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BIBB-IAB Qualification and Major Occupational Field Projections

Notes on the methodology of a cooperation project

The BIBB-IAB Qualification and Major Occupational Field Projections (Helmrich, Zika, 2010, in press) are a coordinated projection of supply and demand in the German labour market up to the year 2025, on the basis of jointly defined occupational fields and skill levels.

On the basis of data from several years' Microcensus¹ surveys, figures had been compiled both for the persons in employment by occupation and industrial sectors, and for the labour force by skill level, age and gender. For the survey year 2005, data on the workforce's initial vocational training occupations were also available.

On the level of qualifications, the population was differentiated into four skill levels (as measured by formal qualifications) following the ISCED classification framework, namely:

- People with no formal qualification (ISCED 1,2,3a)
- People with a skilled initial vocational qualification (ISCED 3b, 4)
- People with a master craftsman, technical engineer or a trade and technical school qualification (ISCED 5b)
- People with an academic degree (ISCED 5a, 6)

On the level of occupations, the classifications of the BIBB occupational fields² were applied to both the demand and the supply side. These consist of 54 occupational fields which are grouped at the level of the occupational categories (3-digit codes) from the official German classification of occupations 1992 (KldB 92) on the basis of comparable job characteristics and branch dominance. Thus, in contrast to the KldB 92 occupational classification scheme, they show greater intra-homogeneity and, at the same time, greater inter-heterogeneity. For

¹ The Microcensus results tend to put the size of the workforce lower than the German system of national accounts (NA). Hence, a structurally neutral upward adjustment of the Microcensus figures to the NA level was undertaken for the projections.

² Tiemann et al (2008): *Berufsfeld-Definitionen des BIBB* [occupational fields definition of the BIBB]. *Wissenschaftliche Diskussionspapiere des Bundesinstituts für Berufsbildung*, No. 105. Bonn.

methodological reasons, initially results are only reported on the level of the 12 major occupational fields (MOF) and 3 top-level occupational domains, which are similarly based on the BIBB occupational fields (OF).

The **demand projection** for the years from 1996 to 2006 (actual figures) and up to 2025 (projection) shows realised demand (persons in employment) in their working occupations for 54 occupational fields, broken down within each field into 4 skill levels. The starting point for the demand projection is the workforce demand projection up to 2025, which was compiled using the IAB/INFORGE model and disaggregated by 59 economic sectors, on the basis of model calculations with the IAB/INFORGE model. This is a macro-econometric input/output model, constructed on the 'bottom-up' principle and differentiated according to 59 industrial sectors, 59 product groups and 43 types of use. Foreign trade is incorporated endogenously since the model is an integral element of the GINFORS global model (50 countries, 26 product groups) developed by the Institute of Economic Structures Research, GWS mbH. In the labour market, the labour supply and the potential labour force is exogenous. Labour demand is modelled endogenously on an hourly basis, i.e. the volume of labour necessary for production is determined first, and only then converted to a per-capita figure.

Figure 1: Components of qualifications and occupational field projections 2025

	Demand side (IAB) Realised demand	Occupational fields 12 MOF, 54 OF	Supply side (BIBB) Potential study
Data bases	MC → NA level	BIBB-BAuA Microcensus	MC → NA level Population projection
Differentiations	59 economic sectors 4 skill levels (ISCED) Working occupation		Skill levels (ISCED) Initial vocational qualification by specialisation recoded from MC 05, (06-08)
Analysis levels	Per capita Stock variables; No flow variables		Per capita Stock New labour force supply Gender Age
Projection models	IAB-INFORGE (GWS)		BIBB-Demos (GWS) FIT accounts model
Results	Realised demand 2010-2025	Flexibility from initial qualification to working occupation (from above) MC 05 (06-08)	Economically active population 2010-2025

Abbreviations: MOF = major occupational fields, OF = occupational fields, MC = Microcensus, NA = German system of national accounts, BAuA = Federal Institute for Occupational Safety and Health

The '**labour force supply**' projection was calculated with two independent models with the aim of model plurality, both of which, like the demand projection, were based on the same classification schemes and data generation runs. These consist of the BIBB-DEMOS model from GWS, which has certain points of overlap with the IAB-INFORGE model and the established model from FIT, the Fraunhofer Institute for Applied Information Technology, already in use for the well-known forecasts by the Bund-Länder Commission for Educational Planning and Research Promotion³.

The BIBB-DEMOS model determines the labour supply, taking several interconnected processes into account. The absolute change and relative fluctuation of age cohorts, in which women and men are shown separately, are derived from the 12th coordinated population projection by the German Federal Statistical Office. The demographic trend not only determines the distribution across age-cohorts and gender but also ultimately determines the size of the potential labour force, namely the number of people aged over 14 but under 66 (68).⁴

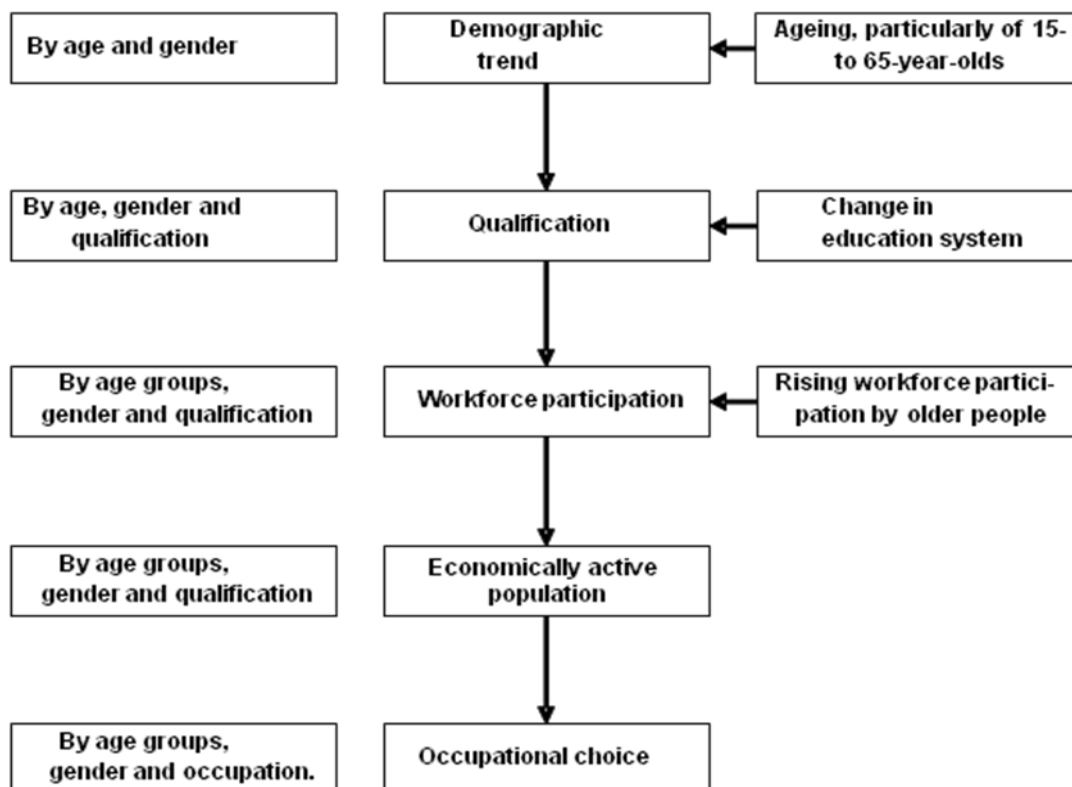
Connected to this is the qualification process, which is notable for a rising level of qualification, particularly among women, and which also determines the length of time taken to achieve a formal initial vocational qualification. The decision to participate in the workforce is not only age- and gender-specific but also dependent on the formal qualifications achieved. Workforce participation is also subject to changes over time.

On the basis of this information, the choice of initial vocational training occupation is made. It is ultimately the outcome of a gender-, qualification- and age-specific distribution. The following figure gives an overview of the relationships between the models.

³ E.g.: Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (2001): *Zukunft von Bildung und Arbeit. Perspektiven von Arbeitskräftebedarf und -angebot bis 2015. Materialien zur Bildungsplanung und zur Forschungsförderung* Heft 104, Bonn

⁴ The model assumes an adjustment of the new standard pension age, but still takes account of active members of the workforce over this age.

Figure 2: Overview of the BIBB-DEMOS model (GWS)



The data derived from evaluations of the 2005 Microcensus by BIBB describe the workforce in terms of age-classes, 54 occupational fields, qualifications and gender. This yields a total of $12 \cdot 54 \cdot 4 \cdot 2 = 5184$ data points. The source of this data, the DEMOS model consisting of 12 age-groups, 4 skill levels and separate genders, supplies a total of 96 parameters. In simple terms, the BIBB data is used as a means of determining the distribution of these parameters across 54 occupational fields.

Ultimately the results of the BIBB-DEMOS projection rest on three specific assumptions:

- (1) Workforce participation rates by age, sex and qualification are extrapolated into the future with the aid of forecast trends,
- (2) the retirement and pension age will be raised to 67, and
- (3) higher-qualified sections of the population will expand less rapidly in future than hitherto.

The FIT labour supply projections are also differentiated by 4 skill levels and 54 occupational fields. They are based on several transition models in which, taking a baseline population as a starting point, future stocks of labour force are modelled by means of entries and exits. The chosen approach thus relies on three basic elements: a population projection, a transition model of the education and training system to quantify the new labour force supply, and an analysis of workforce participation to determine the remainders.

The projection of the new labour force supply from the vocational education and training system in terms of skill levels and occupational fields is based on modelling the vocational education and training system including higher education establishments in a way that reflects the numbers enrolled at the individual training establishments as well as the transitions to and from the individual educational establishments and the labour market. This model builds largely on concepts and results from the IAB system of educational accounting (*Bildungsgesamtrechnung*, BGR). In the projection period, this model is adjusted to the greatest possible extent to the benchmarks of the projection of school pupils and leavers by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder⁵ (*Kultusministerkonferenz*, KMK) and of the KMK projection of university entrants from the year 2009⁶. Thus, they also take account of the shortened duration of schooling at university-track secondary schools and the resulting double cohorts of school-leavers entitled to enter higher education. This projection of university entrant numbers is a status quo forecast which maintains a constant ratio of university entrants. Thus, rising numbers of higher-secondary school leavers with a higher education entrance qualification will raise the number of university entrants. Accordingly, this is reflected in a rising supply of academically qualified new entrants to the workforce.

The future new labour force supply from the education system and migration is, however, only one of the factors that influences the future qualification structure. It will also increasingly be determined by those who exit from employment. Here, in particular, the assumptions made about future qualification-, age- and gender-specific workforce participation also come to bear. The rapid expansion in workforce participation in past years is extrapolated only moderately in the projection. The projection of workforce participation also took into account the raising of the standard retirement age to 67 years.

In the projection currently in progress, the occupational field has been added as a new dimension for differentiation of the labour supply. In order to recognise this within the existing analysis framework, classification of both the existing labour force and the new labour force supply according to occupational field was undertaken and extrapolated for the projection period.

Comparison of the workforce demand and supply projection is undertaken on the basis of both skill levels and major occupational fields. As a first step, the ‘labour force supply’, i.e. economically active population classified according to training occupations – regardless of

⁵ See KMK statistical publication: *Statistische Veröffentlichung der Kultusministerkonferenz* (2007): “*Vorausberechnung der Schüler- und Absolventenzahlen 2005 bis 2020*” [Projection of pupil and leaver numbers 2005 to 2020], no. 182.

⁶ *Statistische Veröffentlichung der Kultusministerkonferenz* (2009): “*Vorausberechnung der Studienanfängerzahlen 2009 - 2020 – Zwischenstand*” [Projection of university entrant numbers 2009 – 2020 – interim status].

their current working occupation, and including the ‘new labour force supply’ classified by training specialisation within the relevant major occupational field – is compared with the ‘realised demand’. In this step, the supply side thereby reflects the qualification potential created by the education system.

The balancing of these two values can draw attention to possible mismatches between demand and suitably qualified supply.

For the year 2005⁷ a flexibility matrix is available, based on training occupation and working occupation, for the workforce as a whole. This matrix gives an empirical indication of occupational flexibilities.

Figure 3: From training occupation to employed occupation, for the 3 top-level occupational domains.

Initial qualification domain to working occupation using Microcensus 2005 workforce statistics			Production occupations	Primary service occupations	Secondary service occupations	Total
Initial vocational qualification	Production occupations	per cent absolute	57.1 4844092	30.5 2591591	12.4 1048988	100% 8484671
	Primary service occupations	per cent absolute	4.8 489393	85.7 8669787	9.5 963149	100% 10122329
	Secondary service occupations	per cent absolute	6.1 697772	19.6 2239620	74.3 8506482	100% 11443874
	No formal qualification	per cent absolute	25.3 1420228	62.7 3514434	12.0 674583	100% 5609245
	Total (except trainees)		7,451,485	17,015,432	11,193,202	35,660,119

As Figure 3 shows, the proportion of ‘stayers’, i.e. those who remain in the occupation of their initial vocational qualification, lies between 57% and 86%. On the level of the 54 occupational fields the range is considerably greater, spanning from barely 20% in certain textiles occupations up to 85% in academic health occupations, teaching or security occupations (police).

In the second step of the balancing procedure, this flexibility matrix is superimposed on the supply classified by occupational field, and the empirically demonstrable occupational flexibility for the year 2005³ is simulated as an adaptation scenario.

In this second step, it is possible to show how a possible shortage scenario could be alleviated by occupational flexibility.

⁷ Data processing for the subsequent years (2006-2008) is currently still in progress.

There are, however, **limits** to the projection of labour force supply and demand, which need to be borne in mind when interpreting the results. Because it has only been possible to evaluate the flexibility matrix for a single year, at the moment the scope for interpreting and drawing meaningful conclusions from the projection is limited. The supply and demand projections compared for the labour market analyses give an indication of what situations might be anticipated in the given labour market segment in future. However, it should not be inferred from the balancing procedure that labour market situations in which supply coincides with demand represent the ideal state, on the grounds that full employment prevails. This would only be the case under the assumption of perfect labour markets with no elements of friction. If such a situation existed in reality, many places would already be experiencing a massive workforce shortage. Also, it should not be forgotten that in the model world of the demand projection, it is always assumed that the projected demand for workers will actually be realised.

In reality, labour market situations in which demand cannot be satisfied are bound to cause reactions on the demand side (e.g. company owners may alter production processes) and/or on the supply side (e.g. expansion of the volume of supplied working time). It is also highly likely that the occupational flexibilities assumed from the year 2005 would adapt to the market imbalances, producing knock-on effects on other occupational fields and/or skill levels. In the end, though, the demand will never be higher than the supply. However, because we are not yet in a position to quantify these adaptive reactions, the projections do produce just such a result in certain labour market segments. Nevertheless, it is useful to present these labour market balance sheets, since they are a good way of drawing attention at the earliest opportunity to impending labour market imbalances, and specifying the exact fields in which the documented trends indicate that such adaptive reactions are likely to and indeed must occur – whether in the form of the flexibilities we have demonstrated empirically and incorporated into a matrix, or variations on them.

For further information, see:

Helmrich, Robert and Zika, Gerd (eds.) 2010: Beruf und Arbeit in der Zukunft - BIBB-IAB-Modellrechnungen zu den Entwicklungen in den Berufsfeldern und Qualifikationen bis 2025, in press.