

Do cooperative R&D subsidies stimulate regional innovation efficiency? Evidence from Germany

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Outline

- Collaboration and R&D subsidies
- 2-stage empirical approach
- Data
- Empirical results
- Conclusion

Collaboration and R&D subsidies

Collaboration and R&D subsidies (I)

- Effects of collaboration for innovation
 - Resource pooling & knowledge exchange (Hagedoorn 2002)
 - Free riding & “knowledge leakage”
 - Regional collaboration > innovative milieu (Camagni, 1991)
 - Need for inter-regional linkages (Bathelt et al., 2004)
 - Collaboration needs to give access to variety / related knowledge (Boschma & Frenken, 2010)
 - Empirical research mainly on voluntary (co-inventing) or university-firm (EU-Framework programs) collaboration

Collaborative R&D subsidies (II)

- Substantial subsidization of R&D activities by public authorities
- Rich empirical literature
 - Distribution and **evaluation** of R&D subsidies
 - Primarily quantitative with focus on the firm level
- Impact of R&D subsidies
 - (+) R&D efforts (Busom, 2000)
 - (+) Employment growth (Brouwer et al., 2004)
 - (+) Innovation efficiency (Ebersberger and Lethoranta, 2008)

However!

Collaborative R&D subsidies (III)

- Effects of subsidized R&D collaboration?
 - Differences between collaborative and non-collaborative subsidies?
 - Conceptionalization of subsidized R&D collaboration as (policy-induced) knowledge network (e.g. Scherngell & Barber, 2009)
 - Firm-level: Fornahl et al. (2010): German Biotechnology
- No investigation at the regional level
 - R&D subsidies impact on regional innovation performance?
 - Region's position in subsidized knowledge networks?
 - Relevant type of collaboration? Regional? Access to knowledge infrastructure?

Empirical approach

Empirical approach (I)

- Innovation performance as *innovation efficiency*
 - Regional innovation efficiency: relation between knowledge inputs and innovative outputs
 - Nonparametric robust efficiency analysis (Daraio & Simar, 2005)
- 2-stage approach (minimization of endogeneity)
 - 1. stage: temporal variation of innovation efficiency (growth rate)
 - 2. stage: panel regression on growth rate of innovation efficiency
 - Time lags + trend correction + fixed effects
 - Spatial panel regression to control for spatial autocorrelation
 - Estimation for different samples (urban vs. rural regions)

Empirical approach (II)

- Data
 - 4 manufacturing industries: chemistry, electr(on)ics, transport equipment, precision instruments
 - 270 German labor market regions
 - Panel 1999-2003
 - Innovation efficiency: R&D employment (input), patents (output)
 - Regional characteristics: specialization, diversification, population density, GDP, university graduates, research institutes, industry employment, highly qualified employees

Empirical approach (III)

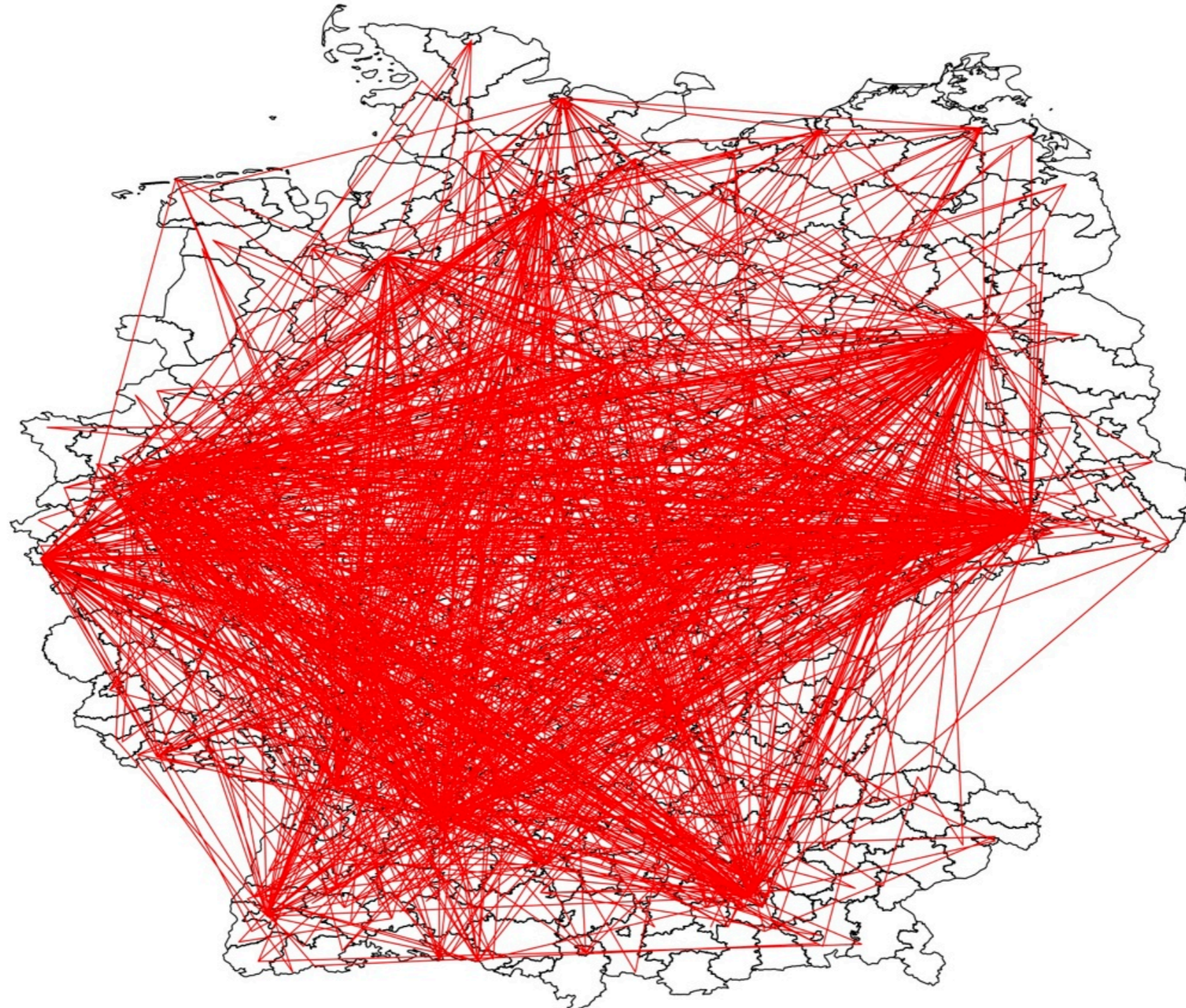
- Data on R&D subsidies
 - Subsidized R&D projects by German federal government (BmBF, BmWi,...)
 - Data from 1995-2000, 2-4 years time lag to patent data, 2 years time lag to R&D
 - Information on firm name, location, amount, collaboration, type of project, start & end date
 - Data on R&D subsidies, R&D employment, and patents matched on basis of 2-digit NACE codes

Empirical approach (IV)

- Network of subsidized R&D collaboration in Germany 1995

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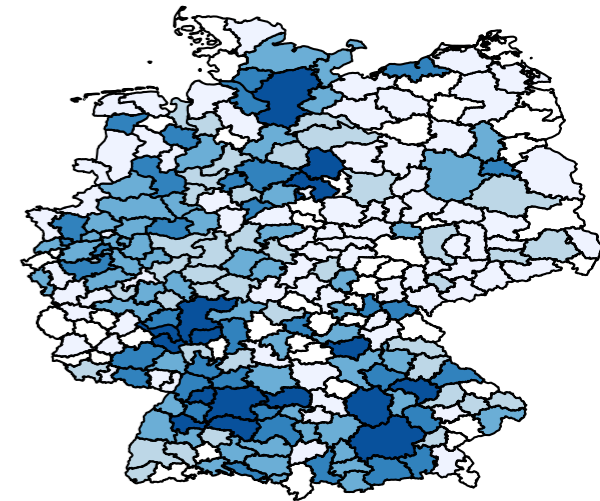
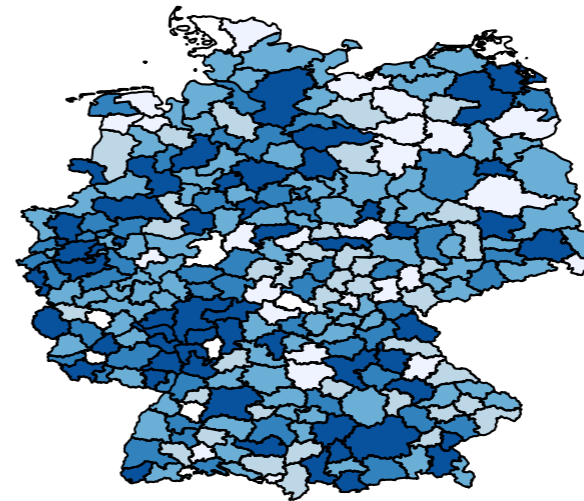
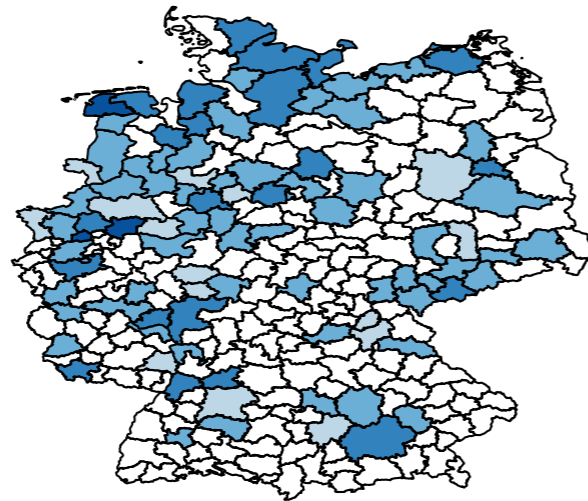
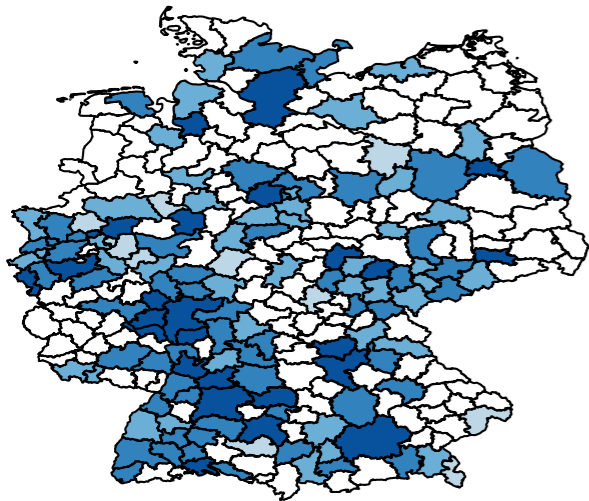
Empirical approach (V)

R&D subsidies per region in 2000, CHEM

R&D subsidies per region in 2000, TRANS

Efficiency of regions in 2003, CHEM

Efficiency of regions in 2003, TRANS

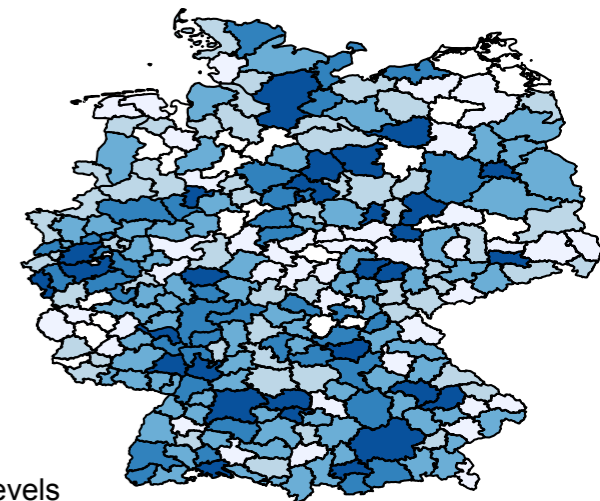
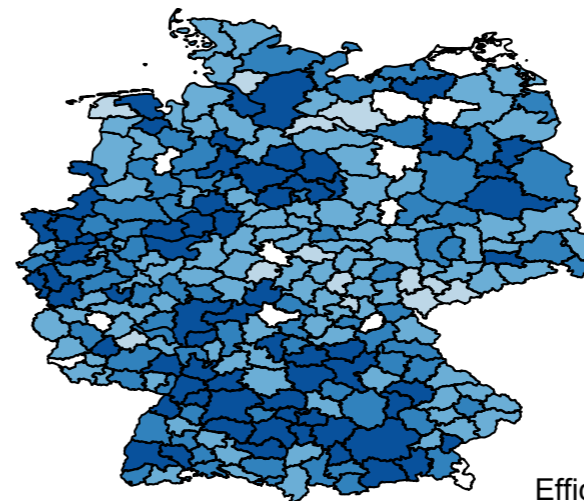
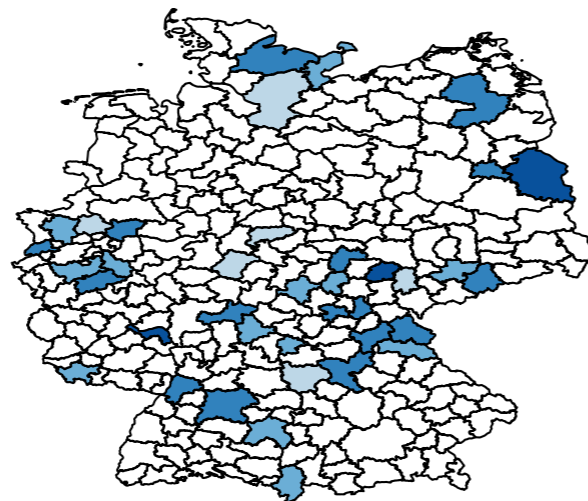
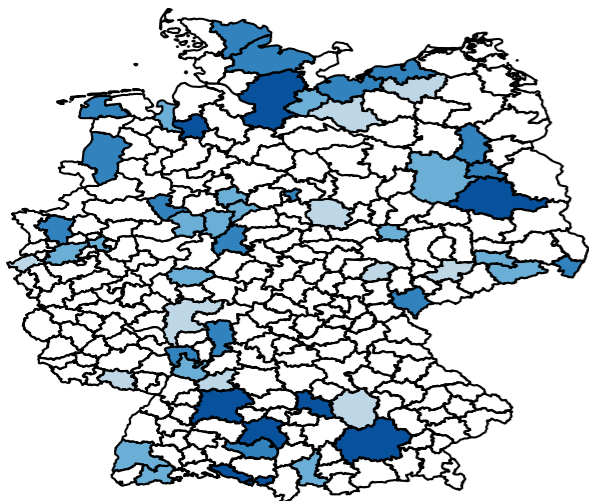


R&D subsidies per region in 2000, ELEC

R&D subsidies per region in 2000, INSTR

Efficiency of regions in 2003, ELEC

Efficiency of regions in 2003, INSTR



Total amounts of R&D subsidies

□ 0	□ ≤10,000	□ ≤100,000	□ ≤1,000,000	□ >10,000,000
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Efficiency levels

□ No R&D	■ 0<=1	■ 1<=2	■ 2<=5	■ 5<=10	□ 10<=
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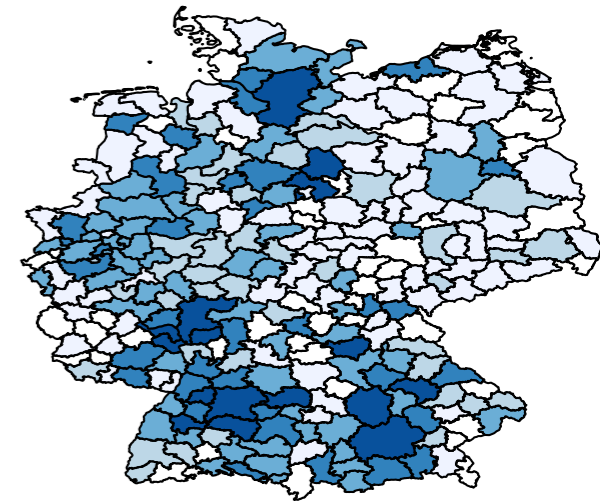
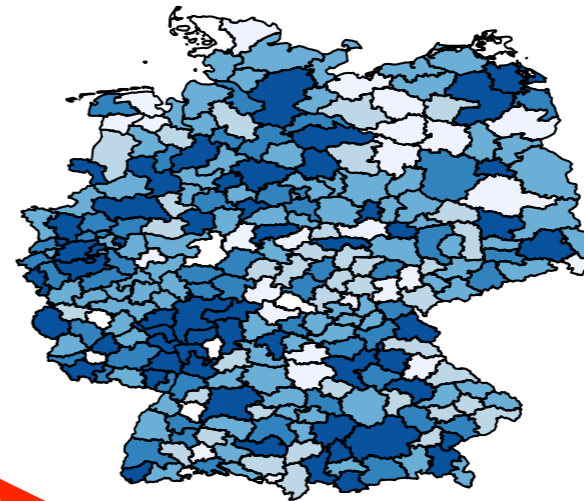
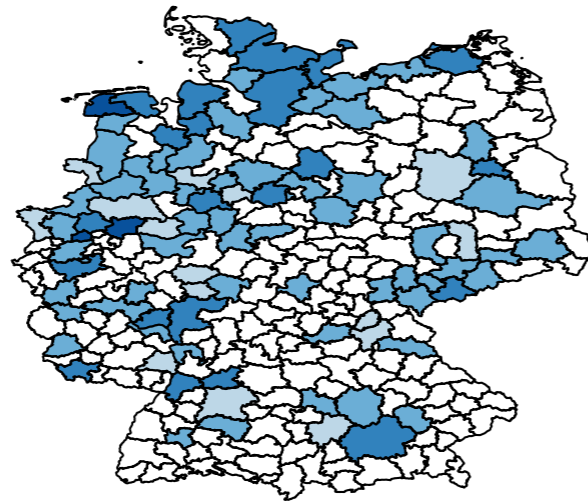
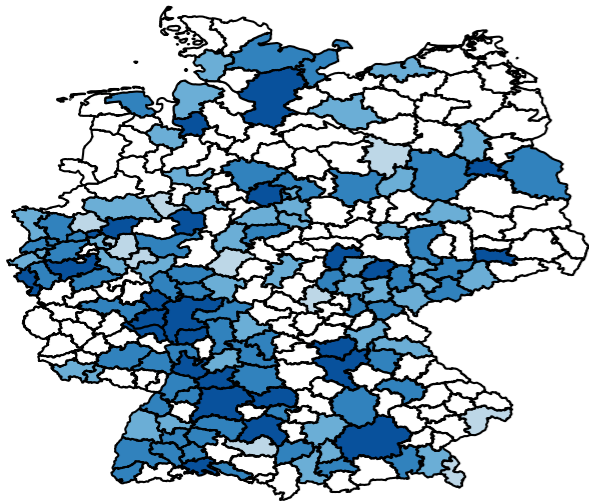
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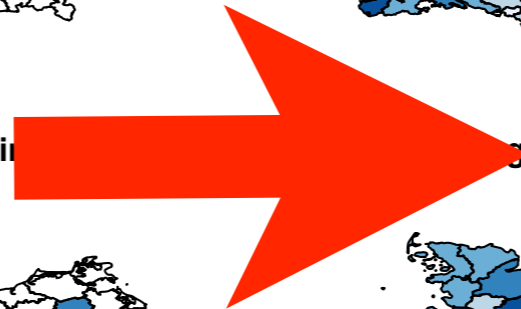
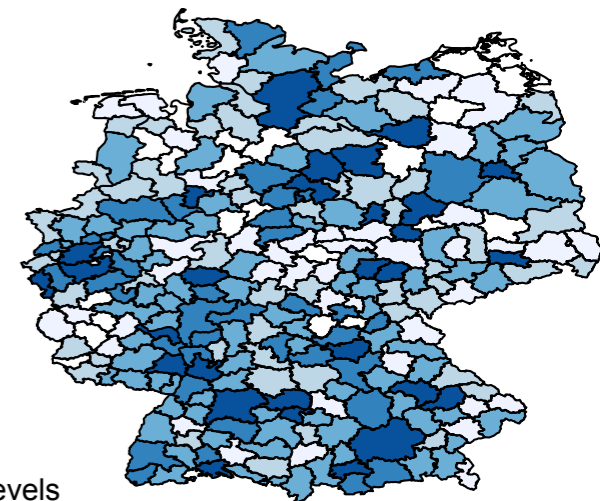
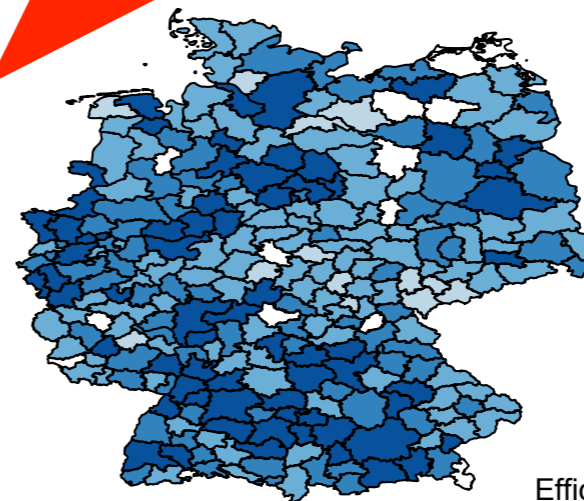
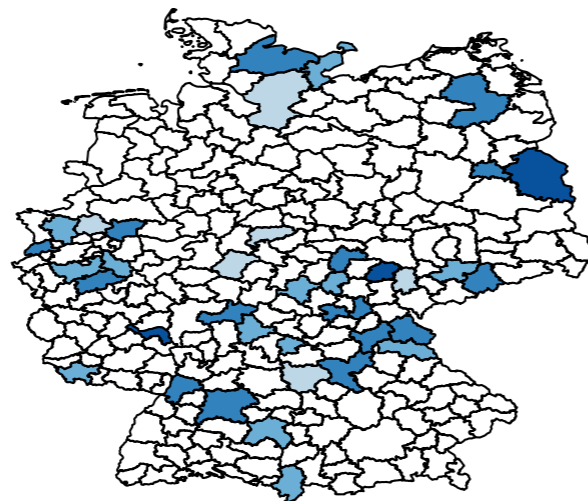
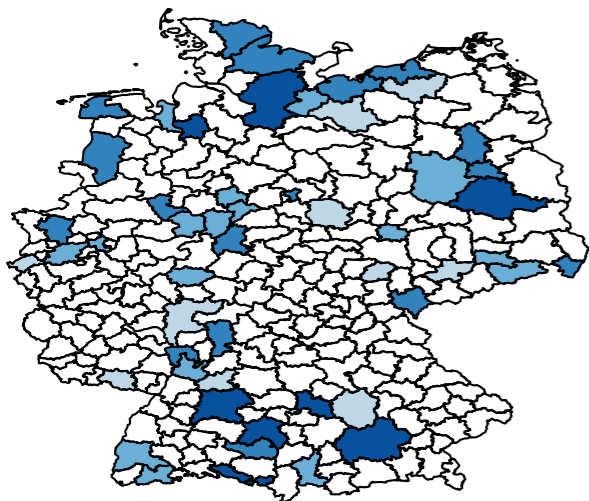


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Results

Results (I)

- **Negative effect** of non-collaborative R&D subsidies (number of supported projects)
 - Relevant for regions with low innovation capacity (rural regions)
 - >900 Mio. Euro
- Explanation?
 - Non-collaborative subsidies primarily for inefficient projects?
 - Crowding out of (more efficient) collaborative subsidies?

Results (II)

- **Positive effects** of collaborative (joint) R&D subsidies
 - <600 Mio. Euro
- Regions with small innovation capacities (rural regions)
 - **Intra-regional collaboration (+)**
 - **Collaboration with research institutes (+)**
- Regions with large innovation capacities (urban regions)
 - **Collaboration with universities (+)**

Conclusion

Conclusion

- Subsidies can stimulate **regional** innovation efficiency
 - Results similar to **firm level** (Fornahl et al., 2010)
 - Positive effects related to **subsidizing collaborative R&D**
 - Choice of collaboration partners is **relevant**
 - Differences between rural and urban regions
- Weakness
 - Pooling of industries
 - Restricted to subsidized R&D collaboration
 - Static approach (life-cycle of industries)

Thank you for your attention
