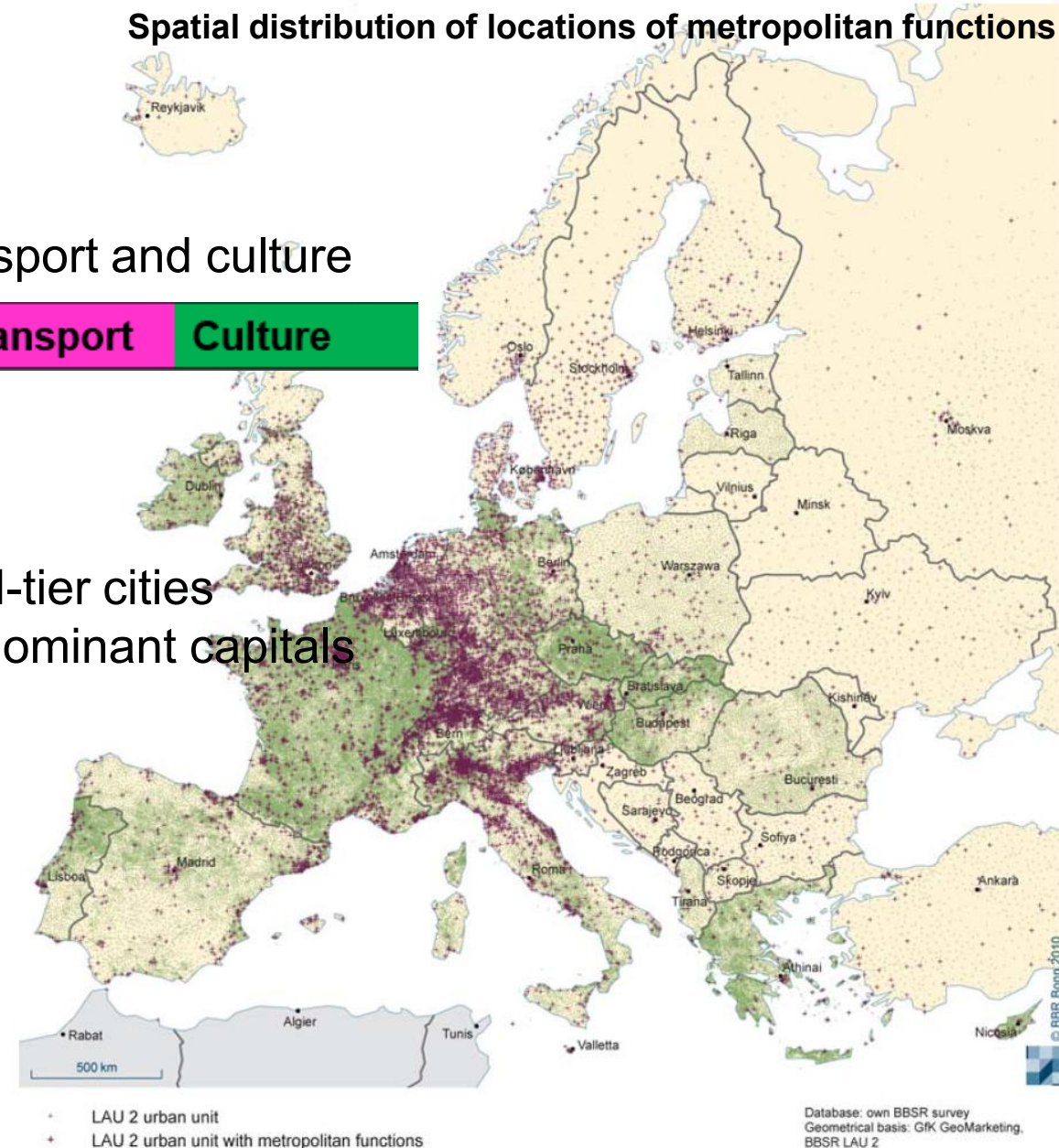
## BBSR 2011 – Results important for us...

Functions analyzed: politics, economy, science, transport and culture



## Primacy Benefit

First-tier cities enjoy a “first city bonus,” while second-tier cities perform worse, especially in centralized states with dominant capitals (Portugal, France, UK).



## Cardoso & Meijers 2016 – results important for us

Functions analyzed: business, science, culture, sports



### Functional Profiles

Second-tier city regions have a different functional profile than larger first-tier city regions

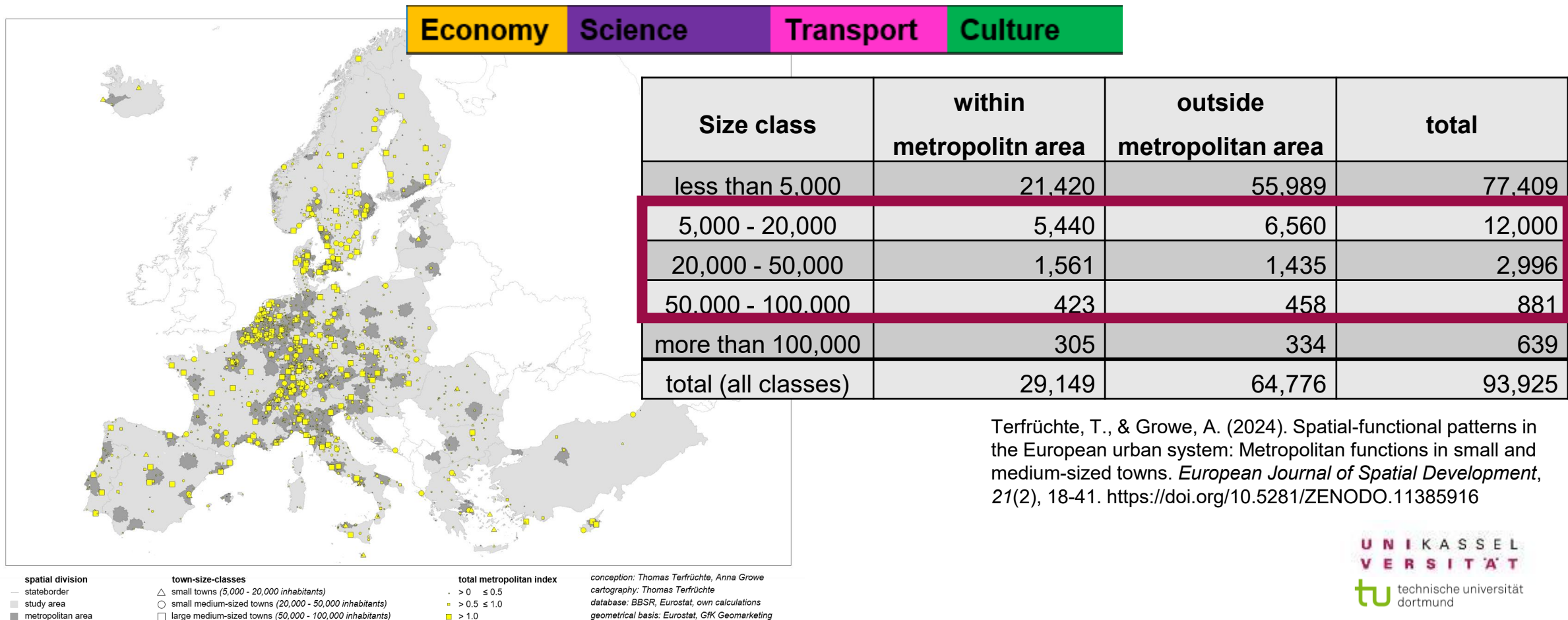
### Relation between city and region

First-tier city regions: 72.6% of urban functions in the core → strong agglomeration shadow.

Second-tier city regions: 49% in the core, 37.8% in surrounding area → broader distribution, showing borrowed size and regional citification.

## Terfrüchte & Growe 2024 – from city regions to small and medium sized towns

Functions analyzed: economy, science, transport and culture



Terfrüchte, T., & Growe, A. (2024). Spatial-functional patterns in the European urban system: Metropolitan functions in small and medium-sized towns. *European Journal of Spatial Development*, 21(2), 18-41. <https://doi.org/10.5281/ZENODO.11385916>



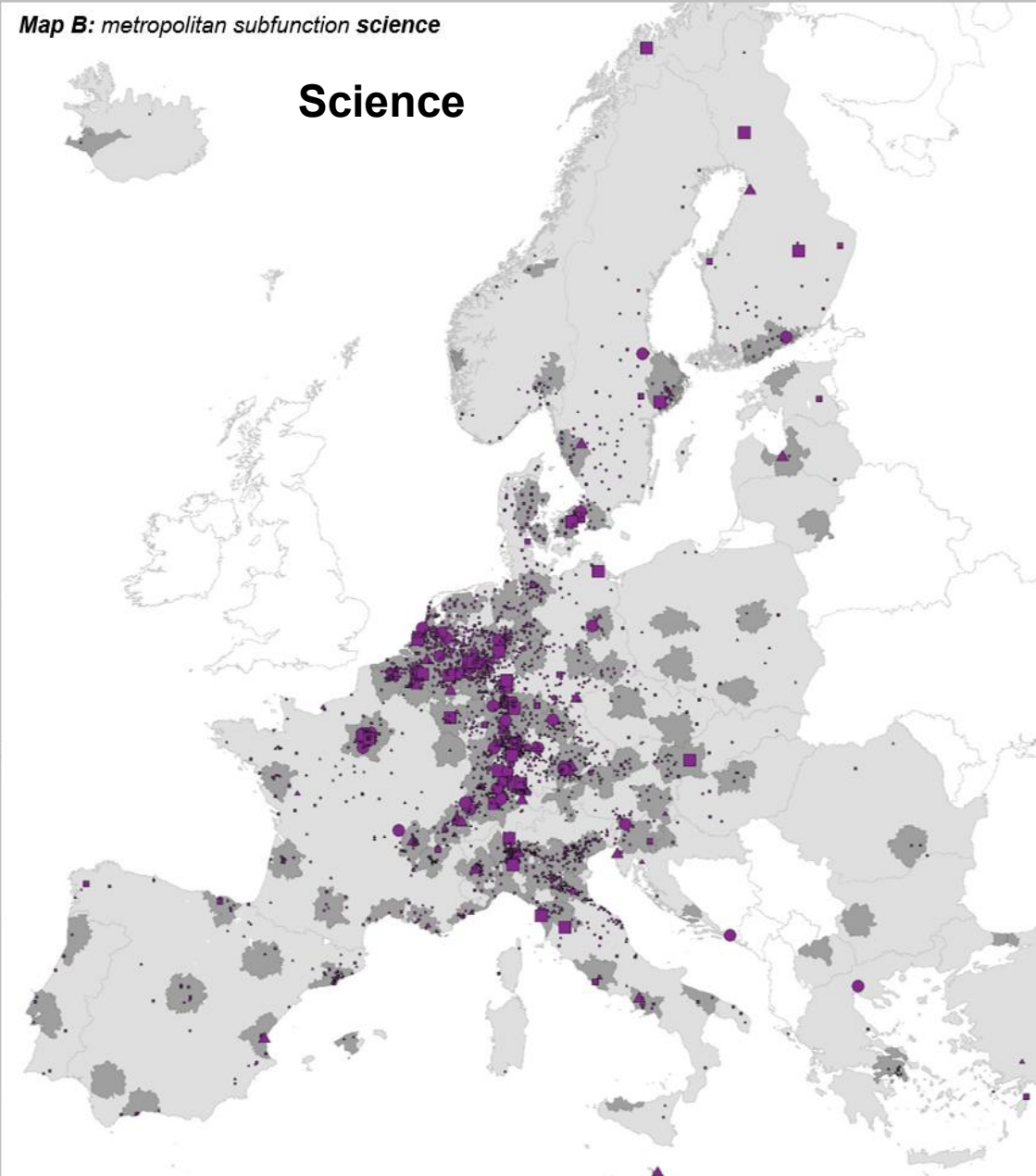
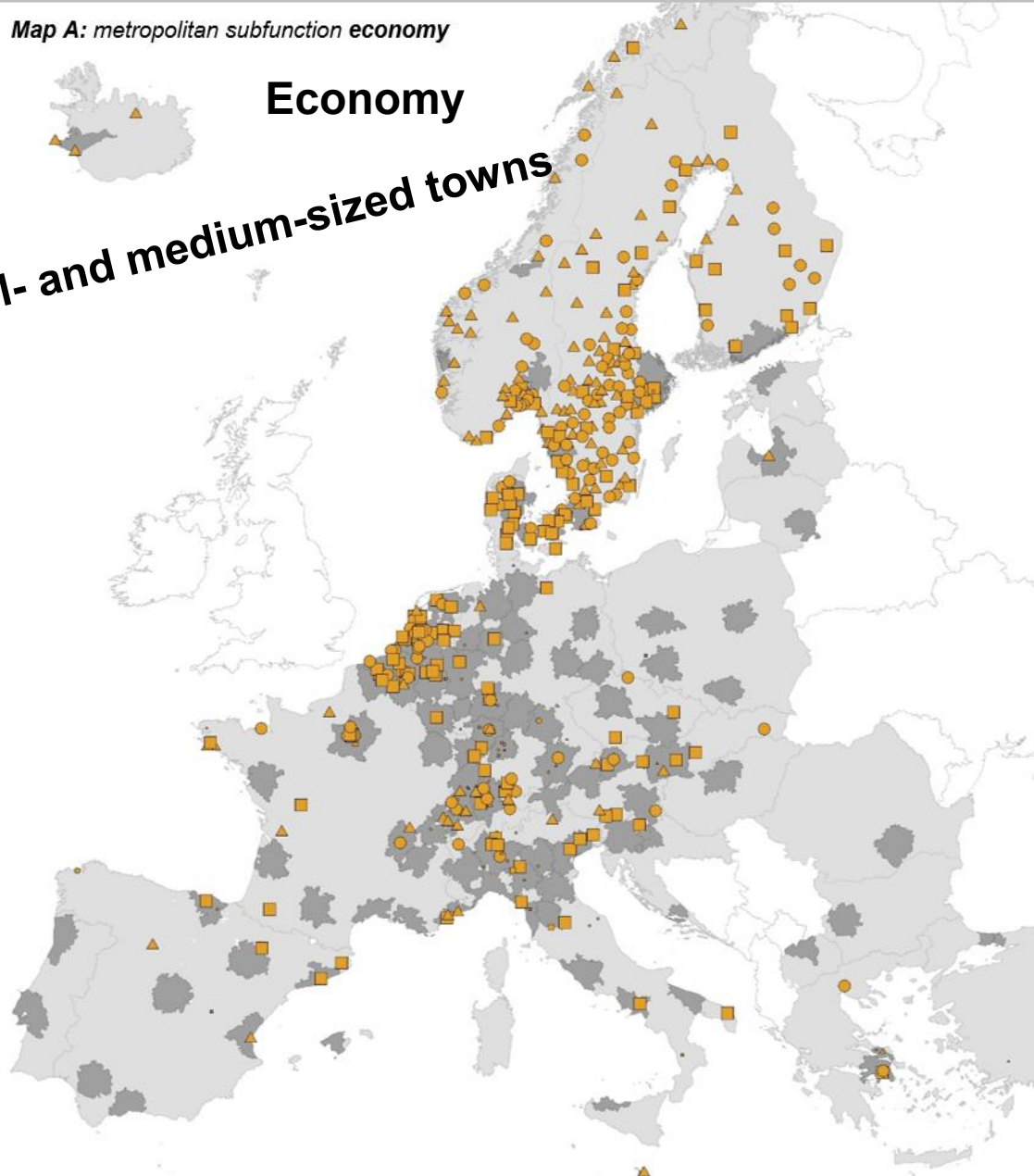
Map A: metropolitan subfunction economy

Map B: metropolitan subfunction science

## Economy

## Science

Small- and medium-sized towns



### spatial division

- stateborder
- study area
- metropolitan area

### town-size-classes

- △ small towns (5,000 - 20,000 inhabitants)
- small medium-sized towns (20,000 - 50,000 inhabitants)
- large medium-sized towns (50,000 - 100,000 inhabitants)

### subfunction index

- > 0 ≤ 0.5
- ◻ > 0.5 ≤ 1.0
- ◻ > 1.0

### subfunctions

- economy
- science
- transport
- culture

conception: Thomas Terfrüchte, Anna Growe

cartography: Thomas Terfrüchte

database: BBSR, Eurostat, own calculations

geometrical basis: Eurostat, GfK Geomarketing

UNIKASSEL  
VERSITÄT

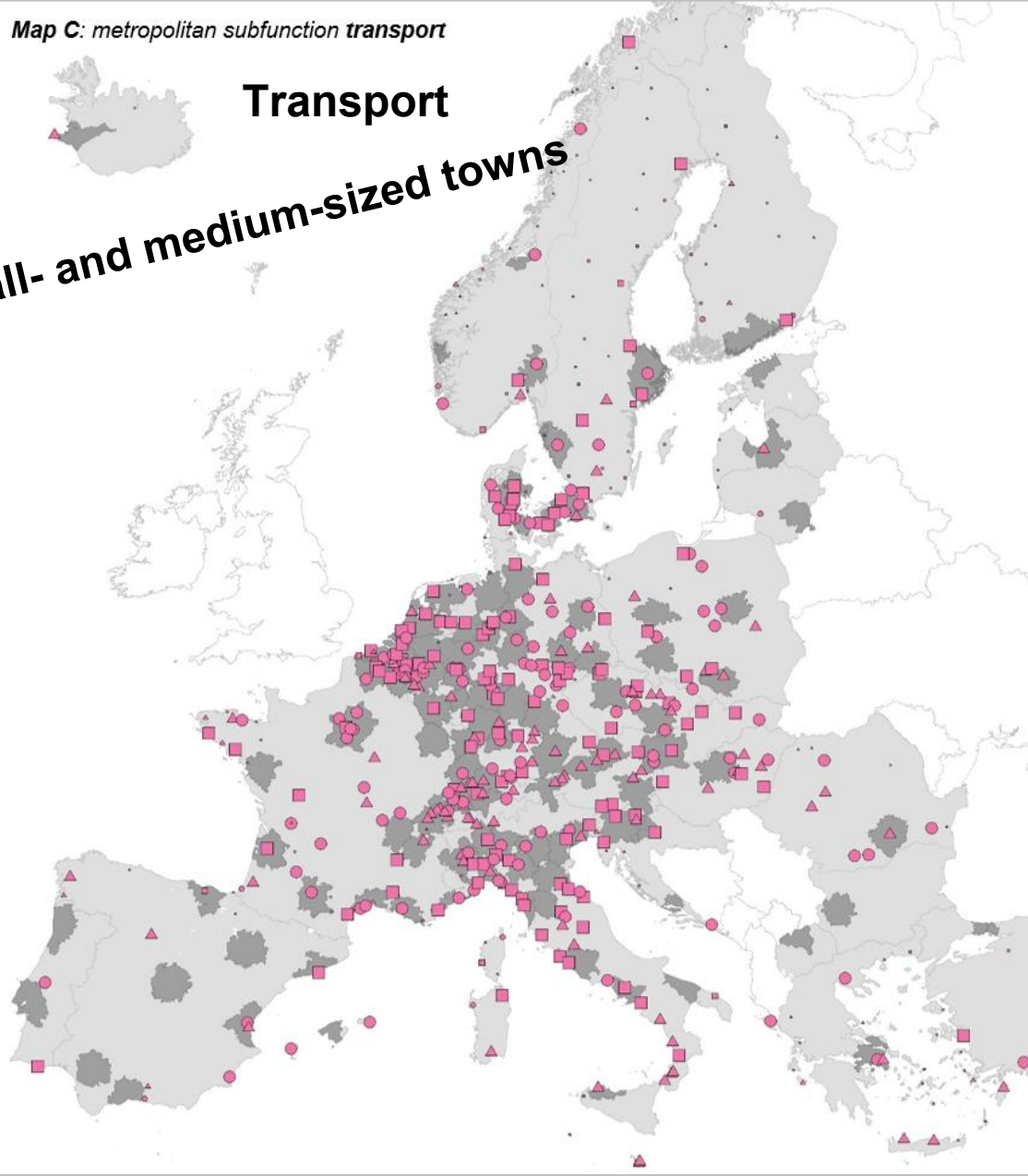
tu technische universität  
dortmund



Map C: metropolitan subfunction transport

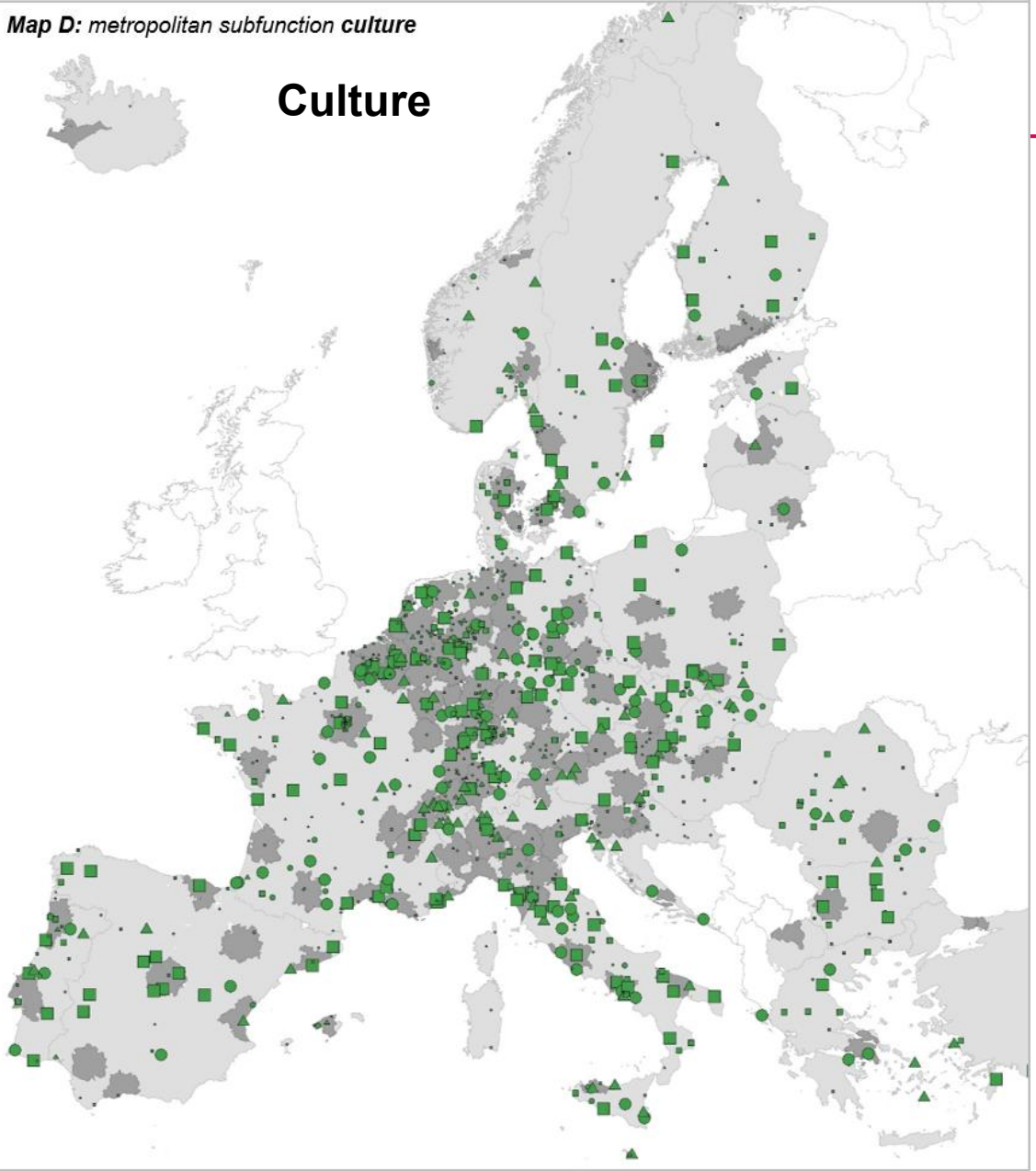
## Transport

Small- and medium-sized towns



Map D: metropolitan subfunction culture

## Culture



### spatial division

- stateborder
- study area
- metropolitan area

### town-size-classes

- △ small towns (5,000 - 20,000 inhabitants)
- small medium-sized towns (20,000 - 50,000 inhabitants)
- large medium-sized towns (50,000 - 100,000 inhabitants)

### subfunction index

- > 0 ≤ 0.5
- ◻ > 0.5 ≤ 1.0
- ◻ > 1.0

### subfunctions

- economy
- science
- transport
- culture

conception: Thomas Terfrüchte, Anna Growe

cartography: Thomas Terfrüchte

database: BBSR, Eurostat, own calculations

geometrical basis: Eurostat, GfK Geomarketing



## Beyond metropolis and SMST: Why comparing all scales in Europe's Urban Hierarchy

1. Considering spatial interdependencies...
2. Bridging local and regional perspectives...

Therefore, the concepts of 'borrowing size' and 'agglomeration shadow' are crucial in this context:

- **They capture spatial advantages and disadvantages:** Both concepts explain how proximity to larger cities can either enhance or constrain the functional development of small and medium-sized towns.
- **They link local performance to regional structure:** They show that the cities' functions and growth potential depend not only on local assets but also on their position within wider urban and regional networks.



## Background – Developments within and outside of metropolitan regions

Importance of cities dependent on their location inside and outside of metropolitan regions: gaining through ‘borrowing size’ or suffering due to ‘agglomeration shadow’:

- **‘borrowing size’**: small and medium-sized towns in agglomeration areas can draw on far more agglomeration advantages and incorporate more functions than equally sized towns in solitary locations due to their proximity to large urban centres.
- **‘agglomeration shadow’**: small and medium-sized towns located in close proximity to other or larger cities incorporate fewer functions than equally sized towns in a solitary location due to competition between cities as locations.

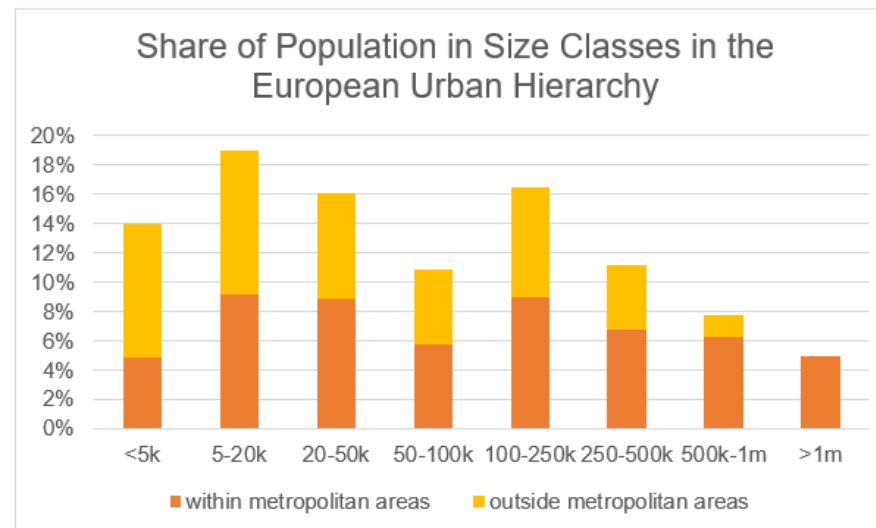
## Europe's Urban Hierarchy

Size class	within metropolitan areas	outside metropolitan areas	total
<5k	21.280	60.673	81.953
5-20k	5.726	6.621	12.347
20-50k	1.786	1.505	3.291
50-100k	518	464	982
100-250k	372	316	688
250-500k	128	81	209
500k-1m	59	14	73
>1m	16		16
total	29.885	69.674	99.559

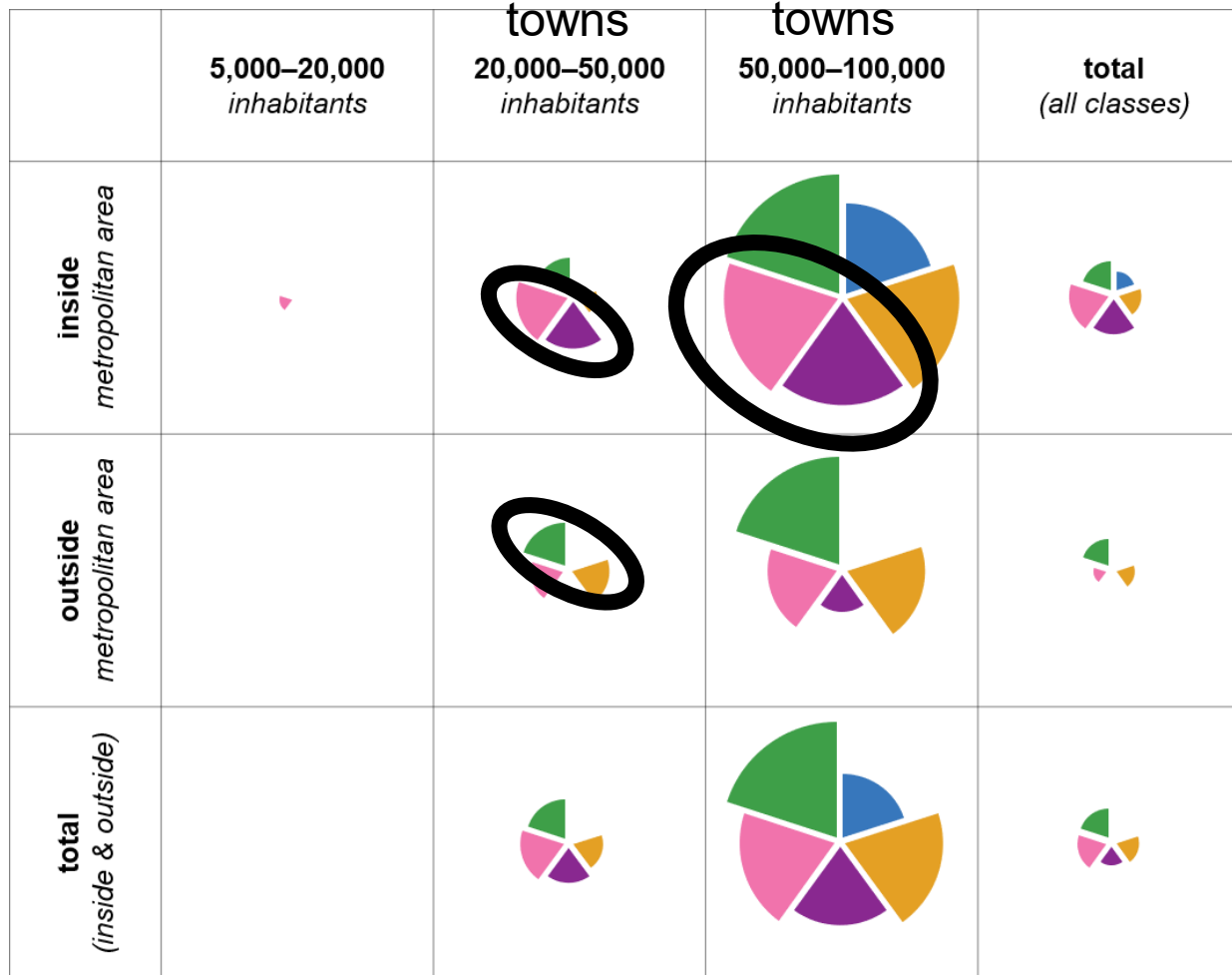
Population in Size class	within metropolitan areas	outside metropolitan areas	total
<5k	5%	9%	14%
5-20k	9%	10%	19%
20-50k	9%	7%	16%
50-100k	6%	5%	11%
100-250k	9%	8%	16%
250-500k	7%	4%	11%
500k-1m	6%	2%	8%
>1m	5%	0%	5%
total	55%	45%	100%

## How to differentiate Europe's Urban Hierarchy?

- Number of units (LAU) of various size classes
- Share of population located in various size classes







**Borrowing size:** functions are more important in towns inside metropolitan areas (benefit of complementarity advantages of smaller towns and bigger cities)

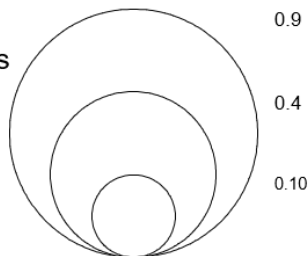
Science and Transport in small and medium sized towns.

**Agglomeration shadow:** functions are more important in towns outside metropolitan areas (suffering from competition)

Economy and Culture in small sized towns.

Metropolitan  
Subfunctions

- politics
- economy
- science
- transport
- culture

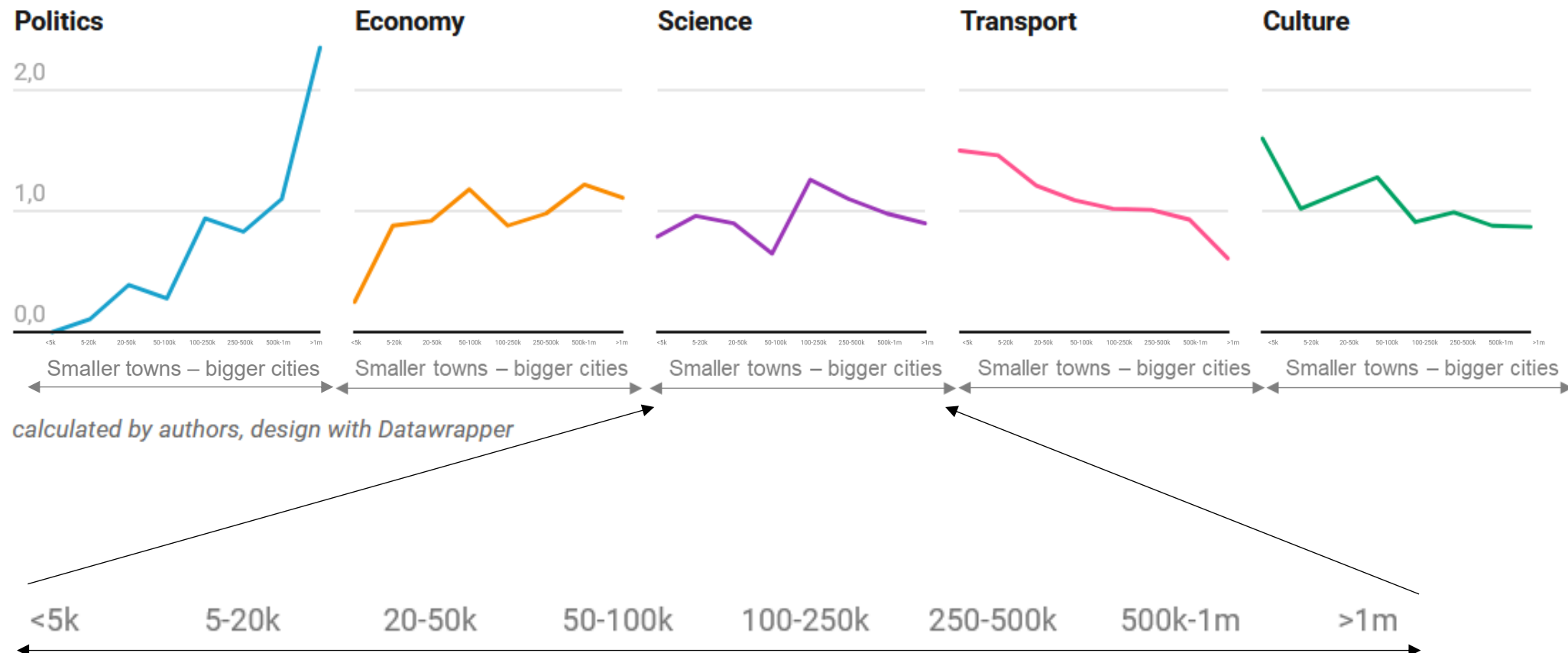


conception: Thomas Terfrüchte, Anna Growe  
design: Thomas Terfrüchte  
database: BBSR, Eurostat, own calculations

Terfrüchte, T., & Growe, A. (2024). Spatial-functional patterns in the European urban system: Metropolitan functions in small and medium-sized towns. *European Journal of Spatial Development*, 21(2), 18-41. <https://doi.org/10.5281/ZENODO.11385916>

# Relevance of subfunctions in city size classes

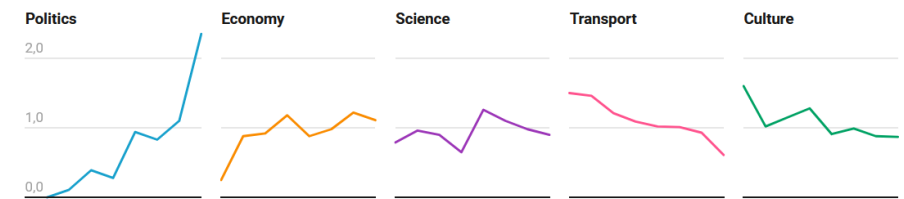
Relation of metropolitan subfunctions / total metropolitan function





## Comparing the functional patterns across size classes in Europe

*To what extent do cities of different sizes in Europe exhibit functional complementarities and do potential complementarities differ according to the cities' locations?*



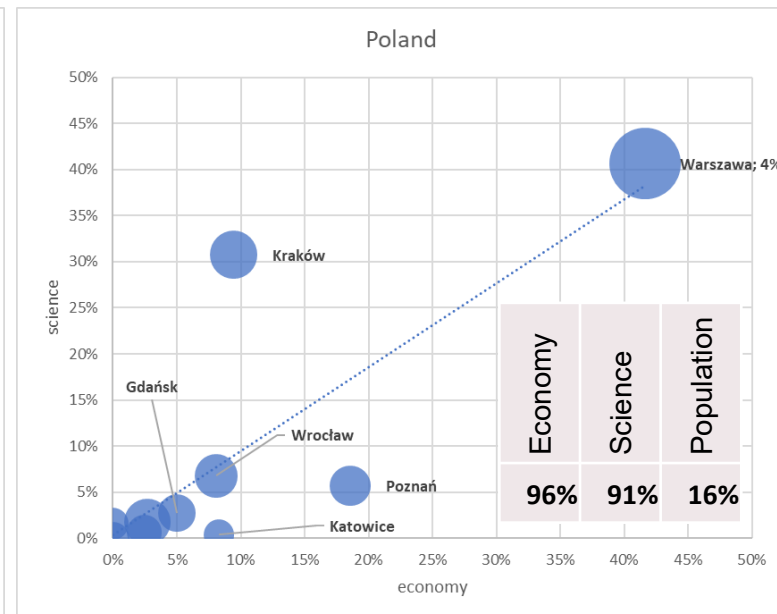
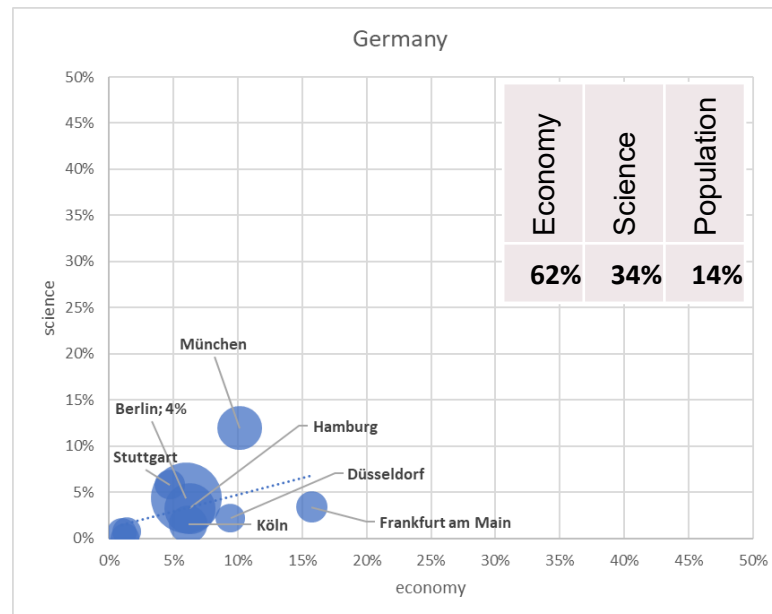
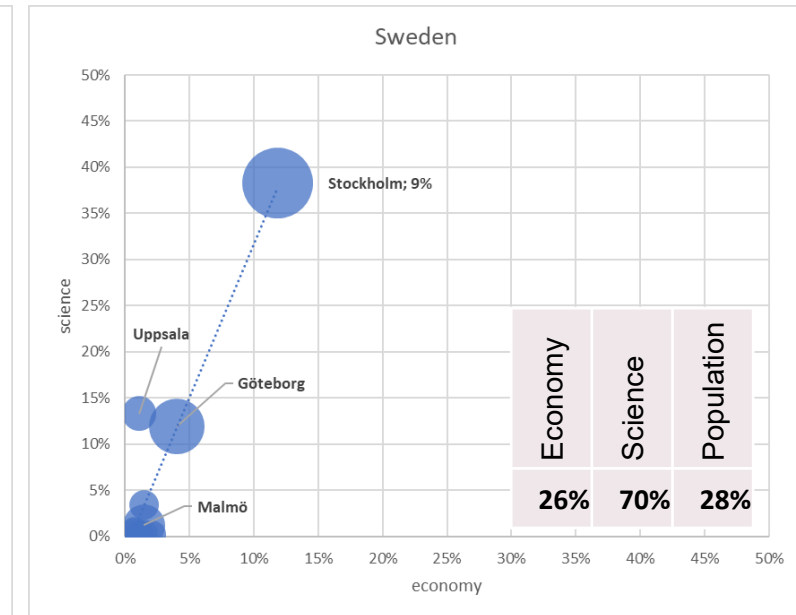
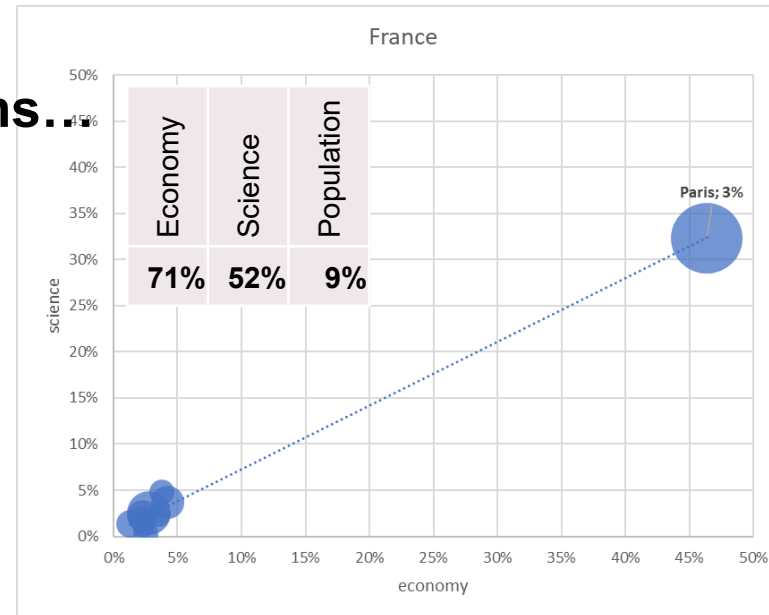
Cities and towns of different size classes display different (relative) functional specializations.

However, also the location of SMST within or outside metropolitan regions influences the location of functions.

- Transport with high relative importance within metropolitan regions
- Culture with high relative importance outside metropolitan regions

## Different national urban systems...

x % of ... are located  
in the top 10 cities  
(population)



**Major differences between  
European countries!**





## Four Perspectives on Secondary Cities

Type of Secondary City	Focus	Key Indicator	Analytical Logic
<b>Size-based*</b>	Demography, rank	Population, urban rank	Size = importance
<b>Functional**</b>	Functional role	Metropolitan functions, specialisation	Function = influence
<b>Systemic/Relational***</b>	Networks & linkages	Connectivity, interdependencies	Relationships = centrality
<b>Development/Policy-oriented****</b>	Governance & territorial planning	Policy relevance, developmental role	Decentralization = objective (normative)

\*Camagni, R., & Capello, R. (2015). Second-Rank City Dynamics: Theoretical Interpretations Behind Their Growth Potentials. *European Planning Studies*, 23(6), 1041–1053. Camagni, R., & Capello, R. (Eds.). (2016). *Second rank cities in Europe: Structural dynamics and growth potential*. Routledge.

Short, J. R., & Pinet-Peralta, L. M. (2009). Urban Primacy: Reopening the Debate. *Geography Compass*, 3(3), 1245–1266

\*\*Cardoso, R. V., & Meijers, E. J. (2017). Secondary Yet Metropolitan? The Challenges of Metropolitan Integration for Second-Tier Cities. *Planning Theory & Practice*, 18(4), 616–635.

Mayer, H., Meili, R., & Kaufmann, D. (2021). Small and Medium-Sized Towns as Secondary Cities: The Case of Switzerland. In M. Pendras & C. Williams (Eds.), *Secondary cities: Exploring uneven development in dynamic urban regions of the Global North* (pp. 55–78). Bristol University Press.

Pendras, M., & Williams, C. (2021). Secondary Cities: Introduction to a Research Agenda. In M. Pendras & C. Williams (Eds.), *Secondary cities: Exploring uneven development in dynamic urban regions of the Global North* (pp. 1–23). Bristol University Press.

\*\*\*Wen, J., Jansen, S. J. T., van der Heijden, H., & Boelhouwer, P. J. (2024). Migration across the urban hierarchy: Has China's urbanisation transitioned from the primate city stage to the secondary city stage? *Urban Studies*, Article 00420980241259923. Advance online publication

\*\*\*\*Hohmann, R. P., & Roberts, B. H. (2014). The systems of secondary cities : the neglected drivers of urbanising economies (Civis. Sharing Knowledge and Learning from Cities No. 7). World Bank Group.

Marais, L., Nel, E., & Donaldson, R. (Eds.). (2019). *Secondary Cities and Development*. Routledge.

Roberts, B. H. (Ed.). (2014). *Managing Systems of Secondary Cities: Policy Responses in International Development*. Cities Alliance.

## Results and Discussion

**Functional differentiation within the urban system:** Cities of different sizes occupy distinct functional roles within Europe's urban hierarchy, reflecting both classic agglomeration advantages and processes of functional compensation across size classes.

**Borrowed size and agglomeration shadow across functions and city sizes:** The dynamics of borrowed size and agglomeration shadow operate differently across functional domains and city size classes. Further research is needed to refine these distinctions — for instance, the often-assumed cultural (relative) importance of small towns mainly applies to those located outside metropolitan regions, while small towns within metropolitan areas tend to exhibit a less important (relative) cultural importance.

**The ambiguous position of small large cities:** Particularly intriguing is the group of small large cities, which may act both as independent centers within their regions and as subordinate nodes within larger metropolitan regions.

## Thank you for your attention



Growe, A.; Terfrüchte, T. (2023): Bedeutende Städte jenseits der Metropolen? – Regiopolen und ihre Rolle im deutschen Städtesystem. In: **Raumforschung und Raumordnung**. Vol. 81 (2), 154–169.  
<https://doi.org/10.14512/rur.756>



Terfrüchte, T.; Growe, A. (2024): Spatial-functional patterns in the European urban system. Metropolitan functions in small and medium-sized towns. In: **European Journal of Spatial Development**. 21(2), 18–41.  
<https://doi.org/10.5281/zenodo.11385916>

Prof. Dr. Anna Growe  
Department of Economics of Urban and  
Regional Development  
Kassel University  
[anna.growe@uni-kassel.de](mailto:anna.growe@uni-kassel.de)

Dr. Thomas Terfrüchte  
Research Group of Spatial Planning and  
Planning Theory  
TU Dortmund University  
[thomas.terfruechte@tu-dortmund.de](mailto:thomas.terfruechte@tu-dortmund.de)