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Methodological aspects of labour market data

Degree of standardised certification of occupations

An indicator for measuring institutional characteristics of occupations (KldB 2010, KldB 1988)

Basha Vicari



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Abstract

Occupations can be considered as an institution of the labour market, which has varying power to connect the educational system with the labour market. In order to make these institutional characteristics of occupations accessible for empirical analyses, I developed an indicator to measure the *"degree of standardised certification"* of an occupation. The indicator provides the proportion of single occupations within an occupational aggregate (e.g. 3-digit code of an occupational classification) whose educational qualifications are regulated by federal or state law uniform or equivalent training certificates. This indicator reaches its highest value if an occupational unit contains only regulated single occupations where the access to an occupation, the practicing and the use of a professional title are limited by legislative, regulatory or administrative provisions through required credentials (like medical doctors). Standardised certifications attest for the bearer of a professional title a minimum level of competencies and skills which are required for practicing occupational tasks. The lowest value of the indicator is reached if no access control exists for any of the single occupations summed up to one unit (like helping professions). This methodological report describes the data base and the way of calculating and aggregating the degree of standardised certification. The indicator was created for analyses with the three-digit and two-digit code of the German Classification of Occupations 2010 (KldB 2010) and the German Classification of Occupations 1988 (KldB 1988).

Zusammenfassung

Berufe können als eine Institution des Arbeitsmarktes betrachtet werden, die in unterschiedlichem Maß das (Aus-)Bildungssystem und den Arbeitsmarkt verbindet. Um diese institutionelle Eigenschaft der Berufe für empirische Analysen zugänglich zu machen, habe ich einen Indikator zur Messung des Grades der standardisierten Zertifizierung eines Berufs entwickelt. Der Indikator misst den Anteil von Einzelberufen innerhalb eines Berufsaggregats (z.B. Dreisteller einer Berufsklassifikation), deren Berufsabschluss durch ein bundes- oder landesrechtlich einheitliches oder vergleichbares Ausbildungszertifikat geregelt ist. Er nimmt den höchsten Wert an, wenn in einem Berufsaggregat nur reglementierte Einzelberufe enthalten sind, in denen der Berufszugang, die Berufsausübung und das Führen eines Berufstitels durch Rechts- oder Verwaltungsvorschriften an einen Qualifikationsnachweis gebunden sind (z.B. bei Ärzten/Ärztinnen). Standardisiert zertifizierte Berufsabschlüsse bescheinigen dem Berufstitelträger ein Mindestmaß an Kenntnissen und Fertigkeiten, die zur Ausübung der entsprechenden beruflichen Tätigkeit erforderlich sind. Den niedrigsten Wert nimmt der Indikator an, wenn für alle dort zusammengefassten Einzelberufe keine Zugangsregelung besteht (z.B. bei Helferberufen). In diesem Methodenreport werden die Datenbasis sowie das Berechnungs- und Aggregationsverfahren des Grades der standardisierten Zertifizierung beschrieben. Er wurde für Analysen mit dem Dreisteller und Zweisteller der Klassifikation der Berufe 2010 (KldB 2010) und der Klassifikation der Berufe 1988 (KldB 1988) erstellt.

Keywords: occupational institution, access to occupations, credentialing, standardisation, entry regulation, German classification of occupations (KldB1988, KldB 2010)

1 Motivation

On the German labour market, there is a strong linkage between the training system and the occupational placement (Allmendinger 1989; Müller/Shavit 1998). In such a highly professionally organised labour market, occupations serve as an orientation for the labour market actors by disseminating information about the competency profiles on offer and in demand (Beck et al. 1980). Occupations consequently function as an institution that transfers consistent and stable signals about the knowledge and skills required for pursuing the professional activity. Thus reduce the uncertainties in the process of job matching. Both individual and operational transaction costs for job matching can be decreased this way (Abraham et al. 2011).

How well the occupational institution succeeds in regulating allocation processes on the labour market, however, depends on the – not directly observed – intensity of linkage between the education and training system and the placement, displayed in the "institutional variance" (Abraham et al. 2011). To make this greatly varying regulating impact of the occupational institution measurable for analysis purposes, it needs to be broken down into its particular instruments. For the German labour market, three such instruments can be tentatively identified for operationalizing the institutional variance: the formal standardisation of the access credentials, the regulation and the collective degree of organisation of the occupation. These indicators are based on the work of Weeden (2002) who developed a similar operationalization of the institutional regulation through occupation for the US labour market.¹

Due to availability of data, in a first step the two instruments of "*standardised credentials*" and "*regulation*" of occupations were developed. The credentials of professional qualifications are standardised if the certificates have been achieved through standardised or comparable final examinations on national or state level and are principally based on comparable training contents. The standardised credentials of professional qualification signal to the employer (or the client) that the bearer of a professional title possesses a certain minimum of knowledge and skills required for pursuing the professional activity. The standardised credentials, consequently, serve as a quality signal of productivity (Spence 1973). In regulated occupations, access to and practice of the occupation as well as bearing the title are bound to the proof of a certified professional qualification through legal and administrative regula-

¹ Weeden (2002) describes five instruments for measuring the institutional closing through occupation. The instruments adapted in this context are based on "formal educational credentialing", "licensing" and "occupational associations". The remaining instruments "voluntary certification" and "unionisation", are not relevant for operationalizing the regulation of allocation processes through occupation for the German labour market.

tions (Bundesagentur für Arbeit 2013). It applies to occupations in which the exercise of the professional activity must meet specific quality standards to protect the general public, such as medical doctors, lawyers or teachers. These are not allowed to bear their professional title until after they have passed their license to practice, or their second or third state examination. As a result, the certification of professional qualification, which is uniform nationwide, is highly standardised in regulated occupations. Regulated occupations, however, also comprise all engineering professions for which not the training contents are standardised, but only the professional title. But in this case, too, the professional qualification acts as a strong quality signal for the minimum of comparable knowledge and skills and has the similar effect as the standardised credentials.²

Since the two measures share the objective to reduce the uncertainties in the process of job matching and to tie the access to practicing a professional activity formally or informally to a specific certified qualification, they are unified into one indicator. This indicator measures, all in all, the *"degree of standardised certification"* in the particular occupational aggregate of the classification of occupations.³ The following section describes the data basis as well as the assignment, weighting and aggregation of this indicator.

2 Definition and operationalization of the indicator

The *"degree of standardised certification"* of an occupation indicates whether access to exercising a professional activity is linked to a standardised training certificate. The selection criterion for assigning a single occupation to the category "standardised certification" is the existence of a training certificate uniform under federal or state law which is normally required for the pursuit of a professional activity. Occupations with standardised access certificates include those which traditionally require a vocational qualification based on the dual training system, that is to say on the classic training in the industry and craft sector that are organised in the German Vocational Training Act (Berufsbildungsgesetz, BBiG) and have comparable curricula (Konietzka 2008). But also vocational school training programs offering recognised training qualifications such as, for example, early childhood educator or geriatric nurse, are based on uniform federal or state level curricula and final examinations and thus belong to the standardised certified occupations. The same is true for further education oc-

² The standardised minimum requirements in regulated occupations are demonstrated, for example, by the fact that persons who have acquired their vocational or academic qualification abroad are not allowed to practice a regulated occupation in Germany before they have acquired recognition of their qualification through the establishment of equivalence (www.anererkennung-in-deutschland.de).

³ In addition, the two distinct indicators *"standardised credentials"* and *"regulation"* are offered in the dataset thus allowing the researcher to decide for him/herself which indicator to use for his/her analyses.

occupations whose training contents and examinations are comparable in terms of space and time, such as for technicians, master craftsmen or business administrators. Academic professions, but also helping professions and certain specialisations (e.g. foreign correspondent⁴), however, do not belong to the standardised certified occupations because neither are their professional qualifications comparable on federal or state level, nor is the access to pursuing the professional activity precisely limited to one certain certificate. Such single occupations are assigned to the category "non-standardised certification".

Due to both data protection and methodological considerations, single occupations are not usually relevant for scientific analyses, but rather aggregated units, such as two- or three-digit codes in a classification of occupations. Therefore, the information about the share of standardisation of certificates must be meaningfully aggregated on the level of the desired unit of analysis. Based on the assignment of the single occupation to the category "standardised certification", the "*degree of standardised certification*" is calculated as weighted average value of an aggregated occupational unit. The weighting is based on the number of people employed in the single occupation. Since the indicator is calculated on the basis of a uniform database of occupations, the procedure can be carried out separately for each analysis unit of the various classifications of occupations. Inaccuracies in the calculation that would arise when using conversion tables for recoding values from one classification of occupations to another are thus avoided. The result is an indicator that specifies the "*degree of standardised certification*" as a metric value between 0 and 1 for the analysis units of the two- and three-digit codes in the Classifications of Occupations 2010 (KldB 2010) and 1988 (KldB 1988).

2.1 Data basis

The information which type of training or education is required for exercising a professional activity is evident from the details on the Career Group ("berufskundliche Gruppe") available on BERUFENET, the career orientation portal of the Federal Employment Agency (Bundesagentur für Arbeit – BA).⁵ The Career Group provides information about the "entry requirements [of the occupation] in terms of a required qualification" (Bundesagentur für Arbeit 2011: 39). For this purpose, BERUFENET accesses the database of the Documentation

⁴ To work as a foreign correspondent, you can complete your studies in the fields of journalism, communication, political or economic or cultural science, linguistics, or do further training in the field of journalism. But access is also open to people from other occupations because there is no formal or informal regulation at all.

⁵ Information on the access to an activity is available in the career orientation portal BERUFENET (<http://berufenet.arbeitsagentur.de/berufe/>) upon entering an occupation at the top left under the link "Activity" and then "Access".

Code Number DKZ ("Dokumentationskennziffer")⁶ - the Federal Employment Agency's basic systematic occupation service - in which a systematic number for nearly all current and historic job titles as well as further meta information are filed and permanently updated (Paulus/Matthes 2013: 16). Since the conversion of the activity key to the Classification of Occupations 2010 (KldB 2010) in 2011, the single occupations have been presented in the form of a hierarchically arranged 8-digit code number (8-digit DKZ).⁷

The starting point for creating the indicator is the so-called "DKZ mapping table"⁸ (status: April 2011) containing the single occupations of the overall list of occupations from the "Systematic Field of Activities"⁹ of the DKZ database both in the form of the new systematic number (8-digit DKZ) and in the form of the old systematic number (7-digit DKZ). Based on this 1:1-translation of systematic numbers, the indicator can later be calculated both for the old and for the new classification of occupations directly and without considering conversion tables. The mapping table also includes the status of the systematic number or occupational position as well as information on the Career Group (berufskundliche Gruppe, BKGR). The status of an occupational position indicates whether the job title is a current or a historical one. A single occupation listed as a current 8-digit DKZ will be designated with status E (valid). Historic 8-digit DKZs hold status R (dormant). For assigning single occupations to the standardised certification, both statuses¹⁰ will be considered because the indicator should also map historic job titles, such as "automobile mechanic" which often occur in the analysis data, but today are designated "automotive mechatronics technician".

2.2 Assignment

The assignment of each single occupation (8-digit DKZ with status E or R) to the indicator "*standardised certification*" is accomplished in three steps: In the first one, it is determined for each single occupation in accordance with its Career Group (BKGR) whether the access to

⁶ Beside BERUFENET, other BA's career information media use the DKZ systematic, such as JOBBÖRSE, KURSNET, planet-beruf.de or abi.de.

⁷ The first five digits of the 8-digit DKZ code correspond to the 5-digit code (Occupational Types) of the KldB 2010. Before the conversion of the activity key, single occupations were organised as 7-digit codes in the DKZ database, with the first four digits of the 7-digit DKZ matching the 4-digit code (Occupational Class) of the Classification of Occupations 1988 (KldB 1988).

⁸ The DKZ mapping table is available in the DKZ download area of the BA under "Umsteigetabellen_Implementierung_KldB2010.zip": <http://download-portal.arbeitsagentur.de/>. The DKZ download area is also open to external users following registration.

⁹ The systematic area of the DKZ database is divided into several sections: Systematic area A for general education and basic vocational training, B for specific career studies (activities), C for further education, etc. Only systematic area B is used for creating the indicator.

¹⁰ For indicating validity, some more statuses exist (A= obsolete training position, L= position to be deleted, M= valid meta unit, S= systematic position) which, however, do not relate to the end points of the occupational positions.

the occupational activity is linked to *standardised credentials*. If this is the case, value 1 is assigned to that single occupation, otherwise value 0 (for overview, see Table 1).

Value 1 for "standardised credentials" has been assigned to the following BKGR designations¹¹ from the DKZ database:

- 2 - Skilled Workers
- 3 - Master craftsmen
- 4 - Technicians and others
- 5 - Business administrators and others
- 13 - Further training for academic professions
- 14 - Military officers
- 20 to 23 - Civil servants, lower to upper grade.

BKGR designations with "non-standardised credentials" (value = 0):

- 1 - Helpers and others
- 6 and 7 - former academic professions (university of applied sciences/vocational academy/university)
- 9 - Activities with varying access
- 11 - Current academic professions
- 12 - Current occupations relating to courses of study

The BKGR designation "8 - Specialisations" is an exceptional case because it can relate to a vocational occupation, an academic profession or a further training occupation. Therefore, the assignment of these single occupations was based on the initial occupation required for the specialisation. Specifically, all single occupations with the BKGR 8 whose activity corresponds to *requirement level 2* (specialist activities)¹² were coded as standardised because these types of specialisation can be assigned to a vocational training. For example, the specialisations of dough maker (B 29222-109) and pizza baker (B 29222-111) were assigned to the category "standardised certification" because exercising this activity normally requires vocational training as a baker (B 29222-101) or training in confectionery technology (B 29222-103).

¹¹ The data pertaining to the Career Groups were revised and expanded along with the conversion of the activity key. For the indicator, the revised version of the BKGR designations (status: November 2012) was used.

¹² For information on requirement levels - coded as the 5th digit in the KIdB 2010 - see Paulus/Matthes (2013) or for further insights see Bundesagentur für Arbeit (2011).

Table 1: Assignment of standardised credentials in accordance with the Career Groups (BKGR)

BKGR	BKGR designation	Stand. credentials	Justification/precondition for exercising activity
1	Helper and the like	0	Access without regulated or recognised qualification
2	Skilled labour (journeymen, skilled workers, merchants)	1	In-company (dual) training, regulated by federal or state law in the BBiG, as well as vocational school training or training in health care school with recognised training qualification, comparable on federal or state level
3	Master craftsmen	1	Vocational school training, comparable on state level
4	Technicians (incl. state approved farmers and the like)	1	Vocational school training, comparable on state level
5	Business administrators / commercial specialists (vocational school level)	1	Initial training in vocational school / grammar school diploma / training / further education at administration and business academies and vocational colleges, however with standardised (state) examination
6	University of applied sciences/Vocational academy (<i>not current</i>)	0	Occupations requiring university education, no comparability of curricula or final examinations
7	University (<i>not current</i>)	0	Occupations requiring university education, no comparability of curricula or final examinations
8	Specialisation (specialisation forms and functions)	0/1	Further education programmes of variable duration and offered by various educational institutions; status is inherited from the underlying access to the occupation
9	Activities with various accesses	0	Various accesses possible to exercise activity
10	Rehab (<i>not current</i>) ¹³	--	<i>Excluded from the assignment</i>
11	University (university activities)	0	Occupations requiring university education, no comparability of curricula or final examinations
12	Occupations relating to courses of study	0	Occupations requiring university education, no comparability of curricula or final examinations
13	Further education for academic professions	1	Occupations requiring university education, thorough-going study with standardised examinations (second or third state examination)
14	Military officers	1	Occupations requiring university education, according to German Soldiers Law and the regulation governing military careers
20	Civil servants, middle grade	1	Vocational training, regulated by federal or state law
21	Civil servants, upper grade	1	Occupations requiring university education, regulated by federal law
22	Civil servants, high grade	1	Occupations requiring university education, regulated by federal law
23	Civil servants, lower grade	1	Semi-skilled occupations, however regulated by state law

¹³ Rehab occupations are special vocational training paths for disabled persons based on the German Vocational Training Act (BBiG). They are, however, not relevant for the assignment.

However, single occupations with the BKGR 8 and *requirement level 3* (complex specialist activities) had to be coded according to the occupational title: If the job title contained the key words "master craftsman", "technician", "(nautical) officer", "pilot / aviator" or "civil servant", it was assigned to the category "standardised certification". But, for example, for the specialisation of "shift foreman" (B 27393-112), the certification was coded as not standardised because the exercise of this activity usually requires further training – preferably in the relevant branch of industry. Consequently, no specific credential from one predefined vocational qualification is required in this case. The specialisations with *requirement level 1* (unskilled and semi-skilled labour) and 4 (highly complex activities) were uniformly coded as not standardised. The information whether the credentials of a single occupation are standardised – that is to say comparable on federal or state level – is stored in the variable "*scred*" (for "standardised credentials").

In the second step, each single occupation is merged with the feature "*regulation*". This feature indicates for each single occupation whether legal and administrative regulations exist which binds the access to and practice of the occupation as well as bearing the title to the proof of a specific qualification. This information is also available in BERUFENET.¹⁴ However, in view of the fact that the feature "*regulation*" was only adopted during the conversion to the new Classification of Occupations (KldB 2010) and is, therefore, only maintained for the current positions (status E), the status of regulation was beforehand added for all non-current single occupations according to their job titles. This feature is found in the variable "*sregul*" (for "standardised regulation").

As described above, the indicator "*standardised certification*" uses both pieces of information about standardisation of the credentials and about regulation. The total of this information is then consolidated in the third step: once the certificate of the single occupation has been coded as "standardised" in accordance with its BKGR, value 1 is assigned to the indicator. The indicator for this 8-digit DKZ is also set to value 1 if, according to its BKGR, it is "not standardised", but at the same time regulated. The certificates, for instance, of engineering occupations are initially not coded as standardised because they belong to BKGR 7, 11, or 12. But because engineering occupations are regulated, they will be coded with value 1 for standardised certificates in the third step. This is, for example, how the occupation of engineer for building technology / facility management (B 34104-114) was treated (see Figure 1). Following this adjustment, the indicator for each 8-digit DKZ of the new Classification of Oc-

¹⁴ The continually updated list of the regulated occupations described in BERUFENET is available under: <http://berufenet.arbeitsagentur.de/berufe/resultList.do>.

cupations (KldB 2010) and each 7-digit DKZ of the old Classification (KldB 1988) shows whether or not the credentials required for pursuing the occupational activity are standardised. The indicator value stored in the variable "scert" (for "standardised certification") could be computed for more than 9,200 single occupations.

Figure 1: Excerpt from the assignment of the standardisation of credentials for single occupations

dkz8	dkz7	dkz_title	status	bkgr	scred	sreg	scert
34102108	6218113	Technical assistant - building technology	E (current)	2. Skilled workers	1	0	1
34103100	6228108	Design technician - building technology	R (dormant)	4. Technicians et al.	1	0	1
34103101	6228109	Elec. eng. technician - building technology (design)	R (dormant)	4. Technicians et al.	1	0	1
34103102	6218112	Skilled worker - building technology	E (current)	4. Technicians et al.	1	0	1
34103103	6218107	Technician - building systems technology	E (current)	4. Technicians et al.	1	0	1
34103104	6218111	Project assistant - building technology	R (dormant)	4. Technicians et al.	1	0	1
34103106	6218114	Design consultant - energy and building technology	E (current)	4. Technicians et al.	1	0	1
34104100	6076106	Graduate engineer (UAS) - hospital operations engineer	R (dormant)	11. University	0	1	1
34104101	6018105	Graduate engineer (univ.) - building technology	R (dormant)	11. University	0	1	1
34104102	6018106	Graduate engineer (UAS) - building technology	R (dormant)	11. University	0	1	1
34104103	6071105	Graduate industrial engineer (UAS) - facility management	R (dormant)	11. University	0	1	1
34104113	6076143	Engineer - hospital operations engineering	R (dormant)	11. University	0	1	1
34104114	6018139	Engineer - building technology / facility management	E (current)	12. Occupations relating	0	1	1
34112100	4727103	Community worker	E (current)	9. Various activities	0	0	0
34112101	7945103	Equipment manager	E (current)	9. Various activities	0	0	0
34112102	7945104	Groundskeeper	E (current)	9. Various activities	0	0	0
34112103	8735100	School assistant (not administration)	E (current)	9. Various activities	0	0	0
34193100	6218101	Senior in-house technician	E (current)	8. Specialisation	1	0	1
34193101	6299108	Industrial foreman - building technology	E (current)	3. Master craftsmen	1	0	1
34201100	2627103	Gas and water plumber assistant	E (current)	1. Helpers and the like	0	0	0
34201101	2627100	Central heating installer assistant	E (current)	1. Helpers and the like	0	0	0
34201102	2627101	Pipe fitter assistant	E (current)	1. Helpers and the like	0	0	0
34201103	2627102	Plumber and installer assistant	E (current)	1. Helpers and the like	0	0	0
34201104	2637100	Piping installer / pipe fitter assistant	E (current)	1. Helpers and the like	0	0	0
34201105	4847100	Stove builder assistant	E (current)	1. Helpers and the like	0	0	0
34201106	2627104	Supply / installation assistant	E (current)	1. Helpers and the like	0	0	0
34202100	2610100	Plumber	E (current)	2. Skilled workers	1	0	1
34202101	2610101	Construction mechanic - sheet metal engineering	E (current)	2. Skilled workers	1	0	1
34202102	2611100	Construction plumber	E (current)	8. Specialisation	1	0	1
34202103	2611101	Insulation plumber	E (current)	8. Specialisation	1	0	1
34202104	2615100	Sheet metal worker - ventilation	R (dormant)	8. Specialisation	1	0	1
34202105	2616100	Cooling plumber	R (dormant)	8. Specialisation	1	0	1
34202107	2619100	Artisan plumber	R (dormant)	8. Specialisation	1	0	1
34202108	2619101	Shopfitting plumber	R (dormant)	8. Specialisation	1	0	1
34202109	2610106	Installer - gas/water, plumber	R (dormant)	2. Skilled workers	1	0	1
34202110	2621100	Plumber and installer	R (dormant)	2. Skilled workers	1	0	1

2.3 Weighting

In order to make the indicator "standardised certification" usable for empirical analyses, it must be aggregated from the single occupation level to an analysis unit that is provided in common datasets, such as e.g. the 3-digit code (occupational group) of the KldB 2010. The aggregation procedure is described below as an example for this analysis unit. Since a simple calculation of the arithmetic average over the single values within one occupational group would not offer a realistic mapping of the labour market conditions, it is necessary to conduct a weighting of the single values through the number of persons employed in the occupation prior to the aggregation. Otherwise, all 8-digit DKZs within one analysis unit would be equally included in the averaging calculation according to their BKGR designation, with the result

that the indicator values of rarely practiced single occupations – often specialisations or further trainings – would be overestimated in the analyses and those of frequently practiced occupations – such as vocational training occupations – underestimated. The problem is illustrated in the following example:

The occupational group "computer sciences" (KldB 2010 3-digit code 431) comprises 133 single occupations (8-digit DKZ). It includes, for instance, the frequently practiced single occupations of IT specialist - system integration (B 43102-113) with the BKGR 2 and computer scientist (state approved) (B 43103-104) with the BKGR 4, the less frequently practiced occupations of computer scientist (university) - general computer sciences (B 43104-121) with the BKGR 12 and management assistant in data processing (B 43112-104) with the BKGR 8, as well as the rarely practiced occupation of computer science engineer (B 43124-106) with the BKGR 7 (regulated) and medical information scientist (B 43134-113) also with the BKGR 7 (not regulated). If the employment figures of the single occupations were not considered in the aggregation to the occupational group, the occupational group of computer sciences would have a considerably lower value for the degree of standardised certification because it is dominated by strongly differentiated occupations requiring university education.

There are, however, two problematic aspects when calculating the weight: The first is that the indicator is sensitive against the employment figures changing every year on the one hand and the continuous adaptation of the DKZ database on the other.¹⁵ This problem occurs when comparing different points in time and must then be considered in the result interpretation. The second and more serious aspect is the absence of information about employment figures on the level of single occupations (8-digit DKZ). The lowest hierarchical level on which employment figures are reported to the social security system by employers is the 5-digit code of the KldB 2010 (occupational types) that was included in the BA statistics in 2012 for the first time. The pragmatic solution to the problem is to assume the employment figures in single occupations (8-digit DKZ) as equally distributed within a 5-digit code. For example, the weight for the 3-digit code of the KldB 2010 (g_{tk}) is then calculated based on the approximated number of employees subject to social insurance contributions within the 8-digit DKZ (N_{ti}) divided by the number of employees subject to social insurance contributions within the 3-digit code (N_{tk}).

¹⁵ The weight is based on the number of employees subject to social security contributions in 2012 (source: DWH of the BA statistics, key date 31 December 2012). It is planned to recalculate both the weight and the indicator annually and thus establish an indicator panel dataset for the KldB 2010.

$$g_{tk} = \frac{N_{ti}}{N_{tk}} \quad \text{with } t = 2012$$

- g_{tk} : weighting factor of 3-digit code k at the time t
 N_{ti} : number of employees subject to social insurance contributions in single occupation (8-digit DKZ) at the time t
 N_{tk} : number of employees subject to social insurance contributions in analysis unit (3-digit) at the time t

The weight for all other analysis units (2- and 3-digit code of the respective classification of occupations) and times is calculated in a similar way.

2.4 Aggregation to analysis unit (3-digit code of the KIdB 2010)

In order to finally obtain the "*degree of standardised certification*" for an analysis unit such as the 3-digit code of the KIdB 2010 (occupational group), the indicator values of all 8-digit DKZ are aggregated as weighted within the 3-digit code. For this purpose, the dichotomous indicator value of the single occupation (D_i) is multiplied with the weight for this analysis unit (g_{tk}) and added up over all 3-digit codes (K):

$$SCERT_{tk} = \sum_{k=1}^K g_{tk} \cdot D_i$$

- $SCERT_{tk}$: degree of standardised certification of 3-digit code k at the time t
 D_i : standardisation of the credentials of the single occupation i (8-digit DKZ)

Since, in the associated dataset, not only the "*degree of standardised certification*" is offered for various analysis units, but also the two single instruments aggregated to the "*degree of standardised credentials*" and "*degree of regulation*", these two must also be weighted and calculated in the same manner. Through this procedure, you obtain - for each of the 144 occupational groups of the KIdB 2010 - a value between 0 and 1 indicating how strongly the credentials of the occupational group are standardised on average. In addition, the standard deviation of the three measured values is calculated for each analysis unit to allow evaluation on the distribution of the indicator within each 3-digit code. Table 2 shows the mean and the standard deviation of the indicator "*degree of standardised certification*" for the 144 3-digit codes of the KIdB 2010. It also outlines the values of the indicator and the number of employees (N) as of 31 December 2012 as an example for the five major occupational groups:

Table 2: Degree of the standardised certification for selected 3-digit codes of the KIdB 2010

Occupational groups (3-digit)	SCERT	Std. Dev. SCERT	N (2012)
All 144 occupational groups of the KIdB 2010	0.7028	0.3191	28,897,440
Five major occupational groups:			
714. Offices and secretariats	0.8671	0.3352	2,102,011
713. Business organisation and strategy	0.6395	0.4985	1,441,854
513. Administration of inventory, postal and delivery services, transshipment	0.4013	0.4904	1,382,458
621. Retail sale (without product specialisation)	0.8190	0.4991	1,183,804
251. Machine-building and -operating	0.8268	0.3179	1,163,383

3 Processing the indicator for further analysis units

3.1 Two-digit code of the KIdB 2010 (occupational main-groups)

The aggregation of the indicator "*degree of standardised certification*" to the analysis unit of the 2-digit code of the KIdB 2010 (occupational main-groups) is carried out analogously to the procedure with the 3-digit code. The weight is derived from the approximated number of employees in the 8-digit DKZ divided by the number of employees in the 2-digit code. The result is multiplied with the indicator values of the single occupations and summed up over the 2-digit code. This way you obtain, for all 37 occupational main-groups of the KIdB 2010, the indicator values for the "*degree of standardised certification*", the "*degree of standardised credentials*" and the "*degree of regulation*". Table 3 lists the mean of the "*degree of standardised certification*" for the 2-digit code as well as the indicator values of the five most frequently practiced 2-digit codes.

Table 3: Degree of the standardised certification for selected 2-digit codes of the KIdB 2010

Occupational main-groups (2-digit)	SCERT	Std. Dev. SCERT	N (2012)
All 37 occupational main-groups of the KIdB 2010	0.7178	0.3692	28,897,440
Five major occupational main-groups :			
71. Business management and organisation	0.7202	0.4853	3,923,198
81. Medical health occupations	0.8961	0.4271	2,210,445
62. Retail sale	0.8850	0.3887	1,996,407
51. Traffic and logistic (without vehicle driving)	0.4864	0.4305	1,703,969
25. Machine- and automotive- engineering	0.8597	0.2677	1.661.102

3.2 Three-digit codes of the KldB 1988 (occupational orders)

Since the three indicators were created on the basis of the "DKZ mapping table" containing both the new 8-digit DKZ systematic number and the old 7-digit DKZ systematic number for each single occupation, it is possible to aggregate the values into the Classification of Occupations of 1988 (KldB 1988). The assignment based on the Career Group and the adjustment regarding the feature of regulation remains unchanged. The calculation of the employment figures for the single occupations (here 7-digit DKZ) from the KldB 2010 5-digit code also follows the same procedure. Merely the weight is recalculated, as was already the case for the aggregation to the KldB 2010 2-digit code, however after having been sorted according to the KldB 1988 3-digit codes. It is equivalent to the approximated number of employees in the 7-digit DKZ divided by the number of employees in the KldB 1988 3-digit code. However, it must be noticed that the reference time for the weight is fixed to the year 2012. As the 7-digit DKZ ceased to be updated and maintained as of 31 December 2013, the indicators for this classification of occupations cannot be extrapolated into the future.

Analogously to the aggregation procedure for the new classification of occupations, the aggregation for the 325 occupational orders of the KldB 1988 is derived from the total of weighted indicator values of the single occupations over the 3-digit codes of the KldB 1988. Table 4 contains the mean for the "*degree of standardised certification*" as well as the indicator values for the five most practiced 3-digit codes of the KldB 1988.

Table 4: Degree of the standardised certification for selected 3-digit codes of the KldB 1988

Occupational orders (3-digit)	SCERT	Std. Dev. SCERT	N (2012)
All 325 occupational orders of the KldB 1988	0.6900	0.3007	28,897,440
Five major occupational orders:			
781. Office clerks	0.9598	0.2494	1,839,908
681. Wholesale and retail salespersons, purchasers	0.9147	0.3368	1,352,636
751. Managing directors and division managers	0.4307	0.4534	1,093,860
682. Shop, stall and market salespersons and demonstrators	0.9239	0.2948	922,534
774. Computer scientists, equipment operators, computing and data processing professionals	0.6590	0.4941	760,477

3.3 Two-digit code of the KldB 1988 (occupational groups)

The aggregation of the indicator "*degree of standardised certification*" to the analysis unit of the 2-digit code of the KldB 1988 (occupational groups) is also carried out by the same principle as for the 3-digit code of the KldB 1988: The weight is derived from the number of em-

ployees in the 7-digit DKZ divided by the number of employees in the KIdB 1988 2-digit code, then multiplied with the indicator values of the single occupations and added up over the 2-digit code. Table 5 lists the mean of the “*degree of standardised certification*” for the 82 occupational groups and the indicator values of the five most frequently practiced 2-digit codes of the KIdB 1988.

Table 5: Degree of the standardised certification for selected 2-digit codes of the KIdB 1988

Occupational groups (2-digit)	SCERT	Std. Dev. SCERT	N (2012)
All 82 occupational groups of the KIdB 1988	0.7225	0.3366	28,897,440
Five major occupational groups:			
78. Office clerks, clerical assistants	0.9251	0.3040	2,522,455
68. Sellers and salespersons	0.8757	0.3838	2,517,696
85. Other health care occupations	0.9193	0.4152	1,971,195
75. Managers, consultants, accountants and related clerks	0.4368	0.4890	1,694,700
86. Social welfare, care occupations	0.7534	0.4944	1,541,795

4 Dataset, description of variables and data access

The three indicators described above, “*degree of standardised certification*”, “*degree of standardised credentials*” and “*degree of regulation*” are available for the following analysis units in the form of an Excel dataset and a STATA dataset:

- Three-digit code of the KIdB 2010 (occupational groups)
- Two-digit code of the KIdB 2010 (occupational main-groups)
- Three-digit code of the KIdB 1988 (occupational orders)
- Two-digit code of the KIdB 1988 (occupational groups)

The variables included therein are the systematic number of the classification, the job titles, the employment figures, the three indicators as well as the standard deviation of each indicator, respectively. All datasets and variables follow the same structure (see Description of variables 4.1 to 4.4), with only the endings of the variable names changing according to the analysis unit: *kldb2010_3* for the KIdB 2010 3-digit code, *kldb2010_2* for the KIdB 2010 2-digit code, *kldb88_3* for the KIdB 1988 3-digit code, and *kldb88_2* for the KIdB 1988 2-digit code.

The datasets are available as free download on the website of the Research Data Centre (FDZ) of the Federal Employment Agency (BA) at the Institute for Employment Research (IAB): http://doku.iab.de/fdz/reporte/2014/MR_04-14_data.ZIP.

4.1 Description of variables for the analysis unit of the KldB 2010 3-digit code

Variable	Variable name	Variable label in STATA
Systematic number of the classification	<i>kldb2010_3</i>	KldB2010 3-digit code
Job title	<i>title_kldb2010_3</i>	Job titles of KldB2010 3-digit code
Employment figures	<i>N2010_3</i>	Number of employees of KldB2010 3-digit code
Degree of standardised certification (SCERT)	<i>scert_kldb2010_3</i>	Degree of standardised certification, KldB2010 3-digit code
Standard deviation of SCERT indicator	<i>sd_scert_kldb2010_3</i>	Standard deviation of SCERT, KldB2010 3-digit code
Degree of standardised credentials (SCRED)	<i>scred_kldb2010_3</i>	Degree of standardised credentials, KldB2010 3-digit code
Standard deviation of SCRED indicator	<i>sd_scred_kldb2010_3</i>	Standard deviation of SCRED, KldB2010 3-digit code
Degree of regulation (SREGUL)	<i>sregul_kldb2010_3</i>	Degree of regulation, KldB2010 3-digit code
Standard deviation of SREGUL indicator	<i>sd_sregul_kldb2010_3</i>	Standard deviation of SREGUL, KldB2010 3-digit code

4.2 Description of variables for the analysis unit of the KldB 2010 2-digit code

Variable	Variable name	Variable label in STATA
Systematic number of the classification	<i>kldb2010_2</i>	KldB2010 2-digit code
Job title	<i>title_kldb2010_2</i>	Job titles of KldB2010 2-digit code
Employment figures	<i>N2010_2</i>	Number of employees of KldB2010 2-digit code
Degree of standardised certification (SCERT)	<i>scert_kldb2010_2</i>	Degree of standardised certification, KldB2010 2-digit code
Standard deviation of SCERT indicator	<i>sd_scert_kldb2010_2</i>	Standard deviation of SCERT, KldB2010 2-digit code
Degree of standardised credentials (SCRED)	<i>scred_kldb2010_2</i>	Degree of standardised credentials, KldB2010 2-digit code
Standard deviation of SCRED indicator	<i>sd_scred_kldb2010_2</i>	Standard deviation of SCRED, KldB2010 2-digit code
Degree of regulation (SREGUL)	<i>sregul_kldb2010_2</i>	Degree of regulation, KldB2010 2-digit code
Standard deviation of SREGUL indicator	<i>sd_sregul_kldb2010_2</i>	Standard deviation of SREGUL, KldB2010 2-digit code

4.3 Description of variables for the analysis unit of the KIdB 1988 3-digit code

Variable	Variable name	Variable label in STATA
Systematic number of the classification	<i>kldb88_3</i>	KIdB1988 3-digit code
Job title	<i>title_ kldb88_3</i>	Job titles of KIdB1988 3-digit code
Employment figures	<i>N88_3</i>	Number of employees of KIdB1988 3-digit code
Degree of standardised certification (SCERT)	<i>scert_kldb88_3</i>	Degree of standardised certification, KIdB1988 3-digit code
Standard deviation of SCERT indicator	<i>sd_scert_kldb88_3</i>	Standard deviation of SCERT, KIdB1988 3-digit code
Degree of standardised credentials (SCRED)	<i>scred_kldb88_3</i>	Degree of standardised credentials, KIdB1988 3-digit code
Standard deviation of SCRED indicator	<i>sd_scred_kldb88_3</i>	Standard deviation of SCRED, KIdB1988 3-digit code
Degree of regulation (SREGUL)	<i>sregul_kldb88_3</i>	Degree of regulation, KIdB1988 3-digit code
Standard deviation of SREGUL indicator	<i>sd_sregul_kldb88_3</i>	Standard deviation of SREGUL, KIdB1988 3-digit code

4.4 Description of variables for the analysis unit of the KIdB 1988 2-digit code

Variable	Variable name	Variable label in STATA
Systematic number of the classification	<i>kldb88_2</i>	KIdB1988 2-digit code
Job title	<i>title_ kldb88_2</i>	Job titles of KIdB1988 2-digit code
Employment figures	<i>N88_2</i>	Number of employees of KIdB1988 2-digit code
Degree of standardised certification (SCERT)	<i>scert_kldb88_2</i>	Degree of standardised certification, KIdB1988 2-digit code
Standard deviation of SCERT indicator	<i>sd_scert_kldb88_2</i>	Standard deviation of SCERT, KIdB1988 2-digit code
Degree of standardised credentials (SCRED)	<i>scred_kldb88_2</i>	Degree of standardised credentials, KIdB1988 2-digit code
Standard deviation of SCRED indicator	<i>sd_scred_kldb88_2</i>	Standard deviation of SCRED, KIdB1988 2-digit code
Degree of regulation (SREGUL)	<i>sregul_kldb88_2</i>	Degree of regulation, KIdB1988 2-digit code
Standard deviation of SREGUL indicator	<i>sd_sregul_kldb88_2</i>	Standard deviation of SREGUL, KIdB1988 2-digit code

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Editorial staff

Basha Vicari, Axel Bülow, Heiner Frank

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Corresponding author:

Basha Vicari
Institute for Employment Research (IAB)
of the Federal Employment Agency (BA)
Regensburger Str. 104
90478 Nuremberg

<mailto:basha.vicari@iab.de>