Structural Change in the Ruhr: Towards a Knowledge-based Economy?

Matthias Kiese
Institute of Geography • Urban and Regional Economics
RUHR-UNIVERSITÄT BOCHUM

Hannam University • Daejeon, Korea • September 28th, 2017

The Ruhr

- At 5.1 million inhabitants, the Ruhr is Germany’s largest metropolitan area, comprising 6.2% of the national population.
- Polycentric structure with 53 municipalities
- Manufacturing heartland with legacy of coal mining and steel industry

Regional Competitiveness: Ruhr Falling Behind?

Revier fällt im Wettstreit der attraktivsten Regionen zurück

13.04.2016 | 05:00 Uhr

- Ranking of 402 counties and county-free cities in Germany by economic performance, labour market and quality of life
- Five Ruhr cities among the bottom ten

Das Thyssen Krupp-Stahlwerk im Duisburger Norden: Die Stadt lebt auch von der Schwerindustrie. Trotzdem, so schreiben die IW-Experten, ist die Stadt im „Regionalranking“ das Schlusslicht. Foto: Hans Blassey

Im Regional-Ranking von 402 Städten und Kreisen liegen laut Institut der deutschen Wirtschaft Gelsenkirchen und Duisburg ganz hinten.

Kohlstadt/Münstermann 2016 (emphasis added)

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„Bottom of the League“ Discourse in the Ruhr

<table>
<thead>
<tr>
<th>IW Ranking</th>
<th>WMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lack of <strong>innovation capacity</strong></td>
<td>• “In contrast to pessimistic assessments, the Ruhr economy is clearly catching up.”</td>
</tr>
<tr>
<td>• Insufficient <strong>knowledge transfer</strong> between science and businesses</td>
<td>• 2014-2015 saw the creation of &gt; 35,000 <strong>new jobs in lead markets</strong>, such as logistics and the healthcare industry</td>
</tr>
<tr>
<td>• Lagging behind in <strong>digital transformation</strong> („Industrie 4.0“)</td>
<td>• “The figures show that structural change is on the right track.”</td>
</tr>
<tr>
<td>• Lack of <strong>unity</strong> (governance)</td>
<td></td>
</tr>
</tbody>
</table>

Cf. Kohlstadt/Münstermann 2016 (own translation, emphasis added)

Structural Change in the Ruhr?

• What is the status of structural change in the Ruhr?
• What does “transition to a knowledge economy” mean?
• How far has the Ruhr come in this transition?
• How can this transition be promoted, and what challenges need to be overcome?

Key Questions
1) Structural Change in the Ruhr

2) Structural Change 2.0: Towards the Knowledge Economy

3) The Ruhr in the Knowledge Economy

4) Conclusion and Outlook

Structural Change in Action: Steelworkers in the Streets of Bochum

22 September, 2017
Structural Change in Action: Demolition of Opel I

Photos: Kiese (left: 15.04.2015; right: 20.04.2016)

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Share of Employment in Manufacturing*, 1964-2014

*) Includes Mining, Energy & Construction; **) Germany excluding East Germany before 1990
Data: RVR (http://www.rvr.de/Shared/Metropole_Ruhr/Statistik/Produktivitaet/StellungIPA/Statistik/Erwerbstaeetigkeit/Erwerbstaeetigkeit_Mikrozensus14.pdf [18.11.2016])

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Employment by Sector, 1964-2014

<table>
<thead>
<tr>
<th></th>
<th>The Ruhr</th>
<th>NRW</th>
<th>Germany**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964</td>
<td>31.0%</td>
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<td>31.4%</td>
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<tr>
<td>1996</td>
<td>21.4%</td>
<td></td>
<td>24.8%</td>
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</table>

*) Includes Mining, Energy & Construction; **) Germany excluding East Germany before 1990


Structural Change in the Ruhr – Towards a Knowledge-based Economy?

Manufacturing Employment, 1996-2012

<table>
<thead>
<tr>
<th></th>
<th>Shares</th>
<th>1996</th>
<th>2012</th>
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</thead>
<tbody>
<tr>
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<td>31.0%</td>
<td>21.4%</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>31.4%</td>
<td>24.8%</td>
<td></td>
</tr>
</tbody>
</table>

Arndt et al. 2015, p. 53

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# Structural Change in the Ruhr – Towards a Knowledge-based Economy?

## Hannam University
• Daejeon, Korea
• September 28th, 2017

### Institute of Geography
Matthias Kiese
• Urban and Regional Economics

## Gross Value Added (GVA) by Sector, 2000-2012

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; Forestry</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
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<tr>
<td>Mining, Energy, Construction</td>
<td>9.5%</td>
<td>9.6%</td>
<td>12.9%</td>
<td>12.8%</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>20.1%</td>
<td>19.8%</td>
<td>17.6%</td>
<td>17.4%</td>
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<tr>
<td>Services</td>
<td>70.2%</td>
<td>70.2%</td>
<td>69.1%</td>
<td>69.6%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
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<table>
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</thead>
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<td>Agriculture &amp; Forestry</td>
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<td>Mining, Energy, Construction</td>
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<td>7.2%</td>
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<td>24.0%</td>
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<td>21.9%</td>
<td>21.6%</td>
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<tr>
<td>Services</td>
<td>68.6%</td>
<td>70.3%</td>
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<td>70.6%</td>
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<tr>
<td>Total</td>
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<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
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<table>
<thead>
<tr>
<th>Sector</th>
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<th>2010</th>
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<td>7.3%</td>
<td>8.3%</td>
<td>8.1%</td>
<td></td>
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<td>Manufacturing</td>
<td>22.3%</td>
<td>22.0%</td>
<td>21.9%</td>
<td>22.4%</td>
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<tr>
<td>Services</td>
<td>68.4%</td>
<td>69.9%</td>
<td>69.0%</td>
<td>68.7%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
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</tr>
</tbody>
</table>

- Share of **manufacturing below average** in the Ruhr
- Manufacturing stable in Germany, but **declining** in NRW and the Ruhr


—

## Manufacturing GVA, 1992-2012

![Diagram](Arndt et al. 2015, p. 48)

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Share of manufacturing employment, 2014

- South-north divide
- West-east divide
- Large cities as service centres
- Sub- and disurbanisation of manufacturing
- **The Ruhr** is no longer a manufacturing heartland!

Share of Manufacturing Employment by City/County, 2012

Data: IT-NRW 2013

Map: BBSR 2017
GVA in the Service Sector, 1992-2012

Employment in Services, 1996-2012

Arndt et al. 2015, p. 48
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Geography of Employment in Services

Share of employment in services, 2014

- **Urban agglomerations** specialise in services
- Some **specialised service centres**, e.g. university towns (Freiburg, Heidelberg, Münster)

![Map: BBSR 2017](image)

Geography of Business Services

Share of employment in Business Services, 2014

- **Agglomerate** more strongly than services in general
  ⇒ Focus on urban agglomerations/ large metropolitan regions

![Map: BBSR 2017](image)
The Ruhr’s Industry Portfolio

**Coal mining & oil refining**
- Employment: 12,600 emp.
- Percentage Change: -53.8%
- Location Quotient (LQ): 5.5

**Energy**
- Employment: 20,300 emp.
- Percentage Change: 16.7%

**Metal processing**
- Employment: 12,600 emp.
- Percentage Change: -53.8%

**Wholesale**
- Employment: 71,500 emp.
- Percentage Change: -16.7%

**Printing & publishing**
- Employment: 12,600 emp.
- Percentage Change: -24.0%

**Automotive**
- Employment: 12,800 emp.

**Construction**
- Employment: 63,500 emp.
- Percentage Change: 6.3%

**Food Processing**
- Employment: 21,200 emp.
- Percentage Change: 21.4%

**Restaurant & Tourism**
- Employment: 24,200 emp.
- Percentage Change: 26.9%

**Machinery & equipment**
- Employment: 72,200 emp.
- Percentage Change: 25.1%

**Software & telecoms**
- Employment: 31,300 emp.
- Percentage Change: 26.9%

**Manufacturing**
- Employment: 136,000 emp.
- Percentage Change: 26.9%

**Business services**
- Employment: 106,800 emp.
- Percentage Change: 26.9%

**Social services**
- Employment: 67,900 emp.
- Percentage Change: 25.1%

**Waste Management**
- Employment: 14,200 emp.
- Percentage Change: 25.1%

**Education**
- Percentage Change: 26.9%

**Housing & Real Estate**
- Employment: 12,800 emp.
- Percentage Change: 24.0%

**Electrical appliances**
- Employment: 12,600 emp.
- Percentage Change: -24.0%

**Automotive**
- Employment: 12,800 emp.
- Percentage Change: 24.0%

**Printing & publishing**
- Employment: 12,600 emp.
- Percentage Change: -24.0%

**Chemicals**
- Employment: 14,000 emp.
- Percentage Change: -21.4%

**Location Quotient (Germany = 1)**

Arndt et al. 2015, p. 56
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GDP, 2000-2012 (2000 = 100)

Data: RVR [http://www.metropoleruhr.de/fileadmin/user_upload/metropoleruhr.de/Bilder/Daten___Fakten/Regionalstatistik_PDF/Wirtschaftskraft/VWGBIP_12_Tab.pdf] [18.11.2016]
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GDP per Capita, 1992-2012

<table>
<thead>
<tr>
<th></th>
<th>1992</th>
<th>2001</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Ruhr</td>
<td>92.8</td>
<td>84.6</td>
<td>90.9</td>
</tr>
</tbody>
</table>

Beware
Net commuter outflow ⇒ Data understate economic performance of the Ruhr!

Arndt et al. 2015, p. 51
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GDP per Employee, 2000-2012 (Germany = 100)

Data: RVR
(http://www.metropoleruhr.de/fileadmin/user_upload/metropoleruhr.de/Bilder/Daten_Fakten/Regionalstatistik_PDF/Wirtschaftskraft/VWGBP_12_Tab.pdf [18.04.2016])
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GDP per Employee, 2000-2012: Cities and Counties

CAGR, 2000-2012

GDP per Employee in €, 2012

Data: RVR; CAGR = Compound Annual Growth Rate
(http://www.rvp.ch/fileadmin/rvp/Unternehmen/Statistik/Abteilung/Regionalstatistik/Regionalstatistik.pdf)
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Disposable Household Income, 1975-2013 (Germany* = 100)

CAGR 1975-2013 1995-2013
The Ruhr +3.3% +1.4%
NRW +3.6% +1.6%
Germany +3.5% +1.9%

Data: RVR; *) excluding East Germany until 1990;
(http://www.rvp.ch/fileadmin/rvp/Unternehmen/Statistik/Abteilung/Regionalstatistik/Regionalstatistik.pdf)
Structural Change in the Ruhr – Towards a Knowledge-based Economy?
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**Disposable Household Income: Cities and Counties, 2004-2013**

**Unemployment Rates, August 2017**

Spatial Cumulation of Employment Risks
- „Culture of unemployment“ in some urban districts
- Skills deficits prevent transition to service sector
- Social polarisation and exclusion (Cf. Bogumil et al. 2012, p. 50)

Data: Federal Labour Agency (Bundesagentur für Arbeit)
Unemployment Rates, 1960-1988

![Graph showing unemployment rates from 1960 to 1988 for The Ruhr, NRW, and Germany. The graph highlights the percentage change from 1968 to 1972 without Wesel county. Data source: RVR.](http://www.metropoleruhr.de/fileadmin/user_upload/metropoleruhr.de/Bilder/Daten_Fakten/Regionalstatistik_PDF/Arbeitsmarkt06_Zeitr_Arbeitsmarkt15.pdf [18.11.2016])

Unemployment Rates, 1991-2015*

![Graph showing unemployment rates from 1991 to 2015 for The Ruhr, NRW, and Germany. The graph highlights the percentage change from 1991-1994: annual average. Data source: RVR, StBA.](http://www.metropoleruhr.de/fileadmin/user_upload/metropoleruhr.de/Bilder/Daten_Fakten/Regionalstatistik_PDF/Arbeitsmarkt06_Zeitr_Arbeitsmarkt15.pdf [18.11.2016])
Labour Force Mobilisation*, 2013

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Women</th>
<th>Foreigners</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Ruhr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Germany</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*) Employees as share of working-age population (15 to below 65 years)
Data: Arndt et al. 2015, p. 63

Structural Change in the Ruhr: Preliminary Conclusions

- **Deindustrialisation/Tertiarisation** well advanced
  - Increasing linkages manufacturing ⇔ business services in hybrid value chains
  - Below-average presence of manufacturing = weakness

- **Legacy of structural change**
  - Structural unemployment
  - Spatial & sectoral fragmentation of structures and trajectories
  - Backwardness in value added and labour productivity, but catching up
  - Persistent income gap, esp. disposable household income falling behind
Outline

1) Structural Change in the Ruhr

2) Structural Change 2.0: Towards the Knowledge Economy

3) The Ruhr in the Knowledge Economy

4) Conclusion and Outlook

Forms of Knowledge

Knowledge

- explicit
  - Know-what
    - information
  - Know-why
    - abilities, skills
- implicit / tacit
  - Know-how
    - relations, networks
  - Know-who
    - E = mc²
What is the Knowledge-based Economy (KBE)?

Knowledge-based economies are „directly based on the production, distribution and use of knowledge“ (OECD 1996, p. 7).

Characteristics of the KBE (cf. Smith 2002)

- Knowledge as a factor of production (input)
- Knowledge as a product (output)
  - high-tech industries
  - knowledge-intensive business services (KIBS)
- Increasing codification ⇒ information ↑
- Costs of knowledge sourcing and diffusion ↓
- Networks as hybrid forms of knowledge (cf. Arrow 1994)

Delineating the Knowledge Economy in Germany

- R&D-intensive manufacturing industries by share of turnover spent on internal R&D
  - High technology (Hochtechnologie)
    - R&D intensity: 2.5%-7%
    - Chemical industry, mechanical engineering, electrical equipment, automotive industry, other vehicles
  - Cutting-edge technology: R&D intensity > 7%
    - Pharmaceutical industry, IT hardware, communications engineering, medical and measurement technology, aerospace
- Knowledge-based services
  - > 11% of employees with university degrees and > 4.5% natural scientists and engineers
  - Printing and publishing, telecommunication, financial services (banking, insurance), data processing, R&D services, business services, health and social services, cultural industries, entertainment, sports
  - Sub-group: Knowledge-intensive business services (KIBS) ⇒ bridges in systems of innovation (cf. Czarnitzki/Spielkamp 2002, BMWI 2009)
R&D Intensity by Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data processing, electronic and optical equipment</td>
<td>&gt; 7%</td>
<td>&gt; 7%</td>
<td>&gt; 7%</td>
</tr>
<tr>
<td>Pharmaceutical industry</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
</tr>
<tr>
<td>Aerospace industry</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
</tr>
<tr>
<td>Automotive industry</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
</tr>
<tr>
<td>All manufacturing industries</td>
<td>2.5% - 7%</td>
<td>2.5% - 7%</td>
<td>2.5% - 7%</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
</tr>
<tr>
<td>Mechanical engineering</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
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<tr>
<td>Electrical equipment</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
</tr>
<tr>
<td>Mfg. of other vehicles</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
</tr>
<tr>
<td>Plastics &amp; rubber processing</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
<td>&gt; 2.5%</td>
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</tbody>
</table>

EFI 2016, p. 109

KBE: International Comparison

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<td>South Korea</td>
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<tr>
<td>Japan</td>
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Share of national GVA

<table>
<thead>
<tr>
<th>Country</th>
<th>Knowledge-intensive services</th>
<th>Cutting-edge technology</th>
<th>High technology</th>
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<tr>
<td>Japan</td>
<td>00</td>
<td>14</td>
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EFI 2017, p. 161
Outline

1) Structural Change in the Ruhr
2) Structural Change 2.0: Towards the Knowledge Economy
3) The Ruhr in the Knowledge Economy
4) Conclusion and Outlook
### Knowledge Economy in the Ruhr: Dimensions

<table>
<thead>
<tr>
<th>Dimensions/Sectors</th>
<th>Relevance</th>
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<tbody>
<tr>
<td>Innovation potential (R&amp;D, patents)</td>
<td>• Driver of economic growth (Fritsch et al. 1998, Romer 1986, 1990)</td>
</tr>
<tr>
<td></td>
<td>• Absorptive capacity (Cohen/Levinthal 1989, 1990)</td>
</tr>
<tr>
<td>Universities</td>
<td>• Research ⇒ invention</td>
</tr>
<tr>
<td></td>
<td>• Human capital accumulation (vgl. Harding et al. 2007, Varga 2009, Schiller/Kiese 2010)</td>
</tr>
<tr>
<td></td>
<td>• Antenna function (Fritsch/Schwirten 1998)</td>
</tr>
<tr>
<td>Human capital</td>
<td>• Driver of economic growth (Romer 1986)</td>
</tr>
<tr>
<td></td>
<td>• Diffusion, absorption</td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td>• Commercialising new knowledge = innovation (Schumpeter 1934)</td>
</tr>
<tr>
<td>Cultural &amp; creative economy</td>
<td>• Creative class (Florida 2002)</td>
</tr>
<tr>
<td></td>
<td>• Symbolic knowledge base (Asheim/Gertler 2005; Martin 2012)</td>
</tr>
</tbody>
</table>

#### Data & Map: BBSR 2017

<table>
<thead>
<tr>
<th>County/City</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolfsburg</td>
<td>56.2</td>
</tr>
<tr>
<td>Bund</td>
<td>10.3</td>
</tr>
<tr>
<td>München (Stadt)</td>
<td>8.8</td>
</tr>
<tr>
<td>Bochum</td>
<td>7.2</td>
</tr>
<tr>
<td>Köln</td>
<td>7.0</td>
</tr>
<tr>
<td>Dortmund</td>
<td>6.8</td>
</tr>
<tr>
<td>Düsseldorf</td>
<td>5.8</td>
</tr>
<tr>
<td>Duisburg</td>
<td>4.5</td>
</tr>
<tr>
<td>Essen</td>
<td>3.5</td>
</tr>
</tbody>
</table>

- West-east divide
- South-north divide
- Weak position of the Ruhr

Data & Map: BBSR 2017
Structural Change in the Ruhr – Towards a Knowledge-based Economy?

Hannam University • Daejeon, Korea • September 28th, 2017

Institute of Geography
Matthias Kiese • Urban and Regional Economics

Share of Employees in R&D, 2011

- South-north divide
- Urban-rural divide
- Large mfg. firms in R&D intensive industries

<table>
<thead>
<tr>
<th>County/City</th>
<th>Share (per 1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groß-Gerau</td>
<td>91.1</td>
</tr>
<tr>
<td>Munich (city)</td>
<td>37.5</td>
</tr>
<tr>
<td>Germany</td>
<td>12.6</td>
</tr>
<tr>
<td>Cologne</td>
<td>11.1</td>
</tr>
<tr>
<td>Essen</td>
<td>7.2</td>
</tr>
<tr>
<td>Dortmund</td>
<td>8.3</td>
</tr>
<tr>
<td>Bochum</td>
<td>6.7</td>
</tr>
<tr>
<td>Duisburg</td>
<td>6.5</td>
</tr>
<tr>
<td>Düsseldorf</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Data and map: [www.inkar.de](http://www.inkar.de) [21.10.2015]

R&D in the Business Sector

- Inputs for knowledge production ⇒ Product / process innovation

Data: Arnott et al. 2015, p. 83

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Hannam University • Daejeon, Korea • September 28th, 2017
Patent Applications per 100,000 employees (2011/2012)

<table>
<thead>
<tr>
<th>Region</th>
<th>Patent Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>116</td>
</tr>
<tr>
<td>West Germany</td>
<td>132</td>
</tr>
<tr>
<td>NRW</td>
<td>80</td>
</tr>
<tr>
<td>The Ruhr</td>
<td>60</td>
</tr>
</tbody>
</table>

Data: Arndt et al. 2015, p. 84

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50 Years of Universities in the Ruhr

http://aktuell.ruhr-uni-bochum.de/mam/images/fittosize_440_0_abe65bd3d2a5d04285d257fa7ac56502_stil-leben_a40.jpeg,
http://www.ruhr-guide.de/artikel_pix/RUB_68.0071.jpg,
http://www.ruhrnachrichten.de/storage/pic/mdhl/artikelbilder/lokales/ rn/bolo/bochum/2612677_1_0727bo-rub-eroffnung-stadtb.jpg?version=1387193021,
https://www.bochum.de/C12571A3001D56CE/vwContentByKey/W29RXCWN386BOCMDE/$FILE/1965_Baustelle_RuhrUniversitaet_29_Juni_1965_gross.jpg
[09.10.2015]
RVR 2016

Winter Semester 2014/2015

- 260,211 students, of which 70,000 distance learning (Fernuni Hagen)
- 36.8% of students in law, management & economics and social sciences (NRW: 29.2%)
- Student numbers exceed absorptive capacity of regional labour market ⇒ Outmigration of graduates (brain drain)
- Quantitative input indicator

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University Students in the Ruhr

(Index WS 1999/2000=100)

The Ruhr

Rest of NRW

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University Students in the Ruhr

The Ruhr

Rest of NRW
University Students in the Ruhr

- The Ruhr is the metropolitan region with the highest number of university students in Germany.
- Measured against population size, Mitteldeutschland has more university students.
- Without distance learning at the Fern-Uni Hagen, the Ruhr would fall back to 6th rank (No. 4 on per capita basis).
- The number of university students in the Ruhr increased faster than in any other metropolitan region.

Data: Kriegesmann et al. 2015, p. 11

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Data: RVR 2016; Essen without Essen divisions of UDE
Brain-Flow Balance of University Graduates*

<table>
<thead>
<tr>
<th>Group</th>
<th>Origin</th>
<th>Retention</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained</td>
<td>Ruhr</td>
<td>Yes</td>
<td>35%</td>
</tr>
<tr>
<td>Lost</td>
<td>Ruhr</td>
<td>No</td>
<td>25%</td>
</tr>
<tr>
<td>Acquired</td>
<td>Other</td>
<td>Yes</td>
<td>13%</td>
</tr>
<tr>
<td>Transit</td>
<td>Other</td>
<td>No</td>
<td>27%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Brain-flow balance
13% gained – 25% lost = -12%

*) Graduation cohort of 2011; without follow-up programmes, further education etc. (n=1,088)
Data: Kriegesmann et al. 2015, p. 18

Brain-Flow Balance by Academic Discipline*

<table>
<thead>
<tr>
<th>Discipline</th>
<th>n</th>
<th>Origin in the Ruhr</th>
<th>Retention in the Ruhr</th>
<th>Brain-Flow Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philology, cultural studies</td>
<td>497</td>
<td>66%</td>
<td>64%</td>
<td>-2%</td>
</tr>
<tr>
<td>Economics, law, social sciences</td>
<td>751</td>
<td>63%</td>
<td>50%</td>
<td>-13%</td>
</tr>
<tr>
<td>Engineering</td>
<td>485</td>
<td>62%</td>
<td>51%</td>
<td>-11%</td>
</tr>
<tr>
<td>Mathematics and natural sciences</td>
<td>421</td>
<td>60%</td>
<td>64%</td>
<td>-4%</td>
</tr>
<tr>
<td>Total</td>
<td>2,154</td>
<td>63%</td>
<td>56%</td>
<td>-7%</td>
</tr>
</tbody>
</table>

• Negative brain flow (brain drain) uncharacteristic of metropolitan regions
• Possible explanations
  • high share of regional student input
  • Limited demand for university graduates in regional labour market (knowledge economy)

*) graduation cohort of 2011
Data: Kriegesmann et al. 2015, p. 18; own calculations
Structural Change in the Ruhr – Towards a Knowledge-based Economy?
Hannam University • Daejeon, Korea • September 28th, 2017

Institute of Geography
Matthias Kiese
• Urban and Regional Economics

Share of Employees with University Degrees, 2014

- Highly **uneven** distribution
- Urban-rural divide
- Reflects distribution of **universities**

<table>
<thead>
<tr>
<th>County/City</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erlangen (City)</td>
<td>31.2</td>
</tr>
<tr>
<td>München (City)</td>
<td>28.5</td>
</tr>
<tr>
<td>Düsseldorf</td>
<td>21.3</td>
</tr>
<tr>
<td>Cologne</td>
<td>20.2</td>
</tr>
<tr>
<td>Essen</td>
<td>16.2</td>
</tr>
<tr>
<td>Dortmund</td>
<td>14.5</td>
</tr>
<tr>
<td>Bochum</td>
<td>13.8</td>
</tr>
<tr>
<td>Bund ∅</td>
<td>13.8</td>
</tr>
<tr>
<td>Duisburg</td>
<td>11.5</td>
</tr>
</tbody>
</table>

Data and map: BBSR 2017

<table>
<thead>
<tr>
<th>Less than 7.2%</th>
<th>7.2% to 8.5%</th>
<th>8.5% to 10.3%</th>
<th>10.3% to 13.2%</th>
<th>More than 13.2%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Highly uneven distribution
Urban-rural divide
Reflects distribution of universities

Education of Employees, 2000 & 2011

Arndt et al. 2015, p. 66
Structural Change in the Ruhr – Towards a Knowledge-based Economy?
Hannam University • Daejeon, Korea • September 28th, 2017
Universities: Impacts on Regional Economies

- Value added, employment, income
  - Income multiplier
  - Tax revenue
- Demand for goods and services
  - Input multiplier
- Production of basic knowledge through research
- Education of highly-skilled personnel
- Image effects
  - Attraction/retention of firms and human capital
- Structural effects
  - e.g. the Ruhr: Structural change manufacturing ⇒ services; knowledge economy
- Knowledge and Technology Transfer (KTT)

RUB: Selected Figures

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Students (WS 2016/17)</td>
<td>42,425</td>
</tr>
<tr>
<td>Employees (01.12.2016)*</td>
<td>ca. 5,702</td>
</tr>
<tr>
<td>- of which (junior) professors</td>
<td>481</td>
</tr>
<tr>
<td>Revenue (2015)</td>
<td>€ 539.1 m</td>
</tr>
<tr>
<td>- of which third-party funding</td>
<td>€ 114.8 m</td>
</tr>
</tbody>
</table>

* including medical faculty, excluding hospitals

KTT through Universities

- Contract research for firms
- Research co-operations with firms
- Education of highly-skilled personnel for firms (incl. executive education)
- Commercialisation of research results through
  - Patents and licences
  - New firm foundation (Spin-offs) by faculty, graduates and students

Antenna Function of Universities

• Universities **absorb** knowledge through interregional and international research co-operations.
• Universities **distribute** knowledge into the regional economy.

Cf. Fritsch/Schwirten 1998

**Example: Study**

Die regionalwirtschaftliche Bedeutung der HTW Chor

Example: Study

Buser et al. 2011

The Ruhr – A Science-based Metropolis?

<table>
<thead>
<tr>
<th>Relevance</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 260,000 university students</td>
<td>• Only 12 <strong>non-university research institutes</strong> (Berlin-Brandenburg: 39; Munich: 22), esp. too few Max Planck &amp; Fraunhofer</td>
</tr>
<tr>
<td>• 1,500 university professors</td>
<td>• <strong>Worst student-professor ratio</strong> in the country: 66 students per professor (Bremen-Oldenburg: 44, Munich: 54)</td>
</tr>
<tr>
<td>• Direct &amp; indirect <strong>employment</strong> effect of 50,000</td>
<td>• <strong>400 more professors needed</strong> to reach average ratio</td>
</tr>
<tr>
<td>• <strong>Demand effect</strong> of € 2.3 bn. p.a. through universities incl. their employees and students</td>
<td>• Low levels of <strong>third-party funding per professor</strong> (cf. Berthold et al. 2016, p. 76)</td>
</tr>
<tr>
<td></td>
<td>• Gap in <strong>science-based entrepreneurship (spin-offs)</strong></td>
</tr>
</tbody>
</table>

Cf. Kriegesmann et al. 2015
New Firm Formation

NFF per 10,000 working-age population, 2009/2012

<table>
<thead>
<tr>
<th>Region</th>
<th>2009/2012</th>
<th>Change 2005/2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>36.6</td>
<td>-11.1%</td>
</tr>
<tr>
<td>West Germany</td>
<td>37.4</td>
<td>-8.7%</td>
</tr>
<tr>
<td>NRW</td>
<td>36.4</td>
<td>-10.4%</td>
</tr>
<tr>
<td>The Ruhr</td>
<td>34.3</td>
<td>-10.8%</td>
</tr>
</tbody>
</table>

• Formation rate typically below average in regions with early industrialisation
• The Ruhr lagging behind only slightly, but...

Data: Arndt et al. 2015, p. 69

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Knowledge-intensive NFF

Arndt et al. 2015, p. 70
Structural Change in the Ruhr – Towards a Knowledge-based Economy?
Hannam University • Daejeon, Korea • September 28th, 2017
University-based Entrepreneurship (Spin-offs)

EXIST entrepreneurship grants, 2007-2015

<table>
<thead>
<tr>
<th>City</th>
<th>Grants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin</td>
<td>204</td>
</tr>
<tr>
<td>Munich</td>
<td>99</td>
</tr>
<tr>
<td>Dresden</td>
<td>57</td>
</tr>
<tr>
<td>The Ruhr</td>
<td>40</td>
</tr>
<tr>
<td>Potsdam</td>
<td>38</td>
</tr>
<tr>
<td>Karlsruhe</td>
<td>37</td>
</tr>
<tr>
<td>Aachen</td>
<td>35</td>
</tr>
<tr>
<td>Stuttgart</td>
<td>34</td>
</tr>
<tr>
<td>Köln</td>
<td>29</td>
</tr>
<tr>
<td>Hamburg</td>
<td>24</td>
</tr>
<tr>
<td>Bremen</td>
<td>19</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>18</td>
</tr>
</tbody>
</table>

Data: Kriegesmann et al. 2015, p. 47
Structural Change in the Ruhr – Towards a Knowledge-based Economy?
Hannam University • Daejeon, Korea • September 28th, 2017

Cultural and Creative Economy

Germany 2014
- Ca. 1.6 million jobs
- 3.5% of total employment
- 2.2% of GDP

(BMWi 2016, p. 13)

BMWi 2016, p. 3
Structural Change in the Ruhr – Towards a Knowledge-based Economy?
Hannam University • Daejeon, Korea • September 28th, 2017
Symbolic Knowledge Base: Creativity

- **Symbolic knowledge base**
  - Based on arts and culture
  - Intangible products
  - Individual and context-specific knowledge (creativity)
  - Short-term, flexible **project organisation**
  - **networks, know-who** ➞ reputation, Reciprocity
  - Examples: Film industry, music industry, fashion, design, marketing...

- **“jobs follow people” or “people-driven economy”**
  - Power of place: creative Milieu more important than local supply of jobs
  - People climate: Culture and lifestyle as drivers of economic development

- **3 Ts**
  - **Technology**
  - **Talent** (e.g., bohemian index)
  - **Tolerance** (diversity, e.g., gay index)

Cf. Florida 2002; Asheim/Gertler 2005; Martin 2012, p. 1572

Share of Employment in Creative Industries (2014)

- Highly **uneven** distribution
- Strong but not exclusively focused on large **urban agglomerations**

<table>
<thead>
<tr>
<th>County/City</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gilhorn</td>
<td>13.9</td>
</tr>
<tr>
<td>Munich (City)</td>
<td>8.9</td>
</tr>
<tr>
<td>Cologne</td>
<td>8.0</td>
</tr>
<tr>
<td>Düsseldorf</td>
<td>5.6</td>
</tr>
<tr>
<td>Essen</td>
<td>3.9</td>
</tr>
<tr>
<td>Bochum</td>
<td>3.5</td>
</tr>
<tr>
<td>Germany</td>
<td>3.5</td>
</tr>
<tr>
<td>Dortmund</td>
<td>3.4</td>
</tr>
<tr>
<td>Duisburg</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Data and map: BBSR 2017
Cultural and Creative Economy (CCE) in the Ruhr

- Significant efforts, esp. with European Capital of Culture 2010 (cf. Heinze/Hoose 2011)

- **White hope**
  - Interim use of vacant property
  - Pioneers for upgrading urban spaces
  - Structural change

- Turnover, employees, GVA: **Lower shares** than in Düsseldorf, Cologne and other metropolitan regions in Germany

- Strengths in specific **market segments**, e.g. press, software/games development in Essen

- **Challenges**
  - Negative/weak **population dynamics** (outflow, ageing)
  - Partial lack of **architectural and cultural substance**

Flagship Approach to CCE Development

- **Dortmunder U**
  - 2008 decision to redevelop brewery into centre for CCE
  - Calculated costs of € 46 m (EU 50%, NRW 20%, City 30%), realised for close to € 100 m
  - Some artists’ initiatives, but hardly any spillovers into the neighbourhood (*'Bilbao effect*, cf. Maior-Solgi 2012, Laurin 2013)

- **Design at Zollverein**
  - Ca. 40 firms with > 950 employees (WAZ 2013, Schürmann 2014)
  - Folkwang University of the Arts to open in 2017
  - Creative class prefers authentic urban quarters (Essen: Rüttenscheid, Nordstadt)
The Ruhr in the Knowledge Economy: Summary

- Universities established as engines of structural change, but primarily through **education**
  - Rapidly rising student numbers
  - Poor endowment (student-professor-ratio)
- Knowledge economy underdeveloped & lack of **innovation capacity** in the business sector
  - Low absorptive capacity for university graduates in the labour market
  - Net export of university graduates (brain drain)
- Barriers to **entrepreneurship** and spin-offs
  - **Creative economy** hyped as panacea
    - Lagging quantitatively
    - Thriving bottom-up in selected places and sub-sectors

Outline

1) Structural Change in the Ruhr
2) Structural Change 2.0: Towards the Knowledge Economy
3) The Ruhr in the Knowledge Economy
4) Conclusion and Outlook
What Should Be Done?

- Differentiated, objective analysis instead of euphoria or misery
- Structural change well-advanced, but left scars underneath the surface
  - **Human capital**: Socio-spatial polarisation and groups with little access to (higher) education ⇒ Promote social mobility through programmes such as ‘Talent Scouts’
  - Lack of **innovative and entrepreneurial capacity**, little business-sector R&D
- **Culture of subsidisation** ⇒ help for self-help
  - Endogenous potential
  - Parochial thinking (‘Kirchturmdenken’) ⇒ Co-operation on specific issues
  - Civic engagement and corporate regional responsibility
- **Universities and research organisation** are potential engines for a regional knowledge economy, but their economic impact is still held back by
  - Negative brain-flow balance (brain drain)
  - Entrepreneurial culture and climate (universities and regional level)
  - Lack of linkages with businesses, esp. SME
  ⇒ Potential for strengthening the manufacturing core (SMES, e.g. digitalisation – „Industrie 4.0“)

What Should Be Done?

- Channels of and obstacles to regional knowledge and technology transfer
  - Contract & collaborative research
  - Commissioned student works, teaching assignments to firm staff
  - Graduate employment
  - University spin-offs
- Identification (mapping) of regional knowledge networks
- **Knowledge-based urban and regional development**
  - Master plans in Bochum und Dortmund
  - Development of university quarter in Essen
  ⇒ **Metropolitan research field of competence** of the Ruhr university alliance

Research Needs
References (1/5)


References (2/5)


References (3/5)


References (4/5)


## References (5/5)


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Thank you very much for your kind attention!

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