GWS SPECIALISTS IN EMPIRICAL ECONOMIC RESEARCH

THE NEW RIMES MODEL

Modeling the energy transition in a multiregional input-output approach – Compilation of input-output tables and a scenario analysis framework

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Background information

Collaborative Project: Info-EW – Promoting the clean energy transition in Germany (2023 – 2026)

- Potsdam Institute for Climate Impact Research (PIK, synthetic population/households),
- EWAS-Institute (Stakeholder process)
- HahnIT (Dashboard development)

What do we do?

- Combination of synthetic population (38 million households) and MRIO modeling
- Analysis of economic, social and structural impacts of decarbonisation
- Results at fine regional scale (NUTS 3 level)
- Development of an interactive dashboard for regional energy transition analysis
- Open-access tool for policy- and decision-makers

What makes the project unique?

- Household-level and economic integration
- High spatial resolution and actionable insights
- Create a standardized scenario analysis framework for municipal stakeholders
- Systematic transfer of scientific results into the practice of municipal actors in a transdisciplinary and participatory process.

RIMES – a new subnational multiregional Input-Output model

- New MRIO features:
  - Interlinkages with **INFORGE/LÄNDER** enable the compilation of historical and projected data
  - **Regional resolution**: 400 NUTS 3 regions (districts) of Germany
  - **Economic resolution**: 37 industries

- Six steps of compilation:
  - Preparation of **regionalisation factor**: Employment data
  - **Step A**: Regionalised production and intermediate uses
  - **Step B**: Regionalised final demand
  - **Step C**: International exports and imports

Where in Germany are which goods in demand and used?

  - **Step D**: Inter- and intra-regional trade flows within Germany
  - **Step E**: Harmonisation and model closure

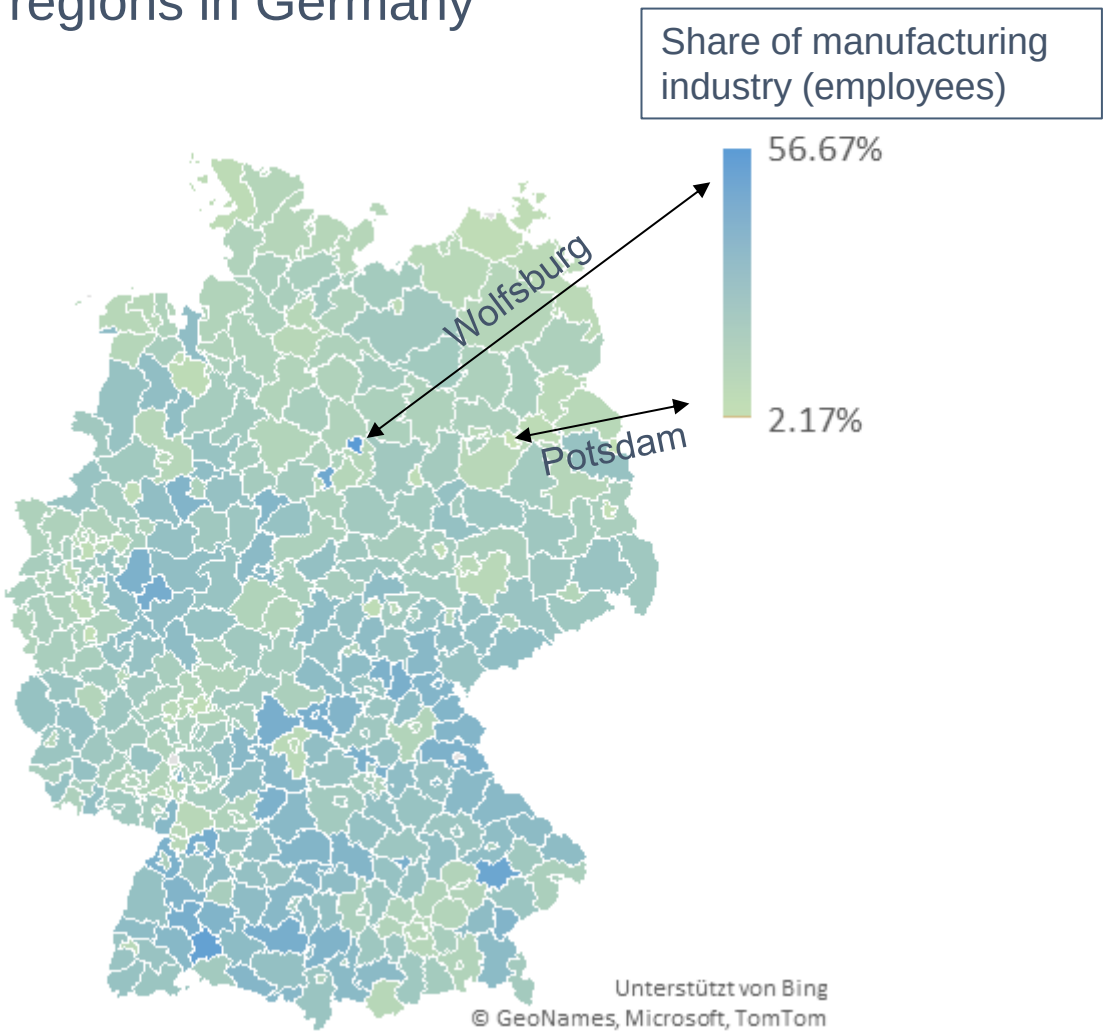
Where in Germany do the demanded and used goods come from?

Preparation of regionalisation factor

- **Data:** Employment statistics by Federal Employment Agency
  - ⇨ **Best level of detail** on industry structures in Germany on NUTS 3 level

- **Number of employees** for 37 industries available for all 400 NUTS 3 regions
  - ⇨ **2023** as base year
  - ⇨ **Statistical disclosure control** meant 960 out of 14,800 entries were blanks
  - ⇨ **Gap-filling routine** based on adjustments to known subtotals and totals
  - ⇨ Calculation of **regional employment share per industry**

- **Diverse economic structures** of the regions in Germany



Source: Own image; Data: BA, employment statistics 2023

Step A: Regionalised production and intermediate uses

- Production for 37 industries in all 16 German Federal states (NUTS 1) is known from the GWS model INFORGE/LÄNDER
- **Regionalisation of production** is based on regional employment share:

$$yg_{k,i} = yg_{l,i} * emp_{k,i} / emp_{l,i}$$

***yg**: production* ***emp**: employment*
***k**: NUTS 3 region* ***l**: associated NUTS 1 region*
***i**: industry*

- **Regionalisation of intermediate uses** by 37 industries
  - ⇨ Assumption: No regional differences in input structures
  - ⇨ Average input structure of the respective industry in Germany is applied to all 400 regions

Step B: Regionalised final demand

<table>
<tr><th></th><th>Cons. exp. private households
R1 … R400</th><th>Cons. exp. NPISH
R1 … R400</th><th>Cons. exp. government
R1 … R400</th><th>GFCF equipment
R1 … R400</th><th>GFCF construction
R1 … R400</th><th>CIV
R1 … R400</th></tr>
<tr><td>Industry 1</td><td rowspan="6">Income and Expenditure Survey (EVS), Destatis: Assign consumer purposes to 37 industries

Regionalisation based on SynPop (PIK)</td><td colspan="2" rowspan="6">INFORGE/LÄNDER

Weighted consumption patterns

Same per capita values as averages of the respective federal state;
Same consumption patterns as in national average for all regions</td><td rowspan="4">INFORGE/LÄNDER

National investment patterns between industries
&</td><td rowspan="4">INFORGE/LÄNDER

Product group structure of respective investment activities
&</td><td rowspan="6">Share of production is assumed to be equal to national average in all NUTS 3 regions</td></tr>
<tr><td>…</td></tr>
<tr><td>…</td></tr>
<tr><td>…</td><td rowspan="3">Regionalised production (Step A)</td><td rowspan="3">Regionalisation based on NUTS 3 statistics on construction completion, Destatis</td></tr>
<tr><td>…</td></tr>
<tr><td>Industry 37</td></tr>
</table>

Step C: International trade

- **Exports**
  - ⇨ Assumption: Share of export use in production is equal to **national average** in all regions
  - ⇨ Specific weights for industrial products based on federal states' statistics

- **Imports**
  - ⇨ Assumption: Import share in total domestic use is equal to **national average** in all regions
  - ⇨ Different weights for
    - **Intermediate use** ➡ Regionalised production (Step A)
    - **Final demand** ➡ Regionalised final demand (Step B)

Step D: Trade within Germany

► Gravity model with a two-step approach

1. Intra-regional trade shares: What share of used products originates from the local NUTS 3 region?

- **Assumption:** Share of intra-regional trade is higher, the higher the local production
- **Goods group-specific approach:** EU FIGARO data on trade by goods
- **Coefficients estimated based on national market shares at EU level:** Probability of intra-regional trade depends on the good

2. Inter-regional trade flows: Which other NUTS 3 regions in Germany supply the used products not sourced locally?

- **Assumption:** Share of goods that is not provided locally or internationally is sourced by inter-regional trade
- Use of EU trade shares to estimate origin of goods
- **Regional distance matrix:** Estimation of good specific distance-decay functions with EU Figaro data and distance matrix

► Good-group dependent differences

1. Intra-regional trade shares

- Some goods and most services are highly local

	Intra-regional trade	
Industry	**Max.**	**Min.**
Construction	99.6%	75.6%
IT Equipment	32.8%	23.5%

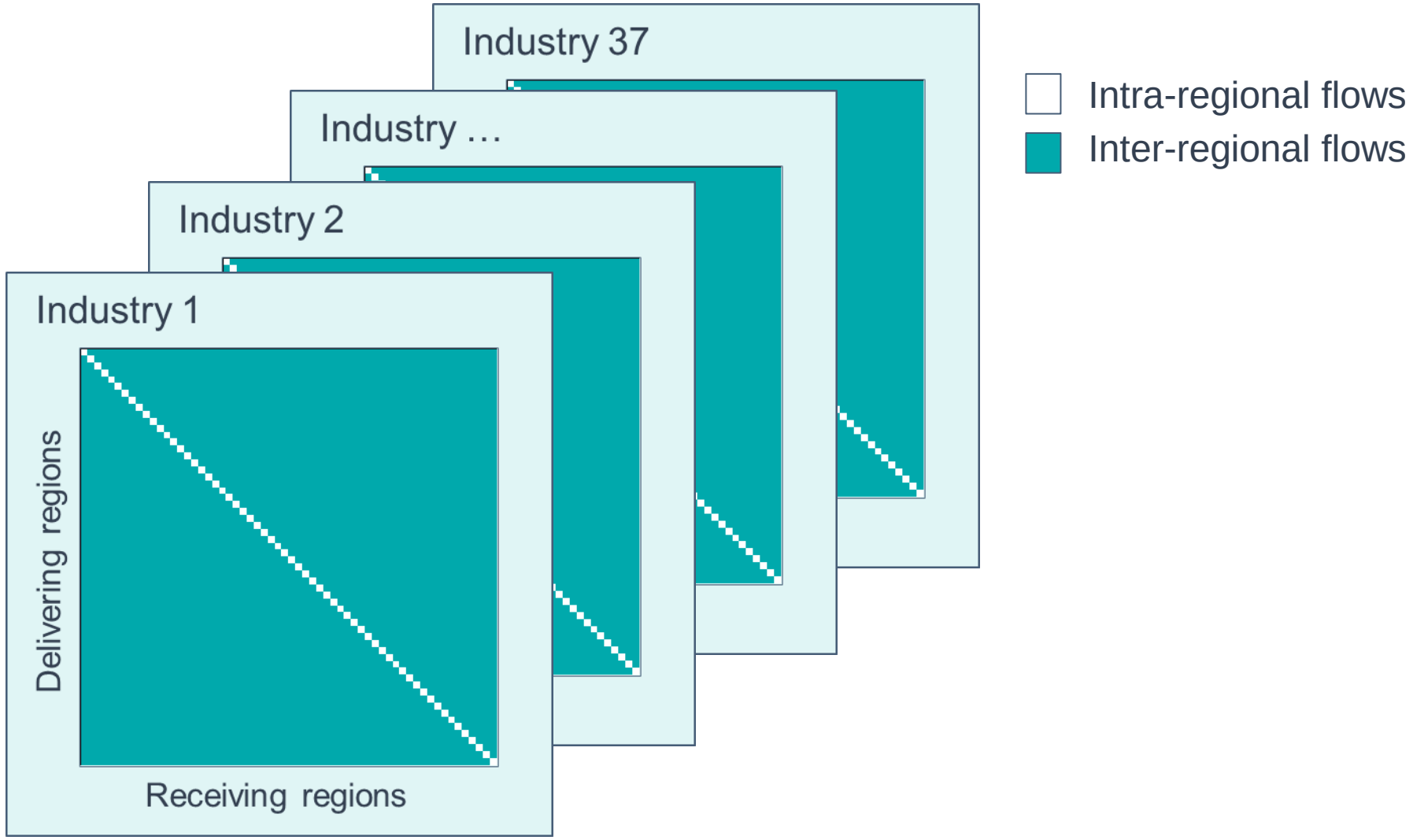
2. Inter-regional trade flows

- Trade shares of goods and services show strongly diverging distance dependencies

Inter-regional trade	
Max.	**Min.**
2.0%	0.0%
58.9%	0.0%

Step D: Trade within Germany

- **Preliminary trade matrices** of 400 by 400 regions for all 37 industries



Step D: Balancing and harmonisation

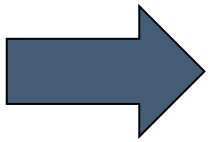
- **Trade matrices are preliminary**
  - ⇨ Initial imbalance between total use and total supply due to unbalanced regional allocation

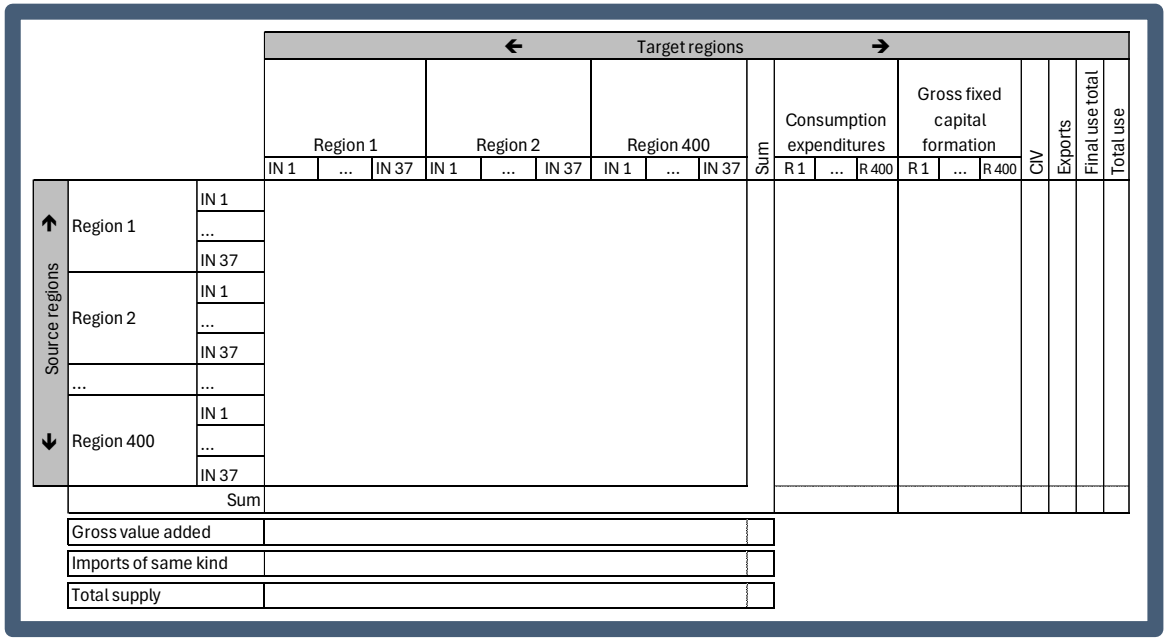
- Marginal totals based on initial assessment of total domestic use and supply
  - ⇨ **Assumption:** CIV and exports are not traded among regions
    - **Point of production equals point of use**

- **Trade share assessment** for total use patterns across all 400 regions
  - ⇨ **Rebalancing process**
    - Adjust domestic trade flows and reallocate among regions through an iterative process
  - ⇨ **Result:** Balanced trade share matrices ensuring consistent regional supply and use patterns

Step E: Model closure

- **RIMES Model closure**
  1. Compute inter-industry transactions (1st quadrant of the MRIO)
  2. Calculate the technology coefficients
  3. Derive the Leontief inverse matrix
  4. Calculate the multi-regional final demand matrix (2nd quadrant of the MRIO)
  5. Assess the Leontief inverse and derive resulting production values





Source: Own image

Outlook

Scenario analysis based on RIMES

- Development of scenarios for clean energy and heat transition in Germany
- Regionalization of private consumption based on demographic development (2030, 2040, 2050)

Application-oriented use of scenario results

Source: Own image

Thank you for your attention!

Project partners Info-EW:

GWS SPECIALISTS IN EMPIRICAL ECONOMIC RESEARCH

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Dr. Britta Stöver (Project Lead)
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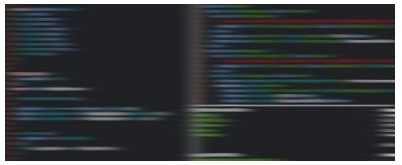

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Further information:

Model RIMES

Project Info-EW

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