CONSIDERING OCCUPATIONAL FLEXIBILITY IN DEMAND AND SUPPLY FORECASTS OF OCCUPATIONS

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“Methodologies of long-term forecasting”

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Why consider occupational flexibility?

- High standardization of vocational education and training (VET) in Germany
  - Federal regulations on medium skill level (ISCED 3b)
- If we want to identify possible skill mismatches, it is not enough to consider the qualification level only
- What qualifies somebody to examine certain tasks?
  - It is not enough to look on employment development in sectors only.
  - It is essential to group occupations according to the main focus of activity (to avoid “taxonomical changes”)
- Occupation as the link between qualification and job requirements
- To provide policy advice, we have to consider not only developments of supply and demand of occupations but also to investigate the balancing process => occupational flexibility
Summary of structure

1. BIBB-IAB model set-up (construction)
2. Results of occupational fields projections
3. What if...? The power of scenarios
4. Drivers of occupational mobility
5. Different assumptions of mobility behavior
6. Challenges of the concept
1. BIBB-IAB model set-up - Institutes

- Federal Institute for Vocational Education and Training (BIBB)
  - Data generation, taxonomy (occupational fields, initial vocational qualification)

- Institute for Employment Research (IAB)
  - Demand projection [IAB/INFORGE-model (integral element of the GINFORS global model of GWS)]

- Fraunhofer Institute for Applied Information Technology (FIT)
  - Supply projection 1 (BIBB-DEMOS model)

- Institute of Economic Structures Research (GWS)
  - Supply projection 2 (BIBB-FIT model)

- BIBB
  - Occupational flexibility matrix
# 1. BIBB-IAB model set-up – Occupational Fields

<table>
<thead>
<tr>
<th>3 top-level Occupational Domains</th>
<th>12 Major Occupational Fields (main focus of activity microcensus)</th>
<th>54 Occupational Fields</th>
<th>Main focuses of activity microcensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production-related occupations</td>
<td>Raw material extraction occupations (2)</td>
<td>1, 2</td>
<td>Harvesting (2), supplying (3), processing and manufacturing (4), repairing (6), controlling and maintaining machines (1)</td>
</tr>
<tr>
<td>Occupational fields: 1-13, 15, 17, 18, 20, 42</td>
<td>Processing, manufacturing and repair occupations (4, 6)</td>
<td>3, 7, 9, 10, 11, 13, 15, 18, 20, 42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Occupations involving the control and maintenance of machines and plants (1)</td>
<td>4-6, 8, 12, 17</td>
<td></td>
</tr>
<tr>
<td>Primary service occupations</td>
<td>Occupations involving trade and sale of goods (5)</td>
<td>27, 28, 30</td>
<td>Commercial activities (5), office activities (7), general services such as cleaning (19), entertaining guests (12), warehousing (18), transport (18), security (20)</td>
</tr>
<tr>
<td>Occupational fields: 14, 16, 19, 27-30, 32-34, 36, 37, 39-41, 43, 53, 54</td>
<td>Occupations involving traffic, warehousing, transport, security, guarding (18)</td>
<td>19, 32, 33, 34, 41, 43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hotel and restaurant and cleaning occupations (12, 19)</td>
<td>14, 16, 53, 54</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Office, commercial service occupations (7)</td>
<td>29, 36-37, 39, 40</td>
<td></td>
</tr>
<tr>
<td>Secondary service occupations</td>
<td>Technical and scientific occupations (9, 7, 8)</td>
<td>21-26, 38</td>
<td>Researching (8-9), developing (8-9), organising (10-11), managing (10-11), applying and interpreting the law (13), providing support (16), healing (16), caring (16), advising (15), teaching (14), journalism (17), entertainment (17)</td>
</tr>
<tr>
<td>Occupational fields: 21-26, 31, 35, 38, 44-52</td>
<td>Legal, management and economic occupations (11, 13, 15)</td>
<td>35, 44</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Artistic, media, humanities and social science occupations (17, 10, 9)</td>
<td>31, 45, 46, 51</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health and social occupations, body care providers (16)</td>
<td>47-49, 52</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teaching occupations (14)</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Bott, Peter; Helmrich, Robert; Schade, Hans-Joachim; Weller, Sabrina-Ines (2010): Datengrundlagen und Systematiken für die BIBB-IAB Qualifikations- und Berufsfeldprojektionen. In: Helmrich, Robert; Zika, Gerd (Ed.): Beruf und Qualifikation in der Zukunft. Bonn 2010*
1. BIBB-IAB model set-up - Overview

Supply
- Educational system
- Qualification
- Vocational choice
- Labor participation
- Initial voc. qualific.

Demand
- Occupation exercised
- Occupation in occupations

Economie
- Sector 1
- Sector 2
- Sector 59

Demography
- Age cohorts, migration

BIBB-FLEX

Occupational flexibility

FIT-BIBB
BIBB-DEMOS
(BIBB, FIT, GWS)

IAB/
INFORGE
(IAB, GWS)
## 1. BIBB-IAB model set-up - Cross-sectional analysis of the population according to their relevance for the labour market

### Demand within 59 economic sectors

<table>
<thead>
<tr>
<th>Persons aged over 15 in employment within 12 MOF, disaggregated by 4 skill levels</th>
<th>Unemployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
<td></td>
</tr>
</tbody>
</table>

### Supply by age cohorts and gender

<table>
<thead>
<tr>
<th>Persons aged under 16 (Preschool, general schooling)</th>
<th>Qualification (4 skill levels) and vocational education and training (VET)</th>
<th>VET within 12 MOF (ISCED 3b-6)</th>
<th>No VET (ISCED 0-3a)</th>
<th>(Still) in training</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ 11.5 million</td>
<td>~ 36.1 million</td>
<td>~ 4.6 million</td>
<td>~ 12.4 million</td>
<td>~ 15.9 million</td>
</tr>
</tbody>
</table>

2. Results of occupational field projections - Supply and demand (trained occupation only)

In 000s

- Teaching occupations
- Health and social occupations, body care providers
- Artistic, media, humanities and social science occupations
- Legal, management and economic occupations
- Technical and scientific occupations
- Office, commercial service occupations
- Hotel and restaurant and cleaning occupations
- Occupations involving traffic, warehousing, transport, security, guarding
- Occupations involving trade and sale of goods
- Occupations involving the control and maintenance of machines and plants
- Processing, manufacturing and repair occupations
- Raw material extraction occupations

Note: "skill over supply" and "skill shortage"
## 2. Results of occupational field projections – Flexibilities from Microcensus 2005(-2008)

<table>
<thead>
<tr>
<th>Major occupational field (MOF) of the occupation learned</th>
<th>Proportional values for change from major occupational field (MOF) learned to major occupational field exercised</th>
<th>( \sum \text{MOF} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Raw material extraction occupations</td>
<td>P 1: 49.5% P 2: 8.6% P 3: 3.0% P 4: 6.3% P 5: 12.8% P 6: 6.1% P 7: 5.1% P 8: 2.6% P 9: 2.1% P 10: 0.7% P 11: 2.3% P 12: 0.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2: Processing, manufacturing and repair occupations</td>
<td>P 1: 1.9% P 2: 46.3% P 3: 7.8% P 4: 6.2% P 5: 15.6% P 6: 5.7% P 7: 4.2% P 8: 7.4% P 9: 2.0% P 10: 0.9% P 11: 1.5% P 12: 0.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>3: Occupations involving the control and maintenance of machines and plants</td>
<td>P 1: 1.3% P 2: 14.0% P 3: 44.3% P 4: 5.2% P 5: 11.9% P 6: 4.7% P 7: 4.4% P 8: 7.8% P 9: 2.0% P 10: 2.4% P 11: 1.7% P 12: 0.4%</td>
<td>100.0%</td>
</tr>
<tr>
<td>4: Occupations involving trade and sale of goods</td>
<td>P 1: 0.8% P 2: 2.9% P 3: 1.2% P 4: 50.4% P 5: 6.2% P 6: 9.5% P 7: 19.8% P 8: 1.3% P 9: 3.4% P 10: 1.1% P 11: 3.1% P 12: 0.4%</td>
<td>100.0%</td>
</tr>
<tr>
<td>5: Occupations involving traffic, warehousing, transport, security, guarding</td>
<td>P 1: 1.1% P 2: 6.1% P 3: 2.0% P 4: 4.3% P 5: 65.3% P 6: 3.8% P 7: 11.5% P 8: 2.2% P 9: 1.4% P 10: 0.5% P 11: 1.3% P 12: 0.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>6: Hotel and restaurant and cleaning occupations</td>
<td>P 1: 3.1% P 2: 5.0% P 3: 2.6% P 4: 9.7% P 5: 8.2% P 6: 56.4% P 7: 7.3% P 8: 1.1% P 9: 1.8% P 10: 0.5% P 11: 3.7% P 12: 0.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>7: Office, commercial service occupations</td>
<td>P 1: 0.5% P 2: 1.2% P 3: 0.5% P 4: 8.6% P 5: 3.7% P 6: 3.5% P 7: 71.3% P 8: 2.0% P 9: 4.8% P 10: 1.1% P 11: 2.3% P 12: 0.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>8: Technical and scientific occupations</td>
<td>P 1: 0.7% P 2: 8.9% P 3: 3.3% P 4: 5.0% P 5: 4.1% P 6: 2.3% P 7: 8.0% P 8: 52.0% P 9: 7.3% P 10: 3.2% P 11: 1.7% P 12: 3.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>9: Legal, management and economic occupations</td>
<td>P 1: 0.2% P 2: 0.8% P 3: 0.2% P 4: 7.3% P 5: 2.3% P 6: 1.5% P 7: 26.0% P 8: 4.2% P 9: 49.3% P 10: 4.1% P 11: 1.4% P 12: 2.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>10: Artistic, media, humanities and social science occupations</td>
<td>P 1: 0.3% P 2: 2.2% P 3: 0.8% P 4: 6.1% P 5: 2.3% P 6: 2.8% P 7: 10.2% P 8: 5.1% P 9: 5.9% P 10: 46.9% P 11: 4.3% P 12: 13.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>11: Health and social occupations, body care providers</td>
<td>P 1: 0.4% P 2: 2.1% P 3: 0.4% P 4: 3.9% P 5: 1.7% P 6: 4.0% P 7: 6.3% P 8: 0.8% P 9: 1.1% P 10: 0.9% P 11: 74.6% P 12: 3.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>12: Teaching occupations</td>
<td>P 1: 0.3% P 2: 1.2% P 3: 0.3% P 4: 1.9% P 5: 1.5% P 6: 2.1% P 7: 4.3% P 8: 1.2% P 9: 1.3% P 10: 2.2% P 11: 4.5% P 12: 79.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td>0a: no vocational training (unskilled)</td>
<td>P 1: 3.2% P 2: 16.1% P 3: 6.0% P 4: 11.3% P 5: 15.1% P 6: 25.5% P 7: 10.8% P 8: 2.5% P 9: 1.7% P 10: 1.9% P 11: 5.2% P 12: 0.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>0b: at school/in training</td>
<td>P 1: 2.1% P 2: 19.8% P 3: 5.4% P 4: 14.5% P 5: 5.8% P 6: 13.0% P 7: 17.2% P 8: 4.8% P 9: 0.7% P 10: 3.1% P 11: 12.2% P 12: 1.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

2. Results of occupational field projections - Supply and demand (incl. occupational flexibility)

In 000s

- Teaching occupations
- Health and social occupations, body care providers
- Artistic, media, humanities and social science occupations
- Legal, management and economic occupations
- Technical and scientific occupations
- Office, commercial service occupations
- Hotel and restaurant and cleaning occupations
- Occupations involving traffic, warehousing, transport, security, guarding
- Occupations involving trade and sale of goods
- Occupations involving the control and maintenance of machines and plants
- Processing, manufacturing and repair occupations
- Raw material extraction occupations

"skill over supply"
"skill shortage"

BIBB-DEMOS 2030
BIBB-FIT 2030
2010

In 000s
What can be manipulated (e.g.)?

**Supply:**
- Demographical development: migration behaviour
- Educational participation: dropout rates at school and university
- Participation of employment: participation rates (women, elderly)

**Demand:**
- Economic structural change: investment in research and development
- Globalisation, growth: export sensitivity
- Technological change: skill upgrade

**Balance of supply and demand:**
- Occupational flexibility
- (Worktime volume)
4. Drivers of occupational mobility

- **Human capital theory:**
  - Higher productivity through investment in human capital (general, specific)
  - Changing the occupation should lead to a loss of specific human capital and therefore result in lower productivity
    - Why should somebody leave the initial vocational qualification?

- **Search and matching theories**
  - Occupational changes as results of a searching process that aims for optimal placement on the labor market.

- **Difference between voluntarily and involuntarily occupational changes**
5. Different assumptions of mobility behavior

- At the current state of the project the flexibility matrix is used statically.

- On the level of MOF, the matrices are distinguished between 4 age groups (15-29, 30-39, 40-49, 50-99), 4 qualification levels (ISCED 1,2,3a; ISCED 3b,4; ISCED 5b; ISCED 5a,6) and gender.
  - Persons still in training are not differentiated in age and qualification already achieved.

- However, scenarios can still be calculated
  - Age or cohort specific mobility behavior?
5. Different assumptions of mobility behavior
E.g. Technical scientific occupations

Source: German Microcensus 2005-2008; own calculations
5. Different assumptions of mobility behavior
E.g. Technical scientific occupations

What if the mobility behavior of a younger age cohort (e.g. 25-29) is passed on to the following age cohort (e.g. 30-34)? (results for 2030)

Source: Microcensus 2008, BIBB-DEMOS; own calculations
6. Challenges of the concept

- Individual mobility behavior vs. macro level data

- How to model voluntary and involuntary occupational changes?
  - Indirect link through qualification-specific mobility tables
  - Dynamic modeling:
    - Wage increases
    - Indicator for “potential over supply” / unemployment rate by occupation?
6. Challenges of the concept

How to integrate mobility behavior in the forecast?

- BIBB-DEMONS / BIBB-FIT computes potential volume of work in 54 occupational fields (trained occupation) AVBFE
  - AVBFE
- BIBB-FLEX computes potential volume of work in 54 occupational fields (occupation exercised) AVBFP
  - AVBFP
- IAB-INFORGE forecast demand of volume of work in 54 occupational fields (occupation exercised) AVBFA
  - AVBFA
- BIBB-FLEX computes surplus and lack of volume of work in 54 occupational fields (trained occupation)
  - AVBFP

- Adjustment of volume of work in corresponding occupational fields in BIBB-FLEX
  - Yes: BIBB-FLEX adjustment?
  - No: Wages in corresponding occupational fields increase about y%?
    - Yes: Wage adjustment?
      - No: BIBB-FLEX adjustment?
      - Yes: Termination: production stop
    - No: Labour shortage in some occupations?
      - Yes: Stop of iteration
      - No: Wage adjustment?
        - No: BIBB-FLEX adjustment?
Thank you very much for your attention!

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