Revision of the IAB Job Vacancy Survey

Backgrounds, methods and results

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Mit der Publikation von Forschungsberichten will das IAB der Fachöffentlichkeit Einblick in seine laufenden Arbeiten geben. Die Berichte sollen aber auch den Forscherinnen und Forschern einen unkomplizierten und raschen Zugang zum Markt verschaffen. Vor allem längere Zwischen- aber auch Endberichte aus der empirischen Projektarbeit bilden die Basis der Reihe.

By publishing the Forschungsberichte (Research Reports) IAB intends to give professional circles insights into its current work. At the same time the reports are aimed at providing researchers with quick and uncomplicated access to the market.

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Abstract

The German Job Vacancy Survey delivers representative data on the number and structure of vacancies in Germany. Such data cannot be derived from other sources and are therefore unique. The survey includes registered and non-registered vacancies. In course of extensive tests and reviews a new extrapolation procedure has been developed. As a result, the aggregate number of vacancies is revised downwards.

The research report is organised as follows: Firstly, an overview about the aim and content of the German Job Vacancy Survey is given. Subsequently, the evolution of the new extrapolation procedure is described. Thirdly, the new method is presented and it is shown that the adaption of it significantly improves the quality of the survey results.

Along with the new extrapolation procedure a revised time series dating back to 2000 is given. However, figures before and after 2010 cannot be directly compared. The research report presents the results for both time periods and compares the results based on the new and the old extrapolation method.

Zusammenfassung

Die Stellenerhebung des Instituts für Arbeitsmarkt- und Berufsforschung (IAB) liefert quartalsweise repräsentative Daten über Anzahl und Struktur der offenen Stellen, die aus anderen Quellen nicht verfügbar und deshalb einmalig sind. Einbezogen sind gemeldete und nicht gemeldete offene Stellen. Umfangreiche Überprüfungen und Tests führten zur Entwicklung eines neuen Hochrechnungsverfahrens. Im Ergebnis kommt es zu einer Abwärtsrevision beim gesamtwirtschaftlichen Stellenangebot.

Der hier vorgelegte Forschungsbericht gibt zunächst einen Überblick über Ziele und Inhalte der IAB-Stellenerhebung und beschreibt anschließend die einzelnen Schritte bei der Entwicklung eines neuen Hochrechnungsverfahrens, ausgehend vom bisher angewendeten Verfahren. Er präsentiert die neue Hochrechnungsmethode und zeigt, dass sich durch ihre Anwendung die Qualität der Befragungsergebnisse verbessert.

Mit der neuen Hochrechnung werden für das gesamtwirtschaftliche Stellenangebot revidierte Zeitreihen bis zum Jahr 2000 zurück vorgelegt, wobei die Vergleichbarkeit zwischen dem Zeitraum vor 2010 und ab 2010 eingeschränkt ist. Der Forschungsbericht präsentiert die Ergebnisse für beide Zeiträume und jeweils für den Vergleich von neuer und alter Hochrechnung.

1 Overview of the IAB Job Vacancy Survey

1.1 Contents and objectives

The German Job Vacancy Survey of the Institute for Employment Research (IAB) is a unique representative establishment survey in Germany that has been conducted on a regular basis for more than 25 years. Since its introduction, the interest in data regarding the number and structure of job vacancies has continued to increase. Growing imbalances on the labour market and the increasing importance of the requirement for skilled workers on an aggregate and corporate level were important impulses for the IAB's Job Vacancy Survey as was the lack of complete data for the aggregate number of vacancies in official statistics. While detailed information regarding labour supply is available (s. str. employed and unemployed), available data regarding labour demand (employed and job vacancies)[1] is limited. For instance, Federal Employment Agency (Bundesagentur für Arbeit – BA) statistics only include a part of the aggregate number of vacancies, i. e. the number of vacancies registered for which the employers want to use the BA's public placement services to fill the position. In Germany, as in many other countries, establishments are not legally obliged to report their job vacancies. The decision of using public placement services is influenced by many factors, not least by soft factors, such as the establishments satisfaction with the local employment agency. The required qualification level is also important: In particular when recruiting highly qualified labour, establishments rather seek other options of placement than public placement services to find suitable applicants (Kettner and Stops 2009). Over time, the percentage of registered vacancies of total job vacancies fluctuates significantly and differs between economic sectors, regions and occupations (Kettner et al. 2011; Fahr/Sunde 2005). Hence, one cannot infer the aggregate number of vacancies from the portfolio of registered vacancies extrapolating e. g. past registration rates or simply assuming a constant relationship between both variables. Vacancies represent the aggregate number of vacancies neither in their structure nor in their volume (Yashiv 2007; Jackman et al. 1989; Kettner and Stops 2009).

This situation has been the subject of scientific dispute since the 1960s (NBER 1966; Nerb et al. 1977) and representative establishment surveys are still considered the best possibility to gain reliable information about the aggregate number of vacancies. The IAB surveys these data for Germany based on the IAB Job Vacancy Survey, a representative survey including all economic sectors and establishment sizes in Western and Eastern Germany. It provides data about the number and structure of job vacancies which are not available from other sources and are hence unique. It includes both job vacancies establishments report to the BA for placement and all other (non-reported) job offers. Furthermore, this survey gains further infor-

[1] Job vacancies are positions for which establishments plan to hire a new employee and for which they actively search for candidates (NBER 1966; Muysken 1994). They can be newly created or already exist within an establishment.

mation regarding the course of staffing processes which significantly contributes to the understanding of balancing processes on the labour market.

The regular surveys of a representative selection of establishments and public institutions[2] are geared towards personnel representatives and/or business managers with personnel responsibility. The survey started with a written questionnaire in Western Germany in 1989 and has since been repeated every year – always in the fourth quarter – as cross-sectional survey[3]; since 1992 also in Eastern Germany. The comprehensive written survey has four main objectives:

1. identification of the number and structure of vacancies while taking into consideration information on the economic situation and the development of the establishments surveyed, including their expectations regarding future development of employment,
2. examination of the course of staffing processes in the past 12 months,
3. examination of scope, causes and corporate effects of unsuccessfully aborted recruiting attempts in the previous 12 months,
4. gaining corporate assessments regarding current developments in labour market policies and instruments, such as the introduction of retirement with 63 years, the introduction of minimum wages and employment opportunities for long-term unemployed people.

Since its introduction, the IAB has continuously reviewed and improved the survey with regard to content and methodology. Due to its expertise, the institute has become an important partner on a European level in the introduction of Europe-wide quarterly statistics of job vacancies. The european coordination started at the turn of the millennium, a joint directive of all European countries on quarterly statistics of job vacancies could be adopted in 2009 (EC regulations 062/2008 and 19/2009). It became effective in 2010 and has since committed all countries to the short term supply of quarterly data on job vacancies and employment by economic sectors and establishment size classes to Eurostat.

The IAB assumed this task in Germany. Since 2006, the written questionnaires of the IAB Job Vacancy Survey in the fourth quarter have been amended by short telephone interviews in the following, second and third quarter. The objective of these interviews is gaining information regarding vacancies during the year. In order to keep the survey burden for the participants as low as possible, the telephone interviews only include a few questions about the number of job vacancies and some

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2 Just like in the survey itself, the term "establishment" as used in the following is not limited to private, trading, commercial or industrial businesses, but also includes social, public, and non-profit establishments, administrations, and associations. According to the statistical concept of BA employment statistics, from which the survey sample is drawn (cf. 1.2), the survey is geared towards establishments, not companies.

3 A new sample is drawn for every annual cross-sectional survey. This randomly redistributes the survey load on all establishments and public administrations every year.

structural characteristics in the actual quarter. This survey design results in an annual panel: It always starts with a written survey in the fourth quarter and ends with a telephone survey in the third quarter of the following year.

The IAB Job Vacancy Survey is essential for research and policy counselling. It provides data and analyses on labour demand and the development of staffing which are available from no other source for Germany. Representative data on job vacancies are published at very short notice for all economic sectors – six weeks after the end of the quarter at the latest. With its annually available data on the progress of staffing processes, for example with information on the search and staffing methods including the degree of engagement of employment services, information on the search durations and the reasons for difficulties in staffing, the survey allows up-to-date analyses as well as the observation of changes over time.

1.2 Sample and survey procedure

A sample drawn new every year forms the basis of the survey. The population of establishments used for this purpose originates from the currently available address portfolio of the BA's employment statistics. It includes all establishments with at least one employee subject to social insurance contributions. As the labour markets in Western and Eastern Germany differ, random samples are drawn separately for the two regions. These differences can be seen among others in the fact that the share of establishments with job vacancies is still significantly higher in Western Germany than in Eastern Germany. As a result of this, a larger sample, in relative terms, is taken for Eastern Germany than for Western Germany.

Until the third quarter of 2015, the annual samples were structured into 23 economic sectors (German Classification of Economic Activities, Edition 2008) and seven establishment size classes (number of employees subject to social insurance contributions) and stratified disproportionately. Since wave IV.2015, the sample has been drawn according to 24 economic sectors and 6 size classes (cf. Appendix 1).

The gross sample comprises 75,000 establishments and public administrations drawn at random. In order to ensure that the cell frequency in the economic sectors/size category matrix is sufficiently large, drawing generally considers the response rates, the permissible sample error and the maximum error tolerance for sampling rates to be expected.

The voluntary survey in the fourth quarter uses a written questionnaire to be completed (since 2006 there has also been the possibility of completing an online questionnaire). The final result after sending a reminder was 13,000 to 15,000 evaluable questionnaires in each fourth quarter of the past years. In the respectively following first, second and third quarter, a subsample of the participants from the previous fourth quarter (about 9,000) is asked for an update of their data on vacancies and employment. The telephone interviews are organised in such a way that there is the best-possible distribution across the quarter by calling establishments in sequence

of the receipt dates of their written questionnaires. This is to ensure that the time interval since the last survey is not too short.

In order to draw conclusions from individual-establishment information to the macroeconomic development, e. g. for the aggregate number of vacancies, this information must be extrapolated to a macroeconomic level using a statistical procedure. This is the only way to gain representative information for the overall economy from a survey of a limited number of establishments.

1.3 The previous extrapolation procedure

The previous procedure, which extrapolated the data from individual establishments to the overall economy, was based on a multi-level iterative method (iterative proportional fitting). The calculated extrapolation factors and/or weighting factors allowed the projection to the basic population of establishments with employees subject to social security contributions (establishment weight) as well as to the population of employees subject to social security contributions in the establishments (employee weight)[4]. In addition to the number of establishments and the number of employees subject to social security contributions, also the number of registered job vacancies in the BA statistics was included in the extrapolation as macroeconomic orientation variable ("anchor variable").

In concrete terms, the "establishment weight" extrapolated the individual-establishment data to the number of establishments in Germany and to the number of registered vacancies (gos) from BA statistics. The employee weight extrapolated to the number of employees subject to social insurance contributions (svB) and to the number of registered jobs from BA statistics.

The weights were determined iteratively in such a way that in the case of the establishment weight they reproduced the vector of registered vacancies as well as the vectors of the marginal totals of the establishments/economic sector matrix for the respective population with sufficient exactness.[5] Both nominal variables were extrapolated with the same factors and were therefore consistent. This ensures that the (aggregated) data of the matrix or vector could be interrelated as absolute values. A differentiation was made between establishments with and without job vacancies when calculating the weights.

The number of registered job vacancies available from BA statistics was – in addition to the number of establishments and the number of employees subject to social security contributions – included in the extrapolation as anchor variable. It was gen-

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4 Furthermore, deduced weights were calculated for successful new hires and aborted search processes. These were multiplicative weights comprised of the establishment weight and the number of new hires and/or the establishment weight and the number of aborted search processes.

5 The procedure for the employee weight is similar, while here the employees subject to social insurance contributions/economic sectors matrix is used.

erally assumed that it reflects the value of registered job vacancies in the overall economy determined with the IAB Job Vacancy Survey. The survey, too, includes the number of jobs reported to the BA (as subset of total vacancies). Under the assumptions described, it made sense to establish a direct link within the framework of the extrapolation.

Since the beginning of the survey, the extrapolation procedure has been subject to constant plausibility checks and further developments and has been constantly adapted to statistical requirements: Changes in official labour market statistics – such as the inclusion of subsidized jobs in the statistics of registered job vacancies – necessitated adjustments to the extrapolation procedure as well as, for example, the expansion of the IAB Job Vacancy Survey as European statistics or the conversion of the classification of occupations. Examples of this are the modifications in 2005 due to the previous introduction of the Hartz reforms. Hence, the expansion of the labour market policy measure of One-Euro-Jobs clearly increased the number of subsidized registered job vacancies. Subsidized jobs were frequently not regarded as job vacancies by the establishments and thus not included in the IAB Job Vacancy Survey but were included in the BA statistics of registered jobs. Corresponding correction factors were therefore introduced in the extrapolation procedure, which accounted for the increase in subsidized job vacancies.[6] Further modifications to the methodology concerned the introduction of the classifications of economic activity WZ 2003 and WZ 2008 and the introduction of the new classification of occupations KldB 2010, which affected sampling, coding and extrapolation and also required a fundamental transformation of the blocks of questions concerned occupational information.

However, so far, the basic extrapolation procedure has always been maintained with a modification for the number of establishments, number of employees subject to social insurance contributions and the number of jobs reported to the BA.

[6] In the course of this modification of the extrapolation procedure, reverse calculations until 2000 were made. Comparing extrapolated values before 2000 and as of 2000 is only possible in a restricted manner.

2 Regarding the necessity of developing a new extrapolation procedure

2010 saw a change in BA statistics regarding jobs reported to the BA, which from then on did not include subsidised employment anymore but only job vacancies on the so-called primary labour market (cf. Federal Employment Agency 2010). Retrospective revisions were made until 2000. The IAB Job Vacancy Survey, too, only considered the primary labour market[7]; subsidised employment in the sense of One-Euro-Jobs was surveyed separately.

In the years before, this sometimes led to difficulties in extrapolation since some establishments with job vacancies in the sphere of publicly subsidised employment did not consider these job vacancies as "regular" and did not include them in the IAB Job Vacancy Survey. The previous extrapolation procedure is a multi-stage procedure at the end of which an adjustment is made to the vacancies registered at the BA. The adjustments required increased significantly over time. Appropriate correction factors had been integrated in the extrapolation to account for this deviation between corporate information and the BA's register-based statistics which included subsidised job vacancies.

The conversion to the exclusive consideration of the primary labour market should actually eliminate these difficulties. But: The survey results concerning the job vacancies reported to the BA and the information from the BA's register-based statistics still differed in parts of the survey significantly, in particular in Western Germany. This, again, required additional interventions and corrections in order to achieve a reliable estimate the aggregate number of vacancies. The IAB was faced with the task of challenging the basic method of extrapolation including the use of registered vacancies as anchor variable.

Initial statistical leads regarding the backgrounds of the deviations observed resulted from scrutinising the temporary employment, sector which frequently showed high deviations between the results from the IAB Job Vacancy Survey and the BA's register-based statistics. This economic sector had gained significant importance over time. The number of temporary employment providers has increased by about 40 percent in the last ten years; within the same period, the share of temporary employees in all employees subject to social insurance contributions has almost doubled (cf. employment statistics register of the Federal Employment Agency).

It was considered that the portfolio of registered vacancies in BA statistics could also include registered vacancies which are currently not considered as job vacancies according to the concept of the IAB Job Vacancy Survey. This could be the case if

[7] Since then, job vacancies in subsidised employment have been surveyed separately. Since 2010, they have not been considered in the (previous) extrapolation procedure. The survey has referred to the determination of job vacancies on the primary labour market exclusively since then.

establishments report jobs to the BA for business policy reasons which, however, are in fact not vacant (yet), or if they do not deregister jobs. In both cases, a calibration of the IAB survey results with the results of the BA's register-based statistics would lead to an exaggeration of extrapolated job vacancies.

The entire survey methodology was scrutinised based on the discovery of a significant deviation between the number of registered job vacancies from the survey and the number of registered vacancies in the BA statistics. Among others, this included non-response analyses, the examination of (other) anchor variables and a basic revision of the extrapolation method including testing alternative variables. In addition, there were comprehensive analyses on the differences in methodology between the IAB Job Vacancy Survey and the BA's register-based statistics and their relevance regarding the respectively determined approach of registered job vacancies in cooperation with BA statistics. Special attention was paid to the temporary employment sector. The following describes the process and results of these efforts.

3 Preliminary work: non-response analyses and evaluation of another anchor variable

Participation in the IAB Job Vacancy Survey is voluntary for the establishments contacted. In the previous years, the response rate of the written survey was 18 to 20 per cent, which is a common value for initial contacts with voluntary participation. To evaluate whether there are specific participation effects in the response behaviour which could have a distorting effect on the survey results, two non-response studies were initiated for waves IV.2011 and I.2012 with financial support from the European Commission.

The structure of participants and non-participants was initially evaluated for survey wave IV.2011 using numerous auxiliary variables which were added establishment-specifically from the BA's employment statistics. This included additions to and deductions from employment subject to social insurance contributions in an establishment, the number of marginal employees, the average age and average income of the staff and many more structural characteristics. The focus was on two questions when conducting univariate and multivariate estimations: Is there a structural difference between participants and non-participants? Do structural differences influence the existence of job vacancies? The analyses showed that some of the examined structural characteristics influence the response willingness and the existence of job vacancies in the establishment, however, their statistical influence is only minor. This includes economic sector affiliation, average wage, employment outflows, affiliation to a federal state and average age of employees. The existence of registered vacancies in the BA's register-based statistics was also evaluated but had no effect.

The structural characteristics mentioned above and some other variables are included in a non-response correction within the framework of the new extrapolation, Chapter 4. However, not considering the non-response effects leads to slight distortions only, which reflects the high quality of the IAB Job Vacancy Survey. Hence,

Figure A3.1 comparatively shows the development of the aggregate number of vacancies when considering the non-response correction as compared to an extrapolation without this correction.

A second step included a separate non-response survey among those establishments which were contacted for the survey in IV.2011 but did not participate. Approx. 7,000 establishments were selected. 49 per cent of them could be interviewed by phone regarding the number of job vacancies in autumn 2011 and spring 2012. The information provided there was compared to the number of job vacancies from the regular surveys in the fourth quarter of 2011 and first quarter of 2012. In addition, the structural characteristics as described above were compared for their relevance regarding the willingness to participate and the target variable of the survey, i. e. job vacancies. This was done to examine possible systematic response differences between non-participants in the regular survey (here participants in the non-response survey) and regular participants. The results show that there are no systematic differences questioning the results of the IAB Job Vacancy Survey, neither regarding the willingness to participate nor the existence of job vacancies.

The non-response analyses thus did not indicate that the results of the IAB Job Vacancy Survey lead to greater systematic distortions regarding the willingness to participate and the variable of "job vacancies". There were also no systematic differences between participants and non-participants regarding the existence of registered job vacancies. Hence, non-response effects can be excluded as an explanation for the differences observed between the number of reported job vacancies in the survey and the number of registered job vacancies in the BA's register-based statistics.

From a point of view of sampling and also after excluding important possible distortions, the evaluations suggest that the disproportionally stratified sample of the survey should be weighted considering (although minor) non-response corrections with a population-related estimator (Generalized REGression estimator, GREG, cf. Section 4.2.1) An estimator like that provides reliable results regarding total vacancies while not requiring the adjustment to registered job vacancies of the BA because, under the circumstances described above, such an adjustment leads to a distortion in the estimation of total vacancies.

The following tasks focused on the evaluation of an alternative anchor variable and the development of a new extrapolation procedure. At the same time, methodological differences between the IAB survey and the BA's register-based statistics were examined in cooperation with the BA and evaluated regarding their relevance for the explanation of existing differences when determining registered job vacancies.

Previous work confirmed the number of employees subject to social insurance contributions and the number of enterprises as relevant and reliable anchor variables. This examination focused on whether the increase in employees subject to social insurance contributions in the previous year could be used as "new" anchor variable and for weighting in the IAB Job Vacancy Survey. The consideration that there

should be a connection between the number of job vacancies and the number of new hires – allowing for a sufficient delay – speaks in favour of using this new variable. The empirical finding that there can be staffing without a previous job vacancy or that staffing does not take place although there was a previous job vacancy (which was not filled or for which the staffing process was aborted) speaks against it. The IAB conducted a separate research project regarding the connection between job vacancies and new hires (cf. Bleninger et al. 2012). No systematic connection could be determined which led to the decision of not using this variable as anchor variable.

4 The new extrapolation method of the IAB Job Vacancy Survey

4.1 Overview

A new extrapolation procedure based on the Generalized regression estimator (GREG) was developed in close collaboration between the IAB, the Economix Research and Consulting survey research institute and the Regensburg University of Applied Sciences. This estimator is widely used in modern survey research (cf. Särndal et al. 1992; Deville/Särndal 1992) and is also recommended by the European Commission, for instance (cf. European Commission 2002).

The GREG procedure continues the basic ideas of the extrapolation method but does without the adjustment to registered vacancies. The number of employees subject to social security contributions and the number of establishments are used as anchor variables.

This method allows the implementation of different kinds of weights. It allows considering non-response corrections and the direct deduction of key figures to assess the quality of the extrapolation and the validity of results which allow statements regarding the statistic validity of the survey. The GREG procedure is more efficient in terms of methodology than the previously used procedure. It significantly improves the quality of the extrapolation, cf. Appendix 2. In the following, we will explain the new procedure when applied to the IAB Job Vacancy Survey in terms of methodology.

4.2 Method

4.2.1 The generalized regression estimator

The starting point is a population of size N (here the number of establishments with at least one employee subject to social insurance contributions) of which a random sample with a certain sample design is drawn. The sample size n; π_k π_k (k = 1,…,N) is for each item k of the population the probability of getting into the sample.

Based on the assumption that $\pi_i > 0$ applies for all k (i. e. every item of the population has a positive probability of getting into the sample), the total value of a charac-

teristic Y (i. e. for example, aggregate number of vacancies in Germany) can be estimated true to expectations with the Horvitz-Thompson estimator:

$$\hat{t}_{Y,HT} = \sum_{i=1}^{n} \frac{y_i}{\pi_i} = \sum_{i=1}^{n} d_i y_i \qquad (4.1)$$

where y_k symbolizes the value of characteristic Y in item k (i. e. for example, the number of job vacancies in establishment k) and $d_i = 1/\pi_i$ $d_k = 1/\pi_k$ is also called design weight of item k.

If information on total values of other variables $\mathbf{X} = (X_1, X_2, \ldots, X_k)$ $\mathbf{X}$ is available that correlates with the total value to be estimated, the accuracy of the Horvitz-Thompson estimator can be improved. For this purpose, weights are determined that, on the one hand, come as close as possible to the design weights and, on the other hand, have the property that with these weights the known benchmark figures can be extrapolated correctly (it is also said that the benchmark figures are *achieved* or that the weights are *calibrated* to the benchmark figures). The generalized regression estimator has this property. It is defined as follows:

$$\hat{t}_{Y,GREG} = \sum_{k=1}^{n} w_k y_k \qquad (4.2)$$

with weights,

$$w_k = d_k + (t_{\mathbf{X}} - \hat{t}_{\mathbf{X},HT})' \left(\sum_{k=1}^{n} d_k \mathbf{x}_k \mathbf{x}_k' \right)^{-1} d_k \mathbf{x}_k \qquad (4.3)$$

where $t_{\mathbf{X}}$ represents the vector of the known total values, $\hat{t}_{\mathbf{X},\mathrm{HT}}$ the vector of the Horvitz-Thompson estimator for $t_{\mathbf{X}}$, and $\mathbf{X}_k$ symbolizes the vector of the characteristics combined in vector **X** for item k.

The property of being calibrated to the benchmark values **X** can also be expressed as follows:

$$\hat{t}_{\mathbf{X},GREG} = \sum_{k=1}^{n} w_k \mathbf{x}_k = t_{\mathbf{X}} \qquad (4.4)$$

4.2.2 Non-response consideration

The representation above initially assumes that there are no non-responses. In order to consider effects due to the response behaviour within the extrapolation procedure, sampling and response processes are regarded as two stages of the selec-

tion process (cf. Särndal/Lundström 2005). In this context, π_k again stands for the probability that an item i gets into the (gross) sample, and p_k for the probability that an item in the gross sample actually takes part in the survey. The entire inclusion probability π_k^* is then the product $\pi_k \cdot p_k$ $\pi_k \cdot p_k$, so that the Horvitz-Thompson estimator with non-response is as follows:

$$\hat{t}_{Y,HT,NR} = \sum_{i=1}^{n} \frac{y_i}{\pi_i^*} = \sum_{i=1}^{n} \frac{y_i}{\pi_i \cdot p_i} \tag{4.5}$$

The following then results for the GREG:

$$\hat{t}_{Y,GREG,NR} = \sum_{k=1}^{n} w_k y_k \tag{4.6}$$

with weights,

$$w_k = d_k^* + (t_{\mathbf{X}} - \hat{t}_{\mathbf{X},HT})' \left(\sum_{k=1}^{n} d_k^* \mathbf{x}_k \mathbf{x}_k' \right)^{-1} d_k^* \mathbf{x}_k \text{, where } d_k^* = 1/(\pi_k p_k). \tag{4.7}$$

In practice, the response probabilities p_i are not known, of course; they must be estimated from the sample. In the IAB Job Vacancy Survey, this is done based on a logistical regression model.

The estimated response probabilities are referred to as $\hat{p}_i$; the calibrated weights then result as

$$w_k = \hat{d}_k^* + (t_{\mathbf{X}} - \hat{t}_{\mathbf{X},HT})' \left(\sum_{k=1}^{n} \hat{d}_k^* \mathbf{x}_k \mathbf{x}_k' \right)^{-1} \hat{d}_k^* \mathbf{x}_k \text{, where } \hat{d}_k^* = 1/(\pi_k \hat{p}_k). \tag{4.8}$$

For the application in the IAB Job Vacancy Survey, possible non-response effects were evaluated in two studies (cf. Chapter 3). Several structural characteristics (also called auxiliary variables) were identified in the process having significant but minor influence on the response behaviour and the existence of job vacancies. They were considered within the extrapolation procedure based on the GREG estimator.

Initially, in the written survey (in each fourth quarter), a non-response estimation is made with the respective currently added auxiliary variables and an adjustment weight is calculated for the non-response behaviour. The auxiliary variables (vectors) originate from the BA's administrative data (cf. Section 4.3). If these vectors are efficient with regard to the response behaviour, they should be suited to describe the establishments' response behaviour. For this purpose, they must be con-

nected with the study variables to be described (here tendency to participate in the survey) in a way that is statistically verifiable.

The affiliation to an economic sector and the affiliation to a establishment size class are included in the estimation in addition to the added average daily wage and the average age of staff. A binary choice model (logit estimator) is used to calculate the response probability for the given auxiliary variables. The inverse of this response probability of an establishment is the non-response weight (NR) for the written survey in the fourth quarter.

Since the telephone surveys in the following first, second and third quarter depend on the response behaviour in the main survey, a multi-level non-response adjustment is applied: The first component is determined by the non-response weights of the main survey. The second component is a non-response analysis conducted separately for each following quarter on the basis of the information from the auxiliary variables and the response behaviour from the main survey. So, on the one hand, a check is made first for non-responses compared to the gross sample (or the total number of establishments with one employee subject to social insurance contributions from BA statistics) and, on the other hand, on the basis of the written survey for non-participations in the quarterly telephone surveys. Although the willingness to participate is with 80 to 90 per cent significantly higher than in the written survey, specific response behaviour can also lead to systematic distortions in the telephone survey.

Here, another auxiliary variable is used as an indicator of the rapidness of the response behaviour (cf. Table 4.1). It became apparent that establishments that can be allocated to the first half of respondents with regard to time also have a significantly higher probability of participating in the telephone surveys in statistical terms.

Table 4.1
Non-response correction in the quarters

	Main survey (quarter IV)	**Telephone survey (quarters I-III)**
Method	Binary choice (logit)	Binary choice (logit)
Dependent variable	Pr(Response=1)	Pr(Response=1 | Participation Q4)
Auxiliary variables	- Average daily wage (in quintiles) - Average age - Economic sector (23) - Size class (6)	- Response rapidness (Q4) - Economic sector (23) - Size class (6)

Source: IAB Job Vacancy Survey

The non-response weight therefore results from the product of the individual non-response weighting:

NR = NR_main survey * NR_quarterly survey

The non-response weights together with the design weights, which are derived from the cells of the matrix (establishment size classes and economic sectors) of the sampling, are used as start weights for the determination of the extrapolation weights in the GREG procedure.

4.2.3 Design and non-response weighting

A certain number of establishments is randomly selected from a stratum (size class, economic sector, west/east). The design weight is therefore

$$\frac{N_h}{n_{h;brutto}} * NR \tag{4.9}$$

or (without explicit non-response modelling)

$$\frac{N_h}{n_{h;netto}} . \tag{4.10}$$

where $n_{h;brutto}$ $n_{h;brutto}$or $n_{h;netto}$ is the size of the gross or net sample in stratum *h*, N_h the size of stratum *h* in total *N*, and *NR* the non-response weight (i. e., the inverse of the participation probability estimated with the logit model).

The data show that some establishments change the size class between sampling and survey. If the original weights remained, this would lead to greater variances in the estimations: An establishment sampled as small enterprise has a great weight; if it is actually large now, the combination of great values and great weight leads to a strong impact on the estimation results.

This is why in the implementation of the extrapolation method, the stratum affiliation is determined by the establishment size as stated by the establishments in the questionnaire and not by the allocation from sampling. This method was also applied in the previous extrapolation procedure. This is basically a simple form of the "weight smoothing" suggested for this problem ("stratum jumpers") in the literature on company surveys (cf. Beaumont/Rivest 2007).

There are two reasons for a change in size class. There can be actual changes in the staff number since approx. six months pass between the survey date and the time of recording the establishment characteristics for the BA's employee file on which the sample is based. Another explanation for changes in the size classes is that establishments do not complete the questionnaire for their business unit but for a superordinate unit or for the entire establishment. The completed questionnaire then represents several subsidiaries of an establishment. If these units were clearly identifiable, it would be possible to calculate exact selection probabilities. In simplified terms: If all units were in the same stratum, the "real" weight would be the original weight divided by the number of units for which a joint answer was given.

Since we generally do not know this, the decision is usually to not maintain the original design weight but to reduce it in the case described.

To examine the effect of the different methods, a design weighting was implemented and compared for the following four variants:

dgew1 = $\frac{N_h}{n_{h;brutto}} * NR$ (stratum affiliation according to address file; with non-response weighting); (4.11)

dgew2 = $\frac{N_h}{n_{h;brutto}} * NR$ (stratum affiliation of respondents according to questionnaire; with non-response weighting) (4.12)

dgew3 = $\frac{N_h}{n_{h;netto}}$ (stratum affiliation according to address file) (4.13)

dgew4 = $\frac{N_h}{n_{h;netto}}$. (stratum affiliation of respondents according to questionnaire) (4.14)

Extrapolations show an increased variance when the stratum affiliation was determined on the basis of the address file (dgew1; dgew3). In contrast, the impact of the non-response weighting was small. The variants in which it was considered (dgew1; dgew2) showed similar courses as the variants without a non-response correction (dgew3; dgew4), cf. Figure A3.1.

This is why the design weight was selected that determines the stratum affiliation of responding establishments on the basis of the information in the questionnaire and combines the design weights with the non-response weighting (dgew2) for the extrapolation procedure.

4.2.4 Weight restrictions

The weights w_k from formula (4.8) have the disadvantage that they can be of any small (also negative) or large size. Negative weights are hard to interpret; very large weights tend to increase the variance. For these reasons, the weights are usually restricted. The approach in the IAB Job Vacancy Survey is as follows:

1. U is the selected lower limit, O the selected upper limit for the calibrated weights.
2. In the first step, the calibrated weights of the GREG are calculated according to the formula (4.8) stated above.
3. If there are items whose weights are less than U, the weights for these items are set to U; if there are items whose weights are greater than O, the weights for these items are set to O.
4. These items are then separated from the sample. For the remaining sample, the regression estimation is made, i. e. formula (4.8) is calculated, where for $\tilde{d}_k^*$ the

originally calibrated weight w_k is set and t_x is reduced by the total of the new weights of the separated items.

5. This procedure is repeated until all calibrated weights are within the selected limits.

4.2.5 Calibration

The new extrapolation for the individual quarters is performed in several steps. According to the stratified sample selection, design weights (dgew2) are determined (for the sample of the fourth quarter) for all selected establishments.

For the responding establishments, a non-response correction is made. The weights derived from the described non-response estimation together with the design weights are used as start weights for the extrapolation. In a few cases, non-response weights are missing; these are then defined as the mean of the estimated weights. In addition to the response weight of the main survey in the fourth quarter, the quarterly observations are (multiplicatively) assigned a weight for the response probability in the telephone surveys.

After the non-response correction, the GREG estimator is a calibration procedure applied to adjust the corrected design weights such that certain benchmark figures of the anchor variables are exactly achieved. The population of establishments and employees according to the BA's employment statistics is used as benchmark figure. For the matrix by size classes and economic sectors the number of size classes is limited to six and 24 economic sectors are considered. Separate extrapolations are made for Eastern and Western Germany.

The GREG estimator basically transforms input weights to output weights. Without any further restriction, the output weights can be of any small (also negative) or large size. However, negative weights are useless and weights less than 1 are hard to interpret with regard to content. An upper limit is also reasonable, depending on the sample size.

In the extrapolation procedure applied here, the weights are restricted to the range [1, 10,000]. Within the scope of future extrapolations, this arrangement can be adjusted, for example, to account for different sample sizes.

4.2.6 Extrapolation for the years of 2000 to 2010

A general retrospective separation between the primary and secondary labour markets is impossible for surveys before the fourth quarter of 2010. However, one-euro jobs – which make up the majority of subsidised employment – have not been considered in the new extrapolation as of 2005. In addition, due to reasons of data privacy and missing auxiliary variables, only a simple non-response correction could be integrated in the extrapolation procedure for the time before IV.2010 (cf. Appendix 2).

The inverse response probability of the respective economic sector/size class cell known from the respective previous surveys was used for the start weights. The original establishment weights could be used for that. The start values for the GREG estimator therefore result from:

$$d_k = \frac{N_k}{n_k} = \frac{\sum_{n \in k} w_k}{n_k} \tag{4.15}$$

Here, a design weight is calculated for every cell in the economic sector/size class matrix, which reveals the inverse of the response probability. The size of the original stratum was here determined by the total of establishment weights (*w*) across all responding establishments *n* in stratum *k*.

The classification of economic sectors of 2003 was used for the retrograde calculation, as in the old extrapolation procedure. To achieve sufficient cell filling within the economic sector/size class matrix, 16 economic sectors were differentiated. The size classes were restricted to six, where in size class 4 the upper limit was expanded to 249 employees subject to social insurance contributions (previously 199) to guarantee consistence with the extrapolation as of the fourth quarter of 2010 and with the benchmark figures of the employees subject to social insurance contributions. For the years 2009 and 2010, the benchmark figures of the employees subject to social insurance contributions are only available according to the new classification of economic sectors 2008. These were calculated back to the classification WZ 2003 (please find the conversion key in Table 4.2).

Table 4.2
Reconciliation table for the conversion from WZ03 to WZ08

WZ03		WZ08*
A, B	Agriculture, hunting, forestry and fishing	1
DA, DB, DC, DN	Food and beverages, textiles, clothing, furniture	3
DD, DE	Wood, paper, publishing and printing	4
DF, DG, DH	Chemicals, plastics, glass, construction materials	5
DI	Metals, metal products	6
DK, DL, DM	Machinery, electronic products, vehicles	8, 9
CA, CB, E	Electricity, mining	2
F	Construction	10
G	Wholesale and retail trade	11
H	Accommodation and food service	13
I	Transport, communication	12, 14
J	Banks/insurances	15
K	Economic services	16, 17, 18
O, P	Private and public services	22, 23
M, N	Social services	20, 21
L, Q	Public administration	19

Source: IAB Job Vacancy Survey/Economix; *For the definition of WZ08 see table A1.2 in the Appendix

4.2.7 Error calculation

The estimation of the standard errors (i. e. the variances of the estimation functions) for estimated total values is well-examined in the literature for the generalized regression estimator (GREG), at least in the ideal case without non-response (which only plays a minor role in the IAB Job Vacancy Survey as shown in Appendix 2).

The starting point is again the Horvitz-Thompson estimator

$$\hat{t}_Y = \sum_{j=1}^{n} \frac{y_j}{\pi_j}. \qquad (4.16)$$

π_{ij} (i, j = 1,…,N) is for two items i and j the probability that both items together get into the sample. An unbiased estimation of the variance of the Horvitz-Thompson estimator is given (on condition that $\pi_{ij} > 0$ $\pi_{ij} > 0$) for all i and j by

$$\hat{V}(\hat{t}_{Y,HT}) = \sum_{i \in s} \sum_{j \in s} \frac{\pi_{ij} - \pi_i \pi_j}{\pi_{ij}} \left(\frac{y_i}{\pi_i} \right) \left(\frac{y_j}{\pi_j} \right). \qquad (4.17)$$

Considering non-response, the total inclusion probability $\pi_i^* \pi_i^*$ is the product $\pi_i \cdot p_i$ $\pi_i \cdot p_i$. On the plausible assumption that the participation decisions of the selected

items are independent of each other, the following applies for the joint inclusion probability:

$$\pi_{ij}^{*} = \begin{cases} \pi_{ij}\, p_i\, p_j & \text{für } i \neq j \\ \pi_i\, p_i & \text{für } i = j \end{cases} \tag{4.18}$$

and an unbiased estimation of the variance of the Horvitz-Thompson estimator taking into account non-response is given by

$$\hat{V}(\hat{t}_{Y,HT,NR}) = \sum_{i \in s} \sum_{j \in s} \frac{\pi_{ij}^{*} - \pi_i^{*} \pi_j^{*}}{\pi_{ij}^{*}} \left(\frac{y_i}{\pi_i^{*}} \right) \left(\frac{y_j}{\pi_j^{*}} \right) \tag{4.19}$$

An asymptotically undistorted estimation of the variance of the GREG is achieved by replacing in the formula for the variance of the Horvitz-Thompson estimator the characteristic values y_i with those of the residues e_i (Särndal et al. 1992: 235).

$$\begin{aligned} \hat{V}(\hat{t}_{GREG}) &= \sum_{i \in s} \sum_{j \in s} \frac{\pi_{ij}^{*} - \pi_i^{*} \pi_j^{*}}{\pi_{ij}^{*}} \left(\frac{g_i \cdot e_i}{\pi_i^{*}} \right) \left(\frac{g_j \cdot e_j}{\pi_j^{*}} \right) = \\ &= \sum_{i \in s} (1 - \pi_i\, p_i) \frac{(g_i \cdot e_i)^2}{(\pi_i\, p_i)^2} + \sum_{i \in s} \sum_{\substack{j \in s \\ j \neq i}} \frac{\pi_{ij}\, p_i\, p_j - \pi_i\, \pi_j\, p_i\, p_j}{\pi_{ij}\, p_i\, p_j} \left(\frac{g_i \cdot e_i}{\pi_i\, p_i} \right) \left(\frac{g_j \cdot e_j}{\pi_j\, p_j} \right) \end{aligned} \tag{4.20}$$

The IAB Job Vacancy Survey is based on a stratified sample with simple sampling within the strata. For a stratum h, $n_{h,brutto}$ is the gross sample size and N_h the population size in this stratum. The joint inclusion probability is therefore

$$\pi_{ij}^{*} = \begin{cases} \dfrac{n_{h,brutto}}{N_h} \cdot \dfrac{n_{h,brutto} - 1}{N_h - 1} \cdot p_i \cdot p_j & \text{For } i \neq j \text{ and } i, j \text{ in the same stratum } h \\ \dfrac{n_{h,brutto}}{N_h} \cdot \dfrac{n_{h',brutto}}{N_{h'}} \cdot p_i \cdot p_j & \text{If } i, j \text{ in different strata } h, h' \end{cases} \tag{4.21}$$

When this is inserted into the general formula for $\hat{V}(\hat{t}_{GREG})$, the following is obtained after some conversions:

$$\hat{V}(\hat{t}_{GREG}) = \sum_h \sum_{k \in s_h} \frac{N_h}{n_{h,brutto}} \cdot \left(\frac{N_h - 1}{n_{h,brutto} - 1} - p_k \right) \cdot \frac{(g_k e_k)^2}{p_k^2} + \sum_h \frac{N_h (n_{h,brutto} - N_h)}{n_{h,brutto}^2 \cdot (n_{h,brutto} - 1)} \cdot \left(\sum_{k \in s_h} \frac{g_k e_k}{p_k} \right)^2 \tag{4.22}$$

In the practical application, the participation probabilities p_k are unknown and must be estimated from the sample; in the formula stated above, p_k is then replaced with $\hat{p}_k$.

4.3 Data used

The new extrapolation method presented here including the detailed non-response correction is used for all survey waves as of the fourth quarter of 2010.[8]

For the survey waves between 2000 up to and including the third quarter of 2010, the non-response correction is made without auxiliary variables since the auxiliary variables are not available for these waves or must not be added to the survey data for reasons of data privacy. A simple non-response correction considering the selection probability is used.

The BA's employment statistics form the basis for this sampling. According to the regulation on the collection and transmission of data of the social security agencies (DEÜV), social-security relevant data of employees is recorded in establishments and transferred to the social security agencies. The employee history (BeH) maps the establishments' social insurance notifications. These statistics include all establishments with at least one employee subject to social security contributions and numerous other establishment-related characteristics. They are recorded with a delay of approx six months. Data available on 31 December and 30 June of every year are also adapted retrospectively. This guarantees a population degree of social insurance notifications of at least 95 per cent. A population degree of 100 % is only achieved after a waiting period of three years, when all notifications of the establishments have been received. The BeH thus forms the framework for the disproportionate sampling of the gross sample, drawn at each 31 December of a year preceding a survey, and as a source for the benchmark values of the non-response correction. The latest available information at 95 per cent level is used to this end.

The respective current benchmark values of employees subject to social insurance contributions (Eastern and Western Germany and Germany as a whole) are forecast as a monthly value of the extrapolation by the forecasts and structural analyses research unit with the IAB and provided to the IAB Job Vacancy Survey. Subsequent-

8 The employment statistics of the Federal Employment Agency were subject to a retrospective revision in 2015. On the one hand, this affected the differentiation of the portfolio of employees subject to social insurance contributions and, on the other hand, the started and concluded employment relationships subject to social insurance contributions. The effects are described in detail in the "Methodenbericht Beschäftigungsstatistik Revision 2014" by the BA (Federal Employment Agency 2015). The revision also affects the revised version of the extrapolation of the IAB Job Vacancy Survey insofar as the benchmark values of the new employment statistics have been used until 2014 and this leads to differences as compared to the results of the old extrapolation procedure. As of 2015, there will be a gross sample according to the provisions of the new employment statistics.

ly, these values are extrapolated to the matrix elements required for extrapolation and used as benchmark values for calibration.

The introduction of a new extrapolation of the IAB Job Vacancy Survey also includes the introduction of a regular revision of the extrapolation. The extrapolations are repeated after approx. one year using the data on employment subject to social security contributions available from official labour market statistics (i. e. data are no longer estimated) and published in line with latest results.

4.4 Summary of differences in methodology between old and new extrapolation

Table 4.3 compares the previous and the new extrapolation procedure at a glance. In terms of methodology, the new procedure leads to a clear quality improvement of the IAB Job Vacancy Survey. Distortions resulting from the previous adaptation to jobs reported to the BA have been dismissed. The statistical quality criteria (e. g. coefficient of variation) indicate a high and improved quality of survey results, cf. Appendix 2. The German survey was characterised by its high quality also in international comparison as can be seen in the quality reports of all surveys on job vacancies in Europe (cf. internal documents LAMAS work group, Eurostat, European Commission).

Table 4.3
Comparison of the extrapolation procedures

	Previous extrapolation procedure	**New extrapolation procedure**
Method	Horvitz-Thompsen/RAS method (iterative)	GREG regression estimator
Anchor variables	Establishments, employees subject to social security contributions, registered vacancies	Establishments, employees subject to social insurance contributions
Dimensions	East/West, 23 economic sectors, 7 establishment size classes	East/West, 24 economic sectors, 6 establishment size classes
Adjustment variables	Extrapolation along the benchmark figures/marginal totals of the matrix	Extrapolation along the cell frequencies of the matrix
Non-response correction	No	Yes
Empirical special effects	Individual case decision	Regulations
Transparency of the syntax	Proprietary (Economix)	Open
Quality criterion	Low variance	Lower variance

Source: IAB Job Vacancy Survey/Economix

5 Results of the new extrapolation procedure

5.1 Differentiation of two survey periods

In the following, we will present the key results of the IAB Job Vacancy Survey using the new extrapolation procedure and will compare them with the results based on the old extrapolation. A differentiation is made between the periods IV.2010 to III.2015 (currently available margin at the time the research report was prepared) and IV.2000 to III.2010.[9]

The extrapolation of all quarters as of wave IV.2010 is made using the GREG estimator and a specific non-response correction. The number of establishments and the number of employees subject to social insurance contributions are used as anchor variables in the matrix made of six establishment size classes and 24 economic sectors. As before, the extrapolation is made separately for Eastern and Western Germany. A calibration to the registered jobs from the BA's register-based statistics does no longer take place.

A general retrospective separation between the primary and secondary labour markets for surveys before the fourth quarter of 2010 was impossible for the extrapolation, and for reasons of data privacy, only a simple non-response correction could be integrated in the new extrapolation procedure (cf. 4.2.6).

Since both periods cannot be compared directly in particular due to the consideration of primary and secondary labour market, the results will be presented separately in the following.

5.2 Results for the waves IV.2010 – III.2015 (primary labour market)

5.2.1 The development of the number aggregate number of vacancies

The development of the aggregate number of vacancies on the primary labour market in Germany is presented in Figure 5.1. In the period considered here there were between 730,000 and 980,000 job vacancies due to economic and seasonal influences.

When comparing the development of job vacancies with the data published so far based on the old extrapolation procedure, a clear downwards revision of results can be recognised. The aggregate number of vacancies according to the new extrapolation are 17 per cent or 175,000 job vacancies below the previous values on average for waves IV.2010 to III.2015.

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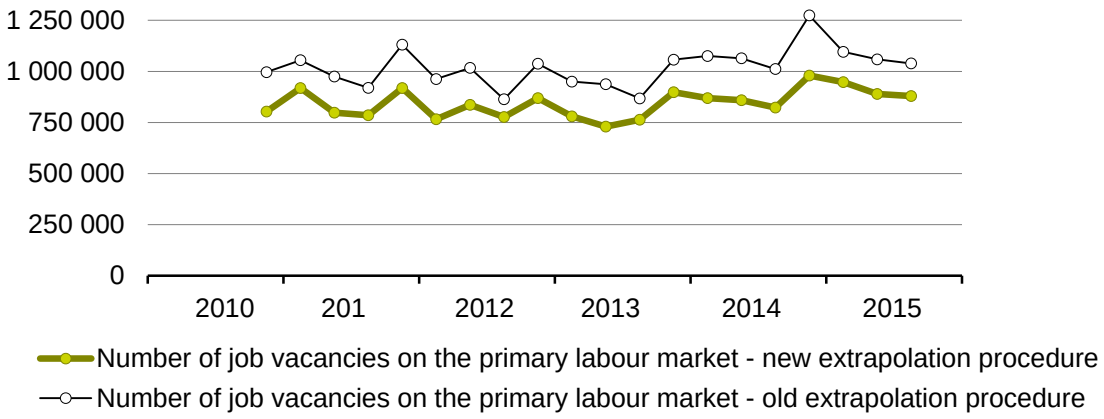
[9] We would like to point out again that since the fourth quarter of 2010, the survey has been conducted quarterly with a written survey in the fourth quarter and telephone surveys in the first, second and third quarters of every year. The same holds true for all survey waves between IV.2005 and III.2010. The survey was only conducted once a year in written form before the fourth quarter of 2005.

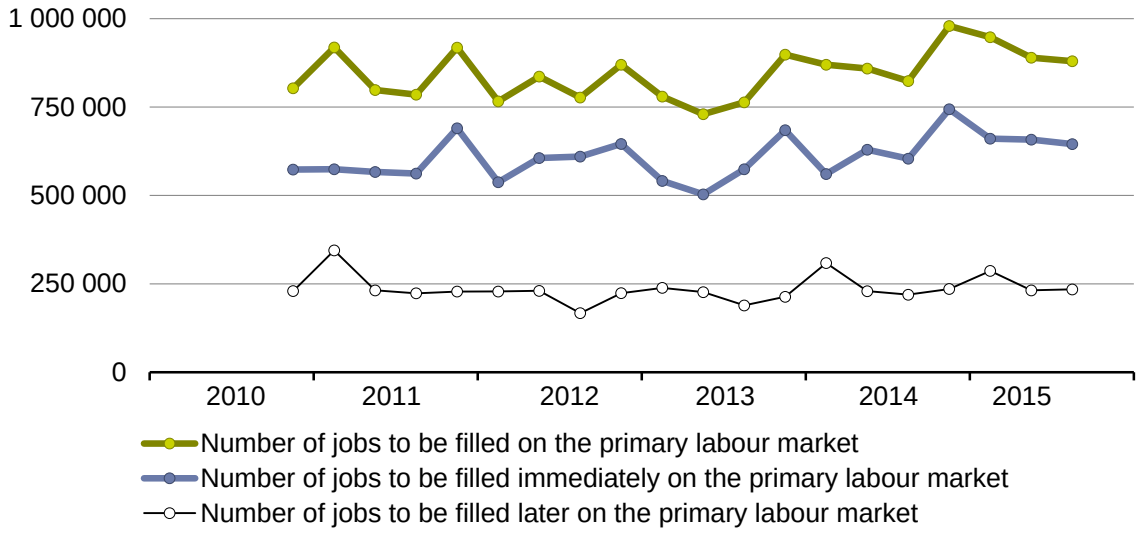
Figure 5.1
Aggregate number of job vacancies; new and old extrapolation procedure, Germany, IV.2010 to III.2015



Source: IAB Job Vacancy Survey/Economix

Figure 5.1 also shows that there are only minor deviations regarding the variation over time. The introduction of the new method hence basically has a level effect while there are no significant influences on periodic fluctuations.

Figure 5.2
Number of jobs to be filled immediately or later; new extrapolation procedure, Germany, IV.2010 to III.2015



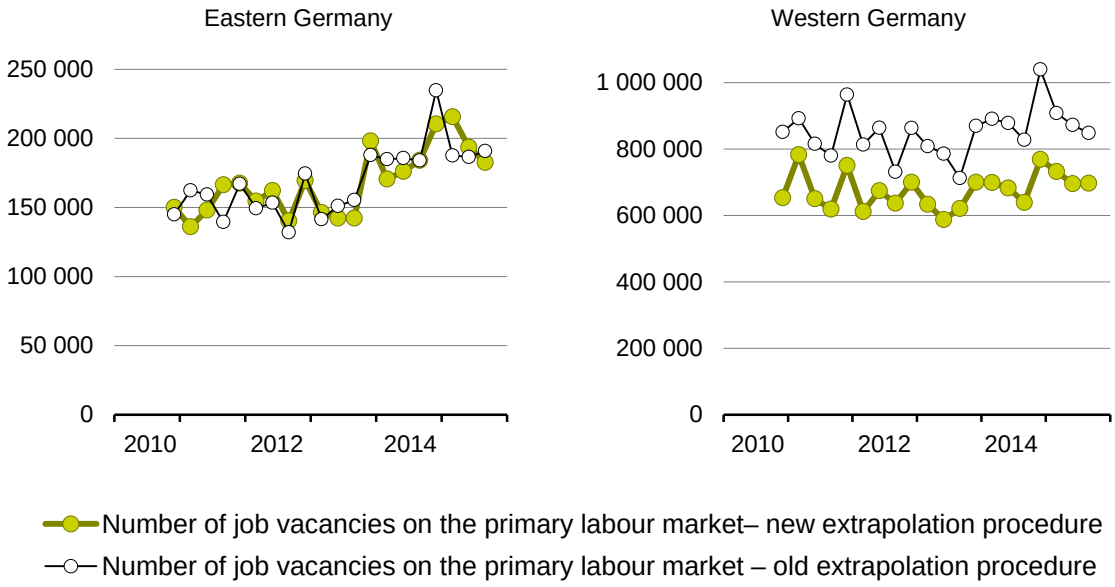
Source: IAB Job Vacancy Survey/Economix

As before, the total of job vacancies is composed of the *job vacancies to be filled immediately* and the *job vacancies to be filled later* (cf. Figure 5.2). In the last survey wave 2014, the latter comprised on average 25 per cent of the job vacancies, the majority of job vacancies was to be filled immediately.

When comparing Eastern and Western Germany in Figure 5.3, it becomes apparent that the revision of the extrapolation affects Western Germany for the most part. The

level changes in Eastern Germany are very little while the previous exaggeration of job vacancies in Western Germany due to the adjustment to registered jobs becomes apparent. Many large temporary employment providers are located in Western Germany. Distortions in the old extrapolation procedure resulting from the special behaviour of employers in this economic sector are particularly important here (cf. details in Chapter 8).

Figure 5.3
Number of job vacancies; new and old extrapolation procedure, Eastern and Western Germany, IV. 2010 to III.2015



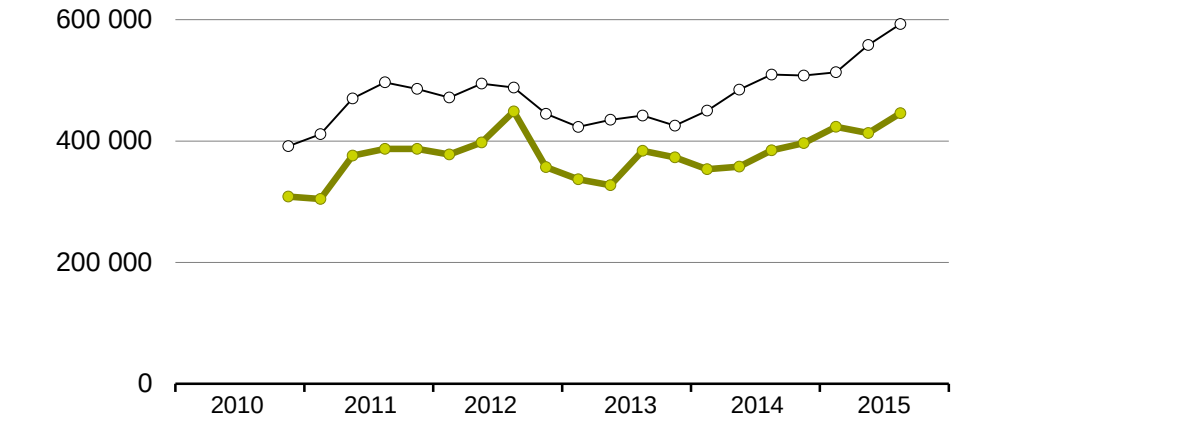
Source: IAB Job Vacancy Survey/Economix

5.2.2 Number of registered job vacancies

Job vacancies included in the survey – including registered jobs – describe the real-time recruiting efforts of establishments. A job is only included in registered job vacancies if, at the survey time, there are active recruiting efforts and the search process has neither been completed nor cancelled. As before, establishments were asked explicitly whether the existing job vacancy was reported to the BA for placement. The number of registered job vacancies can still be deduced from this information. The number of registered job vacancies sampled and extrapolated in the survey, however, does no longer correspond to the number of registered jobs according to BA statistics. This research report will explain the reasons for this in detail in terms of methodology and content (cf. especially Chapter 7 and Chapter 8).

Figure 5.4 shows in the green line the development of registered job vacancies according to the IAB survey using the new extrapolation. The black line shows the number of registered job vacancies according to the old extrapolation which calibrated the number of job vacancies reported to the BA from the survey to registered jobs from statistics which thus had to be equal in result. The level effect due to the changed extrapolation (see green line) is striking. In the period shown here, the difference is on average 21 per cent or approx. 98,000 job vacancies.

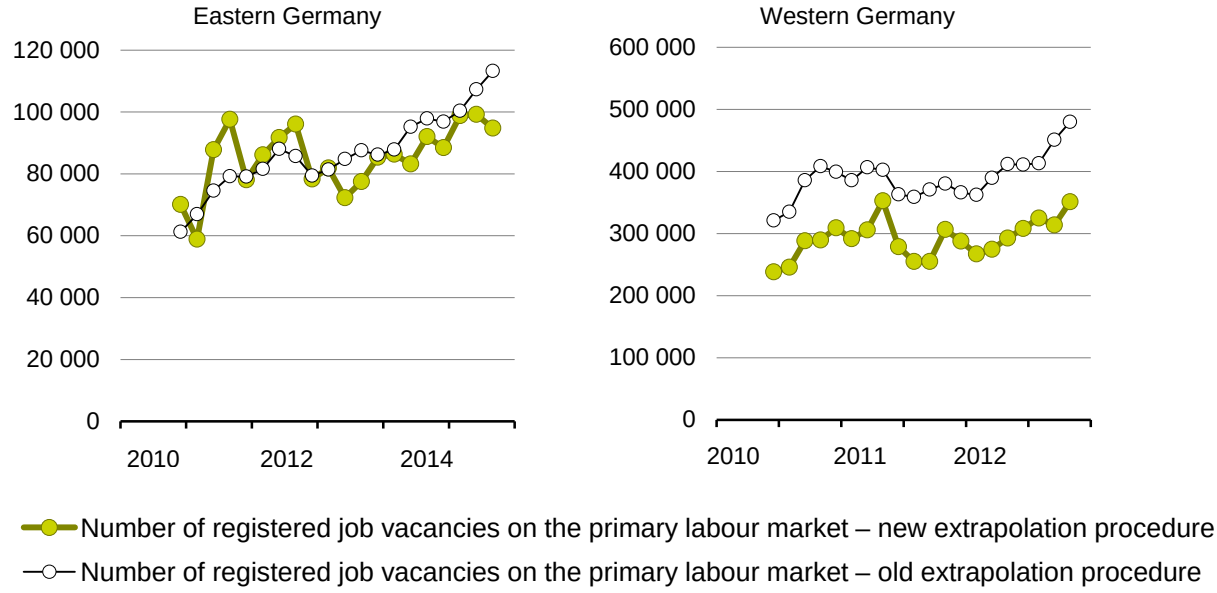
Figure 5.4
Number of registered job vacancies; new and old extrapolation procedure, Germany, IV.2010 to III.2015



Source: IAB Job Vacancy Survey/Economix

When differentiating for Western and Eastern Germany, it can be seen, as for aggregate number of vacancies, that the level effect due to the revision affects Western Germany in particular where many, and especially large, temporary employment providers are located (cf. Chapter 8 regarding the importance of temporary employment).

Figure 5.5
Number of registered job vacancies; new and old extrapolation procedure, Eastern and Western Germany, IV.2010 to III.2015



Source: IAB Job Vacancy Survey/Economix

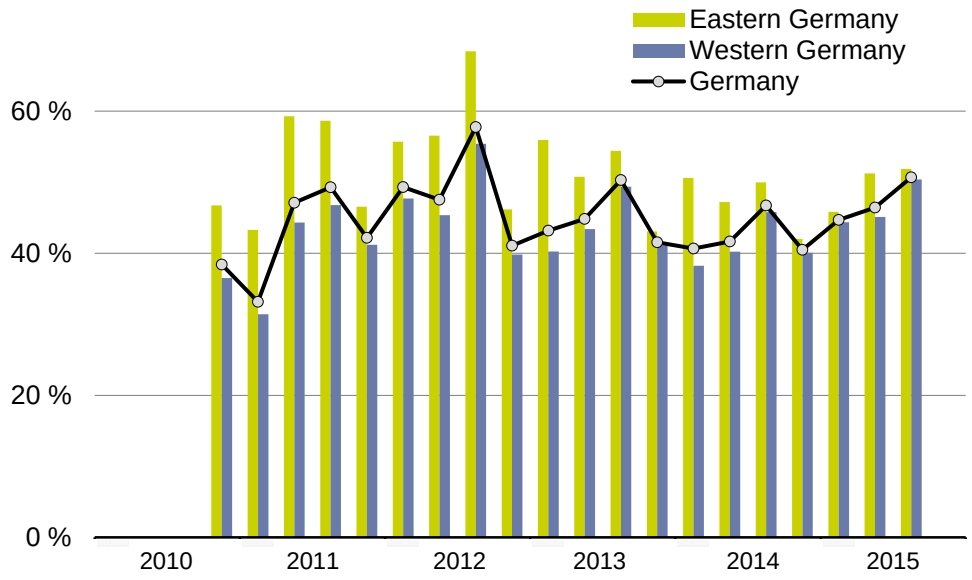
5.2.3 Registration rate

The previous registration rate as a share of all registered jobs included in the BA's register-based statistics in aggregate number of vacancies from the IAB Job Vacancy Survey can no longer be used sensibly.

The registration rate can only be calculated consistently based on the IAB Job Vacancy Survey, because only within this survey are the variables required for this determined – aggregate number of vacancies and the number of job vacancies reported to the BA as subset of this. Mixing IAB and BA statistics with the different underlying concepts when recording registered job vacancies would lead to wrong registration rates.

Figure 5.6 shows the registration rate determined by the IAB based on the IAB Job Vacancy Survey. In the period considered here, it is on average 44.6 per cent in Germany, i. e. almost every second job for which establishments were actively recruiting in the survey period had been reported to the BA for placement at that time. The rate of registered job vacancies was lowest in the first quarter of 2011 with 33 per cent and highest in the third quarter of 2012 with 58 per cent.

Figure 5.6
Registration rate based on the IAB Job Vacancy Survey; Eastern and Western Germany, Germany, IV.2010 to III.2015



Source: IAB Job Vacancy Survey/Economix

As in the old extrapolation, the registration rate is higher in Eastern Germany than in Western Germany, local employment agencies and also the BA's online job exchange are used more frequently for recruiting here (see current IAB short report 4/2016 for current results on the level of utilisation and success rate of employment agencies).

5.3 Results for the waves IV.2000 – III.2010 (primary and secondary labour market)

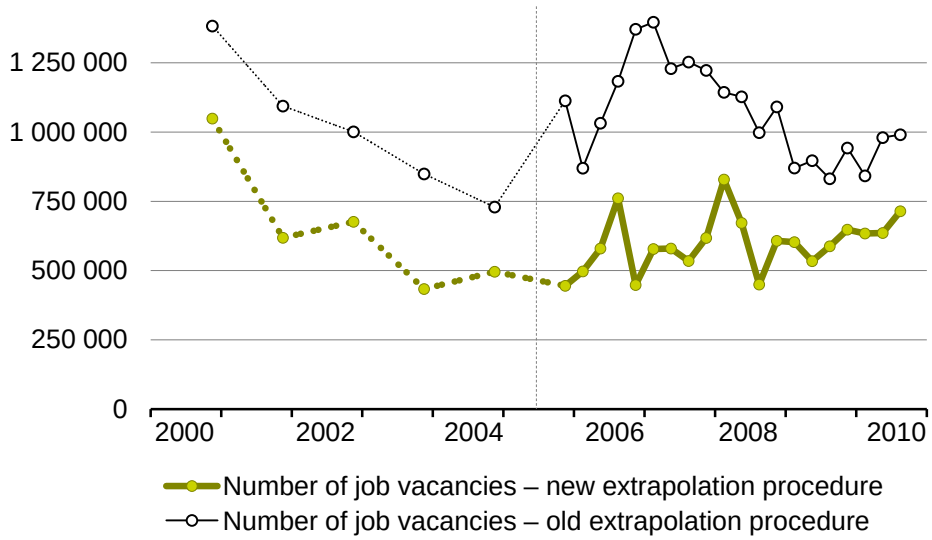
Figure 5.7 shows for the period from IV.2000 to III.2010 the development of the aggregate number of vacancies in a comparison of the new and old extrapolation. The old extrapolation included vacancies on the primary and secondary labour market in this period. The new extrapolation follows this approach up to and including 2004. As of 2005, the new procedure does not include/record one-euro jobs due to the difficulties in recording them (cf. Chapter 2).

Initially, it becomes apparent that the new extrapolation based on historic data produces more volatile results than the estimations for the period between 2010 to III.2014, which is due to the described weighting limitations (only simple non-response weighting, required estimation of design weights) and the significantly smaller sample back then. While in the recent past 13,000 to 14,000 establishments were surveyed, the number was significantly lower in previous waves. The variance of survey results is thus generally clearly higher as in more current waves, irrespective of the extrapolation method used.

There are level effects for aggregate number of vacancies in both parts of the country for the time before 2010 (cf. Figure 5.7. and Figure 5.8.).

However, the periods before 2005 and as of 2005 cannot be compared directly regarding these level effects since the new procedure as of 2005 does not include one-euro jobs. Their distorting effect becomes particularly apparent in Eastern Germany between 2005 and 2007. There were quite many subsidised job vacancies at that time (cf. Figure 5.9).

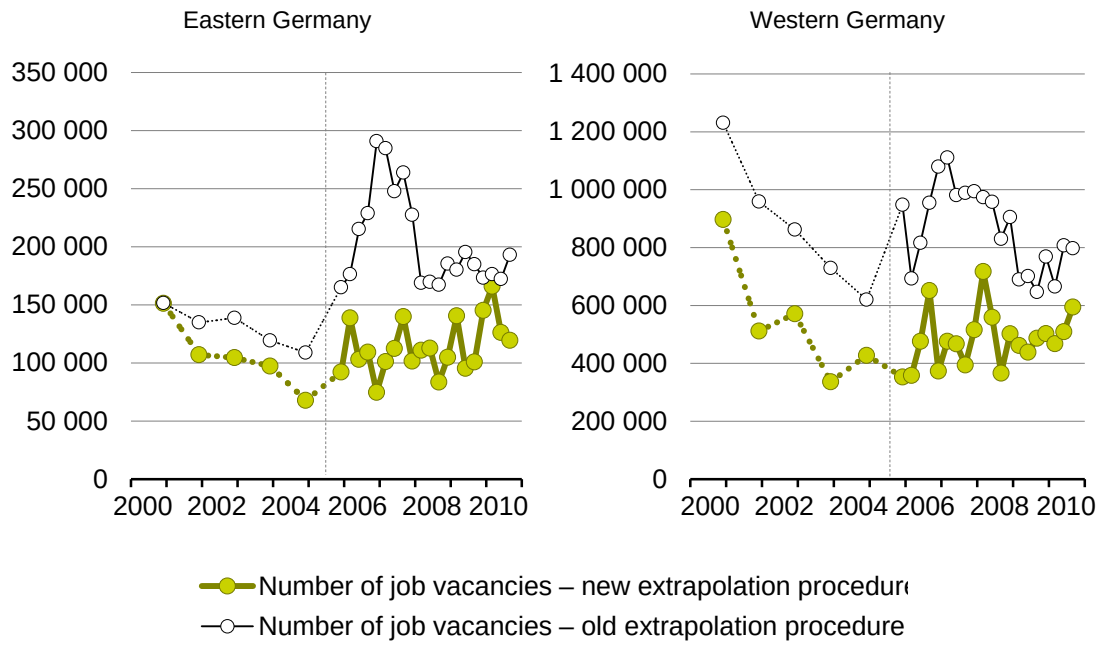
Figure 5.7
Number of job vacancies*; new and old extrapolation procedure, Germany, IV.2000 to III.2010



Note: * = Primary and secondary labour market; quarterly values as of the fourth quarter of 2005, before that only the respective fourth quarter.

Source: IAB Job Vacancy Survey/Economix

Figure 5.8
Number of job vacancies*; new and old extrapolation procedure, Eastern and Western Germany, IV.2000 to III. 2010

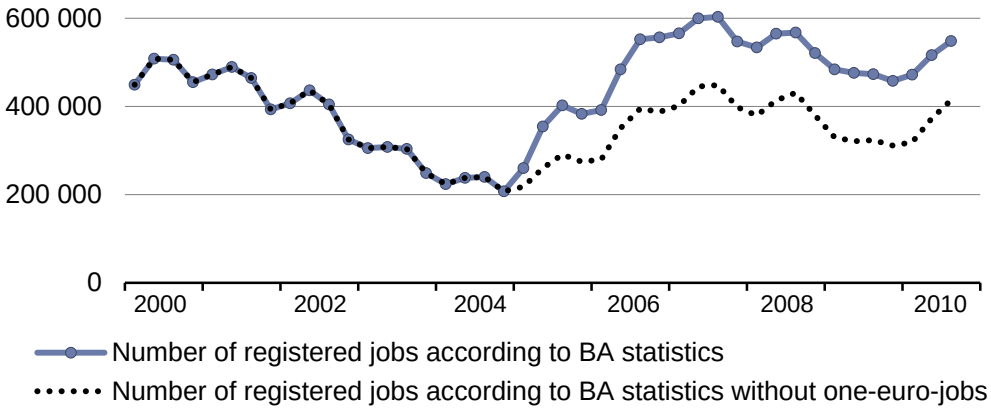


Note: * = Primary and secondary labour market; quarterly values as of the fourth quarter of 2005, before that only the respective fourth quarter.

Source: IAB Job Vacancy Survey/Economix

The differences between the new and old procedure are also quite high when considering registered job vacancies (cf. Figure 5.10). Again, the periods of 2000 to 2004 and 2005 to 2010 cannot be compared directly.

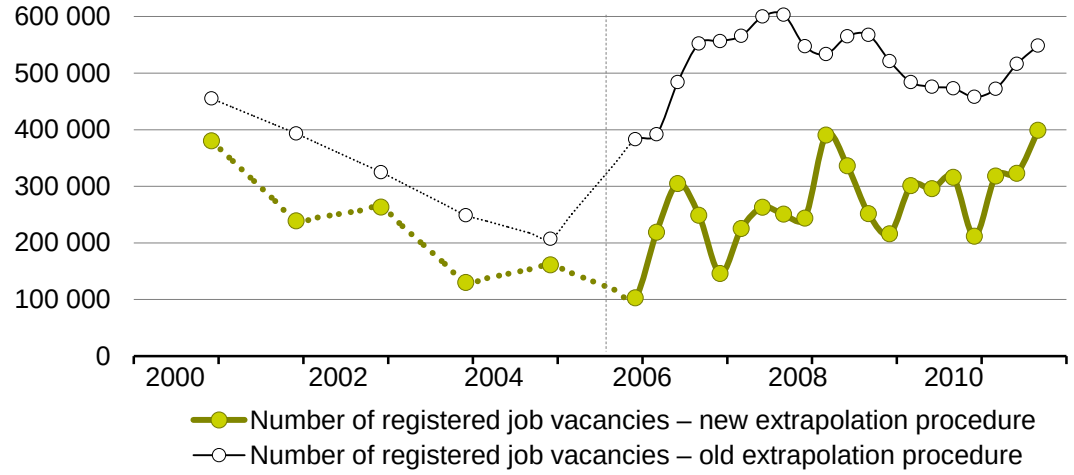
Figure 5.9
Number of registered jobs according to BA statistics*; Germany, IV.2000 to III.2010



Note: * = Primary and secondary labour market

Source: Own representation based on data by BA statistics

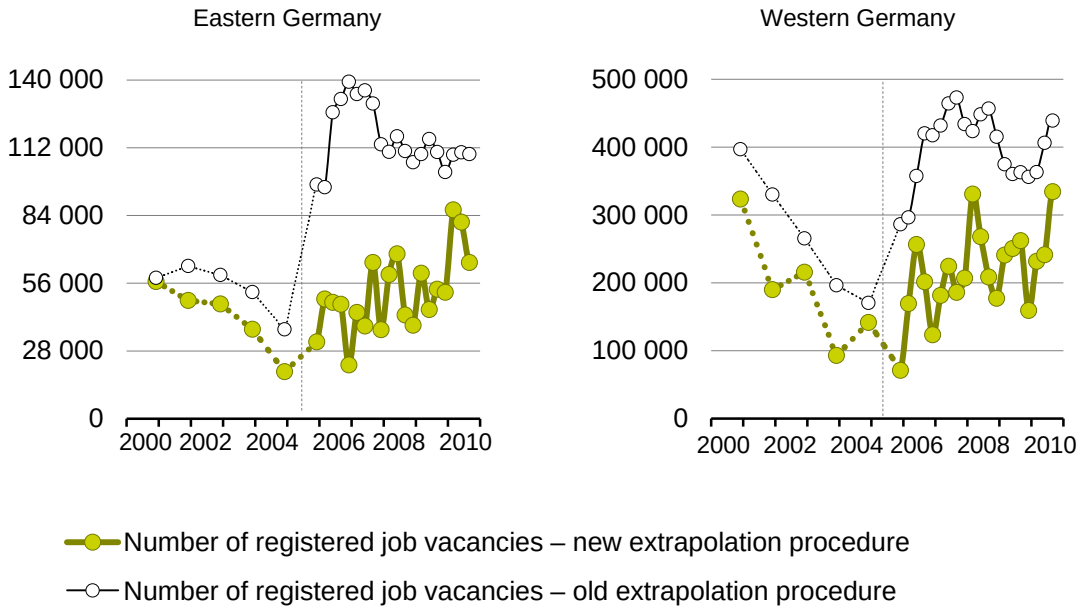
Figure 5.10
Number of registered job vacancies*; new and old extrapolation procedure, Germany, IV.2000 to III.2010



Note: * = Primary and secondary labour market; quarterly values as of the fourth quarter of 2005, before that only the respective fourth quarter.

Source: IAB Job Vacancy Survey/Economix

Figure 5.11
Number of registered job vacancies*; old and new extrapolation procedure; Eastern and Western Germany, IV.2000 to III.2010



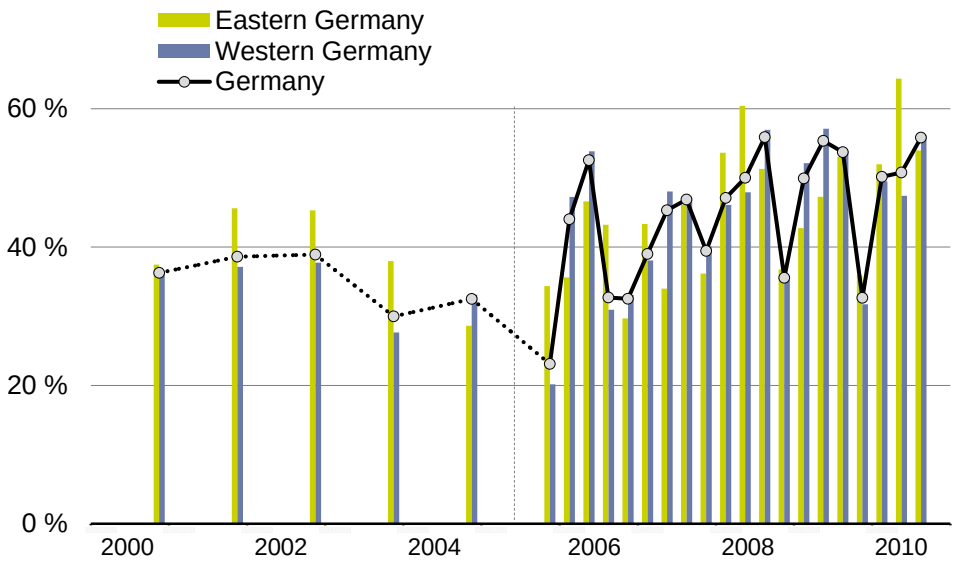
Note: * = Primary and secondary labour market; quarterly values as of the fourth quarter of 2005, before that only the respective fourth quarter.

Source: IAB Job Vacancy Survey/Economix

When applying the new procedure, the registration rate refers to the primary and secondary labour markets together for the period of 2000 to 2004; one-euro jobs have been excluded as of 2005. Between 2005 and 2010, the average registration rate was with 42.9 per cent only slightly lower, while Eastern Germany had a higher value than Western Germany most of the times during this period.

The registration rates determined with the new procedure cannot be compared to the previously presented registration rates and also the periods of 2000 to 2004, 2005 to III.2010 and IV.2010 to III.2015 cannot be compared to each other.

Figure 5.12
Registration rate based on the IAB Job Vacancy Survey*; Eastern and Western Germany, IV.2000 to III.2010



Note: * = Primary and secondary labour market; quarterly values as of the fourth quarter of 2005, before that only the respective fourth quarter.

Source: IAB Job Vacancy Survey/Economix

6 More results based on the evaluation of different variants of the new extrapolation

The decision in favour of the extrapolation procedure used was preceded by an analysis of several variants. In particular the effects of disconnecting registered jobs as anchor variable were to be evaluated in detail and the correctness of this decision was to be scrutinised. This also included extrapolation variants which treated the temporary employment sector separately since this sector has the significant effect on level differences with total vacancies and registered jobs.

Up to and including the third quarter of 2015, all survey waves were extrapolated using the old procedure while the new extrapolation method was developed. In the development stage, this allowed for a comparison between the results of the new and old methodology at any time. Table 6.1 shows an overview of the six variants tested for the new extrapolation procedure and whose results were compared with each other. Variant 2 is the procedure used after completion of all evaluations.

Table 6.1
Variants of the GREG estimator

1	Only design weighting + GREG
2	Design weighting + NR weighting + GREG
3	Only design weighting + GREG (with GOS)
4	Design weighting + NR weighting + GREG (with GOS)
5	Only design weighting + GREG (with GOS except for WZ N)
6	Design weighting + NR weighting + GREG (with GOS except for WZ N)

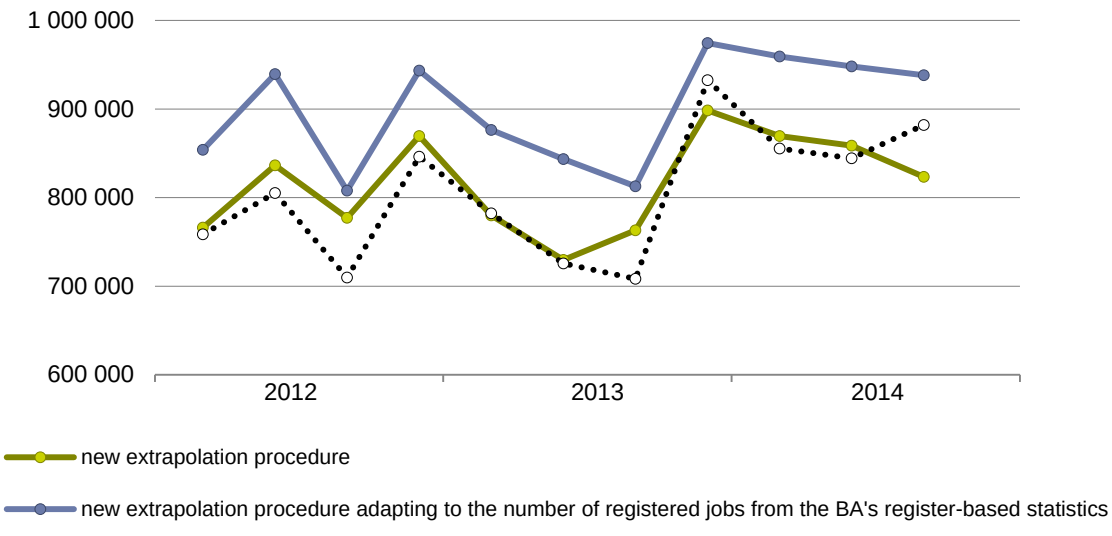
Note: with GOS = adapted to the job vacancies reported to the BA; WZ N = economic sector "economic services"

Source: IAB Job Vacancy Survey/Economix

In addition to the evaluation of the effect of the new non-response correction (cf. Appendix 3), a major evaluation step was the variation of the new procedure regarding an additional calibration to the number of jobs reported to the BA – as in the old procedure – while maintaining all other improvements This was to show the effect this adaptation alone has on the vacancy level. As expected, the estimated level in this variant (variant 4) was significantly above the level resulting without an adaptation to registered jobs (variant 2) which was expected, cf. Figure 6.1 for the period on which this analysis is based I.2012 to III.2014.

When comparing the results, it becomes clear that the level difference between the new and old extrapolation method (variant 2 and variant 4) can basically be traced back to the adaptation to registered jobs. The change from the iterative RAS procedure to the GREG estimator is not decisive. The GREG estimation with an additional adjustment to registered jobs (variant 4) shows very similar results as the old extrapolation.

Figure 6.1
Number of job vacancies – impact of the anchor variables; new extrapolation procedure, Germany, I.2012 to III.2014

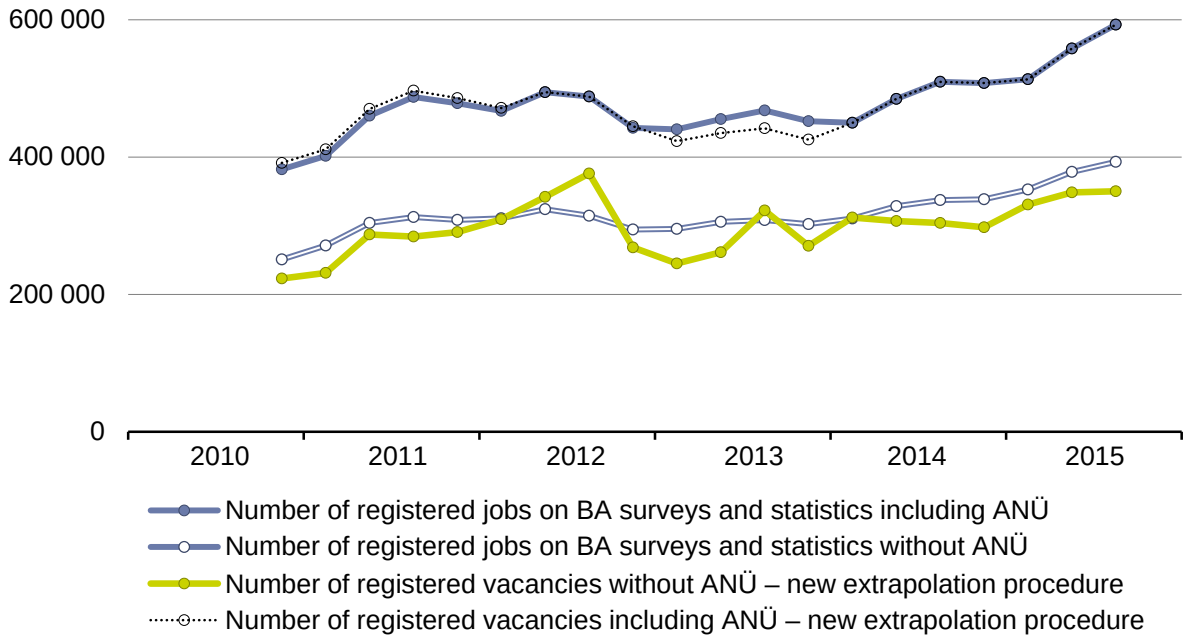


Note: WZ N = economic sector "economic services"

Source: IAB Job Vacancy Survey/Economix

The results of the estimation of vacancies according to the new extrapolation – which additionally adapts all economic sectors to the number of registered jobs from the BA's register-based statistics (variant 6) except for economic services (N) – led to very similar results as the application of the new extrapolation procedure (cf. variant 2, Figure 6.2). This supports the argument of the special importance of economic services and in particular temporary employment for the explanation of differences between new and old extrapolation results. Registered job vacancies are affected significantly (cf. Figure 6.2). When they are used as anchor variable, this leads to an exaggeration of the aggregate number of vacancies.

Figure 6.2
Number of registered jobs (vacancies) based on BA statistics resp. IAB Job Vacancy Survey, Germany, IV.2010 to III.2015

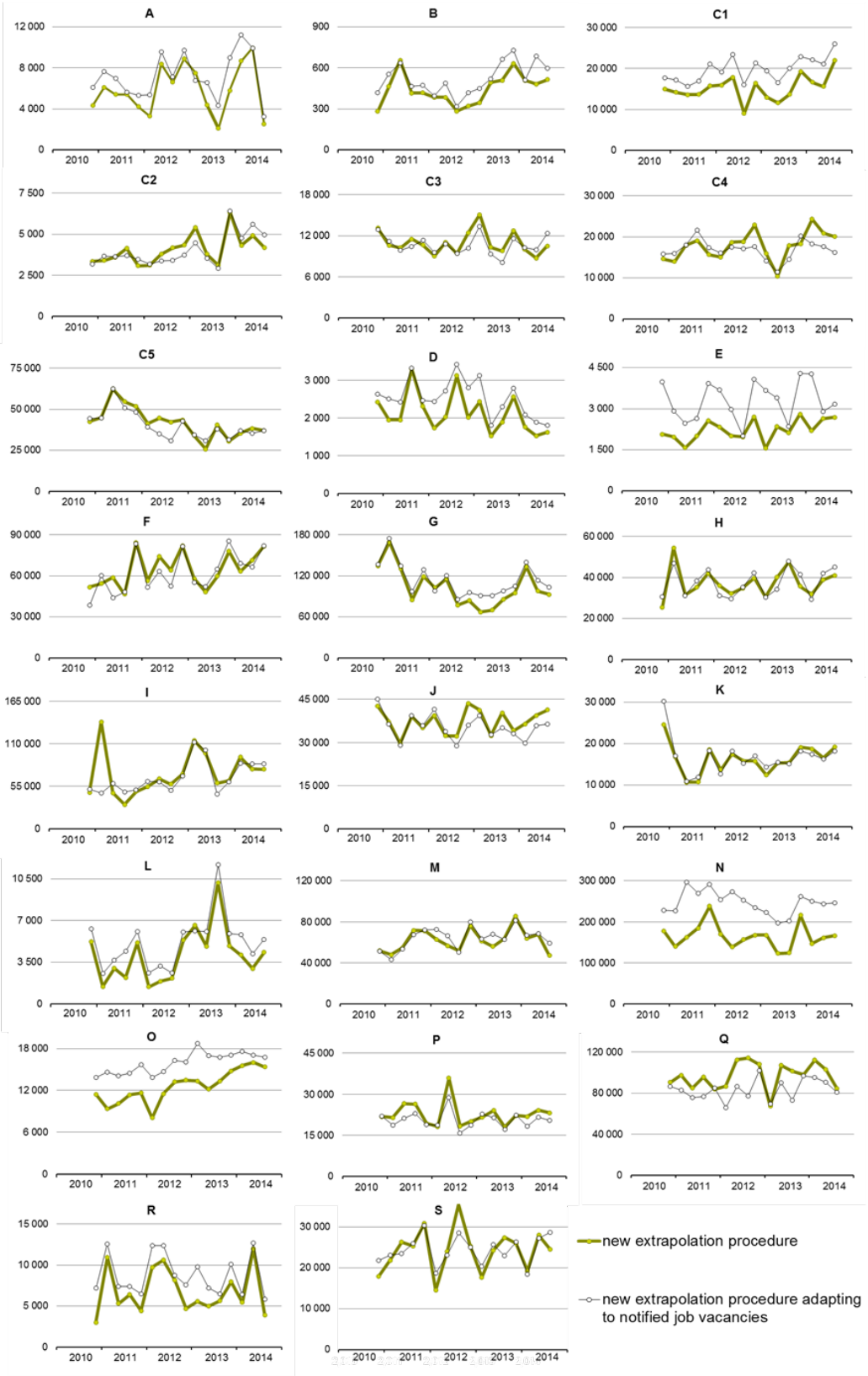


Note: Deviation between old extrapolation (incl. temporary employment (ANÜ)) and BA statistics (incl. temporary employment (ANÜ)) due to retrospective revisions of BA statistics.
Source: IAB Job Vacancy Survey/Economix, BA statistics

All variants were also tested separately for all economic sectors. Figure 6.3 shows an overview of the results for the application of the new extrapolation using the GREG estimator with and without adaptation to jobs reported to the BA. The decisive contribution to the differences in the number of total vacancies comes from other economic services (economic sector N including temporary employment).

The economic sectors of O and E also show larger deviations (cf. also Table A1.1 for sector designation) at first glance. However, the differences are very small as compared to N, they have no significant influence on the total differences in both variants. The decisive influence comes from the temporary employment sector: Differences between the extrapolation with and without adaptation to registered jobs here result from the strategic behaviour of the employers when reporting jobs to the BA and from the delayed deregistration of vacancies, cf. in detail Chapter 8.

Figure 6.3
Variants of the new extrapolation procedure for an estimation of the number of job vacancies; economic sectors (WZ 2008), IV.2010 to III.2014

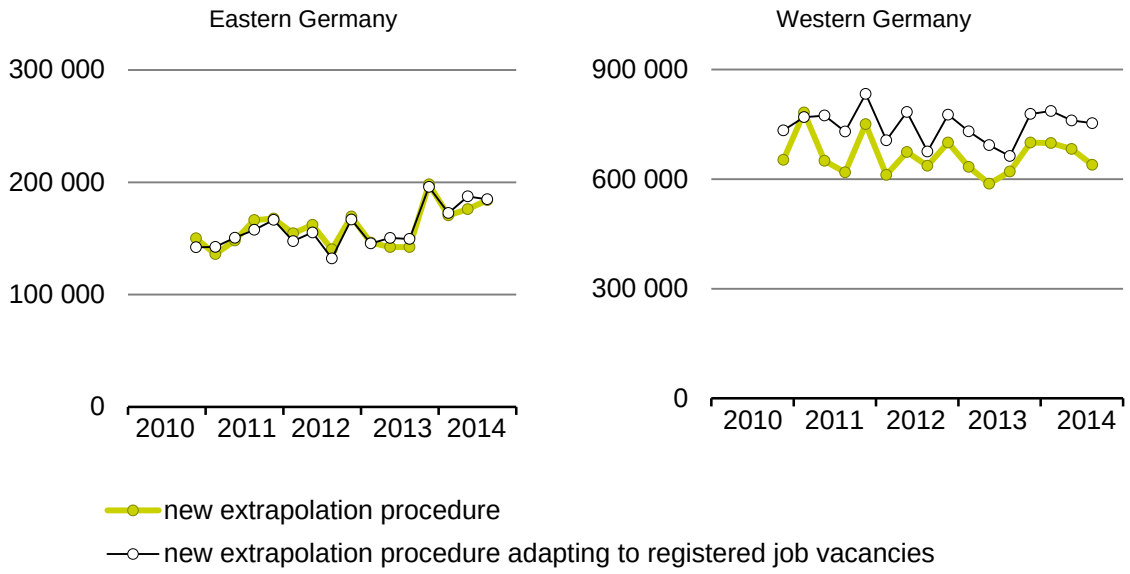


Note: Sector designation (cf. Table A1.2)

Source: IAB Job Vacancy Survey, Economix

The comparison of Eastern and Western Germany in Figure 6.4 also leads to this conclusion. Level differences are particularly apparent in Western Germany where the majority of (large) temporary employment providers is located. There are almost no differences for the Eastern Germany labour market.

Figure 6.4
Variants of the new extrapolation procedure for an estimation of the number of job vacancies; Eastern and Western Germany, IV.2010 to III.2014



Source: IAB Job Vacancy Survey/Economix

7 Differences in methodology between the IAB Job Vacancy Survey and the BA's register-based statistics

Compared to the previous results of the IAB Job Vacancy Survey, the new extrapolation procedure leads to lower aggregate number of vacancies. On the whole, it is a level shift; there are no new conclusions regarding the development of the time series.

As the methodological analyses show, the downwards revision results in particular from detaching the extrapolation method from the statistics of jobs reported to the BA.

The extrapolated number of registered job vacancies using the new method is significantly below the number of registered jobs as included in the BA's register-based statistics. The IAB and BA statistics analysed the backgrounds of these discrepancies together. On the one hand, methodological evaluations and comparisons of both data sources were made, on the other hand, specific evaluations were initiated for the temporary employment sector.

Beyond temporary employment, i. e. in all other economic sectors, the differences between the respective determined number of registered jobs are only minor or within a range which can be tolerated. They can essentially be explained by different due date concepts, the conventional sample error in surveys and a quasi-natural

delay of the employers' deregistration of no longer existing job vacancies from the register.

In the IAB Job Vacancy Survey, the contacted establishments are surveyed across the quarter. The written survey asks for information topical at the day of response. This date is distributed over the months of October, November and December according to the dispatch of the survey documents and of a reminder. The establishments are contacted evenly distributed for telephone surveys in the first, second and third quarters; contacting is organised according to economic sectors, size classes and time of the response of the written questionnaire.

The BA's register-based statistics include all vacancies establishments report to the Federal Employment Agency for placement. It is a total collection following the concept of a stock flow model where influx, stock and outflux form indicators consistent to each other. The number of registered jobs is published once a month at a set due date. Until the next due date, there are changes in portfolio due to influx and outflux.

Even very short time frames can lead to different records of the number of registered jobs in the same establishment in both statistics. An example to illustrate this: An establishment has been searching a new employee for a while and has commissioned the BA for this. At the end of the 12th month, the establishment found an appropriate candidate and finishes recruiting. The following days, the IAB Job Vacancy Survey the establishment and asks for information whether they currently (at the survey date) have job vacancies for which they are actively recruiting and whether these job vacancies, if any, have been reported to the BA. The establishment correctly states in the survey that they have no job vacancy and thus no job reported to the BA because recruiting is finished. However, the establishment does not deregister the job vacancy with the BA immediately but only after a few days. Consequently, the vacancy is included in the BA's register-bases statistics with due date at the 15th of that month; the BA does not know that the job vacancy does no longer exist at that time due to the delay in deregistration. Such delays in deregistration are common due to corporate processes and workload. However, this leads to slight exaggerations of the number of registered job vacancies at the respective due date in register-based statistics.

The difference between the number of registered jobs in BA statistics and the number of registered job vacancies determined using the IAB Job Vacancy Survey, which can be traced back to different due dates and delayed deregistrations, is within the range of common deviations and only minor in the economic sectors without temporary employment (cf. Figure 6.3).

The great majority of deviations in determined registered job vacancies comes from the sector of temporary employment. Specific evaluations in this sector were initiated to explain and determine the backgrounds of that.

8 Empirical evaluations on temporary employment

Two studies were conducted to explain the role of temporary employment providers regarding the differences in registered job vacancies in the IAB Job Vacancy Survey and jobs reported to the BA. The first study is based on 143 interviews with temporary employment providers. The second study conducted analyses on individual-establishment level of the establishments surveyed within the framework of the IAB Job Vacancy Survey. To this end, data from the statistics of jobs reported to the BA and information from the survey at the respective time were merged for different economic sectors. This allowed for the comparison of the information provided by establishments in the written survey of the IAB Job Vacancy Survey with the portfolio parameters registered with the BA at individual-establishment level. The following will present both studies and their results.

8.1 Interviews of temporary employment providers

8.1.1 Procedure

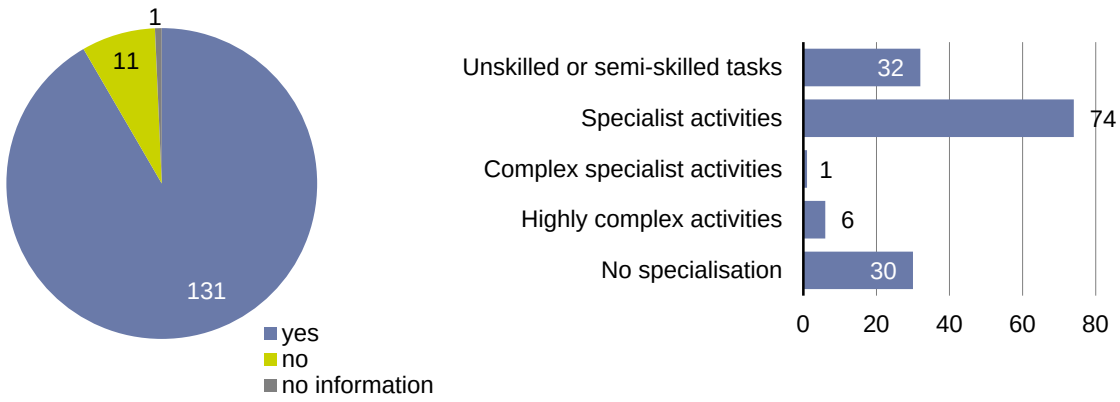
The temporary employment sector was evaluated in more detail using additional interviews. On the one hand, this included expert interviews of several hours with one business manager and one HR consultant of a temporary employment provider to gain deeper insight into the work in this sector, especially regarding recruiting and staffing. On the other hand, temporary employment providers for which information regarding vacancies was available in 2013 and 2014 in the written survey of the IAB Job Vacancy Survey were interviewed. A total of 230 address files of establishments were available. The information summarised here was based on 143 telephone interviews in the period between 20.04.2015 and 30.06.2015. The interviews took between 15 and 20 minutes. The objective was to gain more information regarding response behaviour within the framework of the IAB Job Vacancy Survey and the integration of the BA in search processes.

8.1.2 Recruiting and BA involvement

The key business for temporary employment providers is the prompt provision of appropriate staff for different customers. Only 11 of 143 interviewed establishments claimed they were not currently searching new staff.

When being commissioned with providing temporary work, it is essential to provide the required staff very quickly. The business segment of temporary employment providers is very heterogeneous. The interviews showed, on the one hand, a specialisation for certain economic segments and, on the other hand, establishments offering a wide range of qualification levels (cf. Figure 8.1). This is relevant since the search duration for appropriate staff is significantly different between the respective qualification levels.

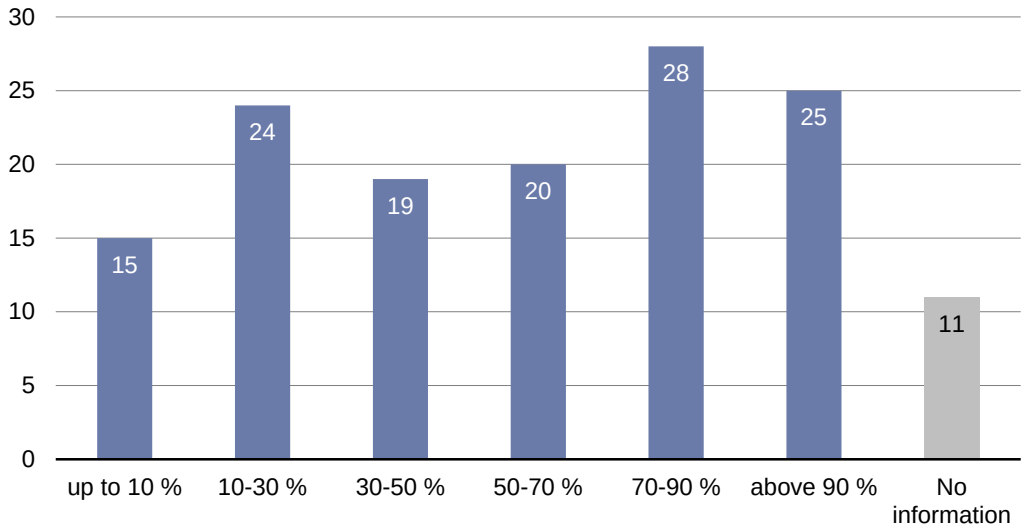
Figure 8.1
Number of recruiting according to specialisations in a certain segment
- Number of establishments at the time of the interview -



Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

Due to staff already employed in the establishment **permanent recruiting, however, is not** always mandatory. However, the establishments surveyed cover their staff requirements arising from provision contracts predominantly with new hires. Figure 8.2 shows that in 25 of the 143 establishments over 90 per cent and in a further 28 establishments between 70 and 90 per cent of the existing staff requirement is realised by means of new hires. The BA is involved with only a few exceptions.

Figure 8.2
Share of new hires to fulfil orders
- Number of establishments at the time of the interview -

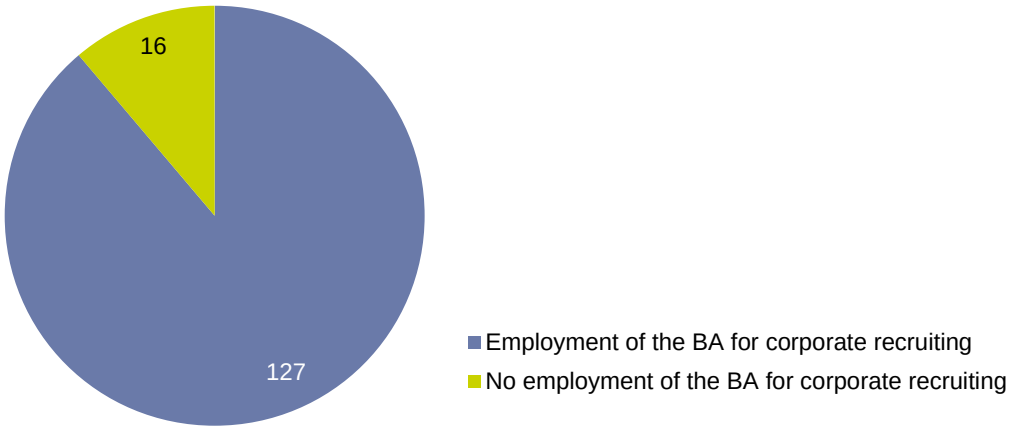


Note: The X axis shows the percentage average of new hires to fulfil the establishments' orders in the past year

Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

The vast majority of establishments interviewed uses the BA's placement services to find new employees. When asked if they employed the BA for corporate recruiting, only 16 establishments stated that they generally did not place placement orders with the BA 16 (cf. Figure 8.3).

Figure 8.3
Employment of the BA for corporate recruiting
- Number of establishments (N) -



Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

Both, the IAB Job Vacancy Survey and BA statistics record corporate recruiting. The following analysis refers to possible differences between the job vacancies reported to the BA in the IAB Job Vacancy Survey and the number of registered jobs according to BA statistics.

The establishments provide information as to how many of these jobs have been reported to the BA. For the latter case of a successfully filled job vacancy or aborted search processes there is additionally, among others, detailed information regarding the start and end of recruiting and the time of the personnel decision and/or the desired employment date.

BA statistics register registered jobs with placement order. The establishment decides whether or not to report a job vacancy to the BA for placement. There is information for every registered job regarding registration date (date of placing the placement order), the desired employment date and the duration of the job vacancy until then (registration date until due date), and/or regarding the total duration in case of an already existing deregistration by the establishment.

Differences between the IAB Job Vacancy Survey and the portfolio parameters registered in BA statistics at a due date can thus occur because:

1. the portfolio of vacancies is recorded differently,
2. there are deviations in the recorded duration.

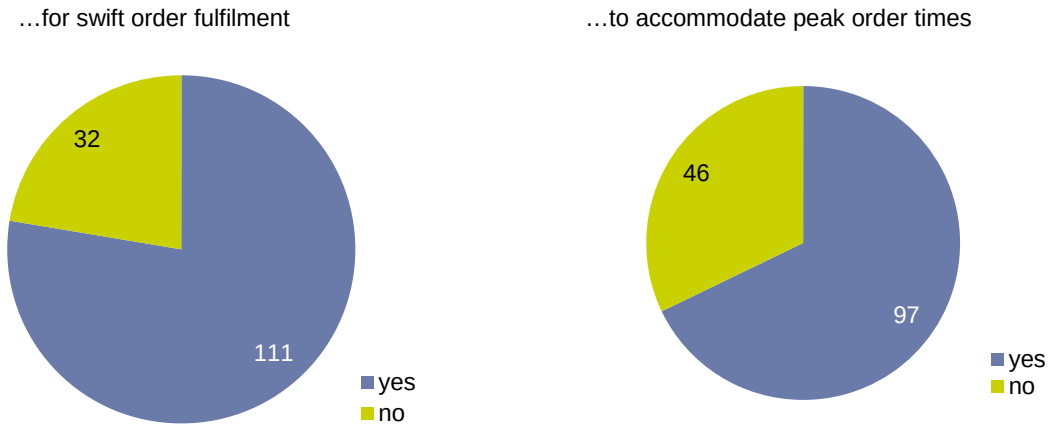
8.1.3 Role of applicant portfolios in temporary employment

Regarding recruiting, the survey showed that recruiting in temporary employment is very different from other economic sectors. Temporary employment providers typically have address files of potential candidates for the daily placement business available (portfolio) from which in the concrete case of a placement order an appropriate candidate can be placed, and/or a contract can only be concluded then.

In order to clarify the reasons for deviating results in recording the portfolio of vacancies, establishments were asked, among others, when they used the assistance of the BA's placement services. It became apparent that, in addition to concrete placement orders and the search for in-house administrative staff, also portfolio searches and the search for staff for placement with third parties is relevant, especially job registration to the BA.

97 establishments, i. e. almost 70 per cent of the temporary employment providers interviewed, stated that they kept this portfolio available for in-time placement during peak order times (cf. Figure 8.4). In this case, the search for appropriate staff by temporary employment providers does not necessary/immediately lead to an employment contract or a job vacancy being filled.

Figure 8.4
Temporary employment providers with a portfolio of potential employees
- Number of establishments at the time of the interview -

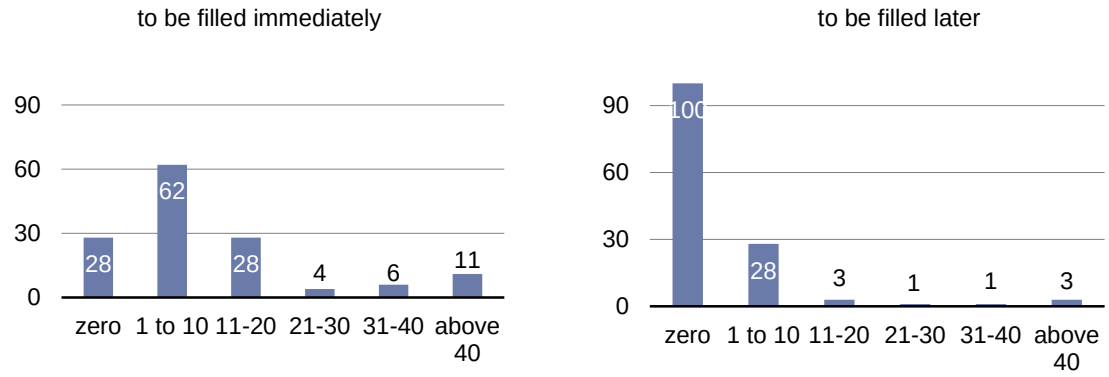


Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

When establishments search staff for their portfolio without actual job vacancies being the reason for that, this leads to an exaggeration of the number of vacancies which can directly lead to employment. Staff-seeking for placement with third parties (companies in other economic sectors), too, leads to an exaggeration of the actually existing number of job vacancies in temporary employment.

These cases are reported significantly less here since the IAB Job Vacancy Survey explicitly asks for the search for new employees. The survey differentiates in this context between "job vacancies to be filled immediately" and the search for employees "to be hired at a later date". According to this, both cases directly aim at concluding an employment contract. Within this context, the IAB Job Vacancy Survey also surveys the number of registered jobs to be filled immediately or at a later date (cf. Figure 8.5).

Figure 8.5
Number of establishments differentiated by the number of registered job vacancies to be filled immediately and at a later date
- Number of establishments at the time of the interview -



Note: 4 establishments without information regarding registered job vacancies to be filled immediately. 7 establishments without information regarding registered job vacancies to be filled at a later date.

Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

If portfolio searches were to be reported within the framework of the IAB Job Vacancy Survey, they should be primarily included in the survey as jobs to be filled at a later date. However, this in particular shows that the majority of job vacancies is to be filled immediately. For instance, 100 surveyed establishments claimed they did not have any registered job vacancies to be filled at a later date.

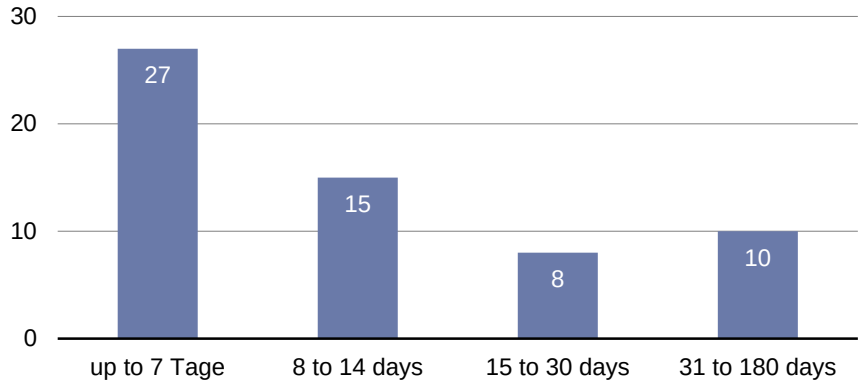
Regarding the general question of who the surveyed establishment considered part of their staff in the sense of a job vacancy, 138 of the 143 establishments stated that they considered leased out employees part of their staff. 64 establishments did not consider recruiting of in-house administrative staff. One reason for this might be the little fluctuation and the small share of the total staff of this group. The vast majority (123 of the surveyed establishments) searches less than once a year for new in-house administrative staff and if so, only for very few persons. In the IAB Job Vacancy Survey, this might lead to an underestimation of the portfolio of job vacancies, which is, however, only very small. Nevertheless, it is clear that leased out employees are understood as an integral part of staff. Questions about recruiting thus primarily aim at the workings of the leasing business with the temporary employment providers surveyed.

8.1.4 Duration of the job vacancy

Temporary employment providers report that the duration of the search for personnel sometimes varies severely. For questions regarding the average search duration, individual information hence referred to concrete qualification levels. The general rule is: The more complex a job profile, the longer the search for personnel. For establishments which could provide respective total averages, it becomes apparent that the search for personnel mostly does not take longer than 14 days (cf. Figure 8.6).

Figure 8.6
Average duration of the search for personnel for successfully filled, registered job vacancies

- Days from the start of the search until the decision in favour of one candidate -

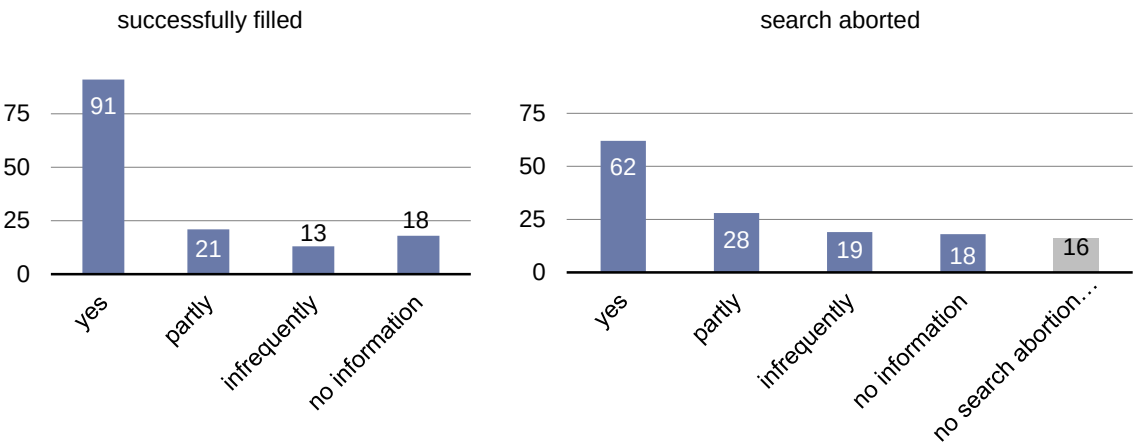


Note: 83 establishments without information regarding average values

Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

It can be profitable for temporary employment providers to offer individual jobs longer than necessary in the BA system to sift through more applicants, e. g. for their portfolio. 91 of the surveyed establishments claimed to deregister successfully filled jobs with the BA. However, in particular in case of aborted personnel searches, only 62 establishments stated that they cancelled the placement order (cf. Figure 8.7). No evaluable information was available for 18 establishments.

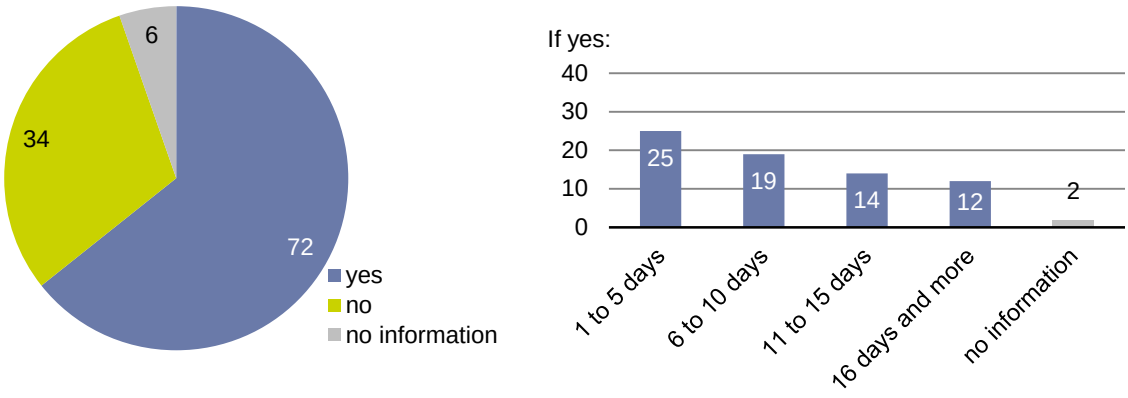
Figure 8.7
Deregistration of a job reported to the BA
- Number of establishments at the time of the interview -



Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

The close contact between the BA's placement service and the temporary employment providers thus leads to a constant portfolio evaluation of registered jobs through the local employment agency representatives. Of the 90 establishments cancelling obsolete placement orders with the BA at least in part, 72 reported that this took place with a delay (cf. Figure 8.8).

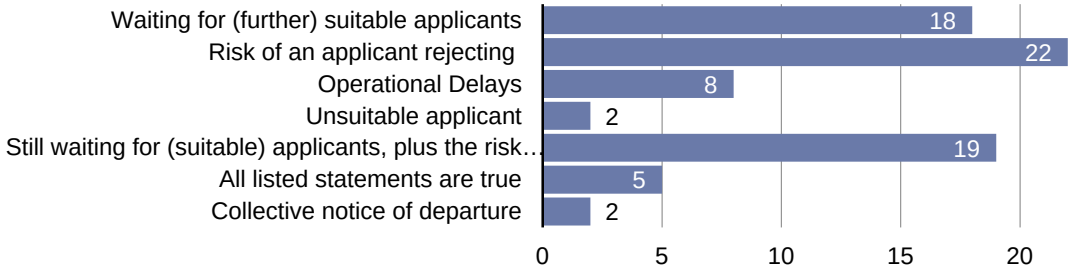
Figure 8.8
Delay upon cancelling and average duration
- Number of establishments if Fig. 8.7: YES/partly -



Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

"Waiting for (more) good applicants" and the risk that the [already found] applicant backs out" or a combination of both are the most frequently mentioned reasons for delays (cf. Figure 8.9). Overall, the reasons leading to the reported delays are both due to technical reasons and established business processes. Although the reasons described are plausible and can be explained with the particulars of temporary employment providers, it becomes apparent that this behaviour – in particular regarding the reported average duration of personnel searches – might lead to a significant extension of the duration of a job vacancy in the statistics of registered jobs of the BA (cf. Figure 8.6 and Table 8.3).

Figure 8.9
Reasons for delayed deregistrations



- Number of establishments if Fig. 8.7: YES/partly -

Note: * = 76 establishments mentioned several reasons for delays

Source: IAB Job Vacancy Survey, special survey of temporary employment providers of waves 2013 and 2014

The establishment survey showed that there can be different collections of the portfolio of vacancies and deviations in the durations recorded. The portfolio search important for temporary employment providers in particular is recorded more strongly within the framework of BA statistics. In addition to delays for technical reasons, longer durations are probable with the BA since there are delayed deregistrations of actually completed personnel searches. In the IAB Job Vacancy Survey, the establishment completes a questionnaire on site at a certain due date. The number of job vacancies reported to the BA is thus provided for this due date.

8.2 Comparison of data from the IAB Job Vacancy Survey and the BA's register-based statistics on individual-establishment level

8.2.1 Procedure

The basis of the second analysis includes all temporary employment providers (economic branches 782 and 783 of WZ 2008) and the economic sectors of "Traffic and storage" (WZ H) and "Provision of financial and insurance services" (WZ K) for which the written surveys from 2013 and 2014 in the IAB Job Vacancy Survey include information regarding vacancies. The economic sectors of K and H were chosen at random. The objective of this analysis is the direct comparison between the individual-establishment (unweighted) information in the survey and the data of the respective establishment in the statistics of registered jobs of the BA. The economic branches of H and K were selected as reference group for the temporary employ-

ment sector. The respectively available data on the number of registered jobs and/or the number of registered job vacancies and information regarding duration of vacancies according to the BA's register-based statistics and/or recruiting processes from the IAB Job Vacancy Survey were compared.

The data from the IAB Job Vacancy Survey was merged with the information from the BA's statistics of registered jobs exactly for the month of completing the questionnaire. Since BA statistics of registered jobs are only available as monthly due date sample (usually by mid-month), the information provided by establishments sampled may deviate from that (at a certain date).

Overall, the share of establishments with registered job(s) (vacancies) depends heavily on the examined groups of economic sectors in the data sources considered (cf. Table 8.1). 149 of 223 temporary employment providers stated that they had job vacancies (approx. 67 %). According to the IAB Job Vacancy Survey, 55 per cent of establishments have registered job vacancies. According to BA statistics, 64 per cent of establishments have registered jobs.

Table 8.1
Sample structure of analysed establishments
- Number of establishments (N) -

	ANÜ	WZ K	WZ H
Establishments, total	223 / 100%	873 / 100%	1,029 / 100%
Establishments with job vacancies (IAB Job Vacancy Survey)	149 / 67%	226 / 26%	338 / 33%
Establishments with registered job vacancies (IAB Job Vacancy Survey)	122 / 55%	87 / 10%	160 / 16%
Establishments with registered jobs (BA)	143 / 64%	64 / 7%	172 / 17%
Establishments with registered job(s) (vacancies) in both data sources	100 / 45%	49 / 6%	94 / 9%
Establishment with job vacancies or with registered jobs with the BA	184 / 83%	232 / 27%	382 / 37%

Source: BA statistics, IAB Job Vacancy Survey: Special survey of temporary employment providers of waves 2013 and 2014

A further differentiation by the required formal qualification level does not show any peculiarities. It can, however, be observed that the differences in the registration behaviour occur especially in small- and medium-sized establishments (up to 249 employees) and that those establishments report much fewer registered job vacancies in the IAB Job Vacancy Survey than are included in BA statistics of registered jobs at the same time.

In contrast to temporary employment providers, the differences in the economic sectors of K and H are less significant. The key figure "reported job" shows a high consistence, however, at a low level. 17 and 16 per cent of establishments respectively have registered job(s) (vacancies) in the economic sector H. The deviation in the economic sector K is also comparatively low with 3 percentage points.

8.2.2 Differences in the portfolio of vacancies

Moreover, the analysis of the portfolio of vacancies of temporary employment providers shows that, on average, they report significantly fewer registered job vacancies in the IAB Job Vacancy Survey than are included in BA statistics (cf. Table 8.2). The sample shows in the temporary employment sector a total of 2,778 registered job vacancies in the IAB Job Vacancy Survey and 3,116 registered jobs in BA statistics. The (unweighted) difference is thus 11 per cent here.

Table 8.2
Number of jobs and establishments, differentiated by type of job

	ANÜ		WZ K		WZ H	
	Jobs	***Establish-ments***	***Jobs***	***Estab-lishments***	***Jobs***	***Estab-lishments***
Job vacancies (IAB Job Vacancy Survey)	3,807	149	896	226	2,049	338
Registered job vacancies (IAB Job Vacancy Survey)	2,778	122	316	87	810	160
Registered jobs (BA statistics)	3,116	143	137	64	837	172
Total		223		873		1,029

Source: BA statistics, IAB Job Vacancy Survey: Special survey of temporary employment providers of waves 2013 and 2014

It must be kept in mind that the sample of the IAB Job Vacancy Survey was drawn disproportionately. This is necessary since only a sufficient case number for the surveyed subgroups allows reliable statements to be made about the population. This leads to fewer small- and medium-sized establishments with a small number of registered jobs being surveyed than their large share of the population would lead to expect. This is compensated for by weighting in the extrapolation procedure so that the difference between the IAB Job Vacancy Survey and BA statistics is higher in representative/extrapolated statements for the population of all establishments.

In addition to the sector level considered to date, there is a number of establishments on individual-establishment level for which there are significantly more jobs in the BA register than were reported by establishments to the BA in the survey at the same time.

Figure 8.10 shows on the X axis all establishments of an economic sector sorted by the level difference of registered job(s) (vacancies) between the IAB Job Vacancy Survey and BA statistics. The Y axis describes the affiliated absolute difference. Negative values occur if the portfolio of jobs reported to the BA is higher than the portfolio of registered job vacancies recorded in the survey.

Figure 8.10
Difference between job vacancies and/or registered jobs based on the IAB Job Vacancy Survey and registered jobs in BA statistics

- Establishments with registered jobs or job vacancies in the sample -

Note: * Three extreme values were corrected in the economic sector H.

Source: BA statistics, IAB Job Vacancy Survey: Special survey of temporary employment providers of waves 2013 and 2014

109 of 186 temporary employment providers who reported a job in at least one of the two sources showed a deviation between registered jobs and registered job vacancies of less than 10. The differences are more significant in a small number of establishments. This must be observed in both directions.

Some establishments interviewed within the framework of the IAB Job Vacancy Survey showed very strong deviations between the number of job vacancies reported to the BA stated there and the portfolio as included in BA statistics. These establishments were checked regarding plausibility and aptitude for the extrapolation procedure. In the temporary employment sector, the sample showed that 22 of the 223 establishments stated in the IAB Job Vacancy Survey that they had registered job vacancies. The BA's registration system, however, does not include these jobs in the sampling month. On the other hand, the BA's data includes 43 establishments with registered jobs which do not report these jobs in the IAB Job Vacancy Survey. 100 establishments have reported jobs in both BA statistics and the IAB Job Vacancy Survey.

In order to explain existing differences between the two data sources, initially establishments with significant differences regarding the information of registered job(s) (vacancies) were evaluated. This information deviates by more than 100 jobs for 3.1 per cent of temporary employment providers in the sample. It can be assumed for these establishments that the information does not refer to the establishment surveyed but to superordinate business units. The registration rate based on the IAB Job Vacancy Survey is with 100 per cent and/or 60 per cent, however, within the limit to be expected for the outliers. As expected, the information regarding the total

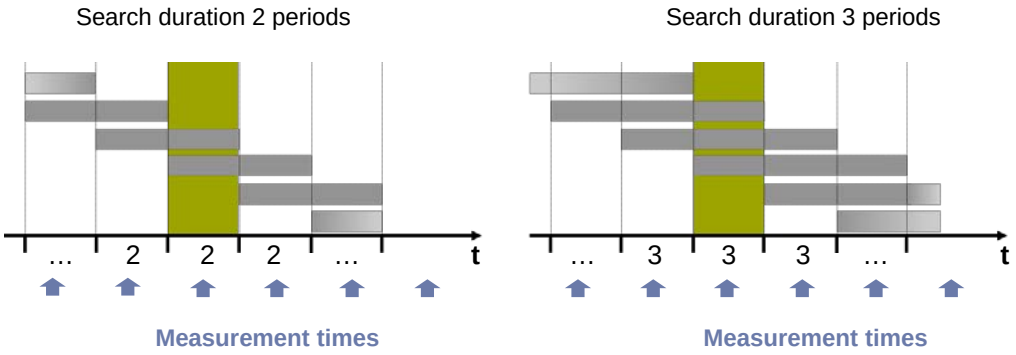
portfolio of vacancies and/or employees subject to social insurance contributions is higher. All other corporate information is plausible, too. Hence, these cases can be treated like similar larger establishments and are considered as such in the weighting procedure.

This affiliation to a new establishment size class has no systematic distortion effect on the result. Some of these cases are already known beforehand. In these cases, the information for the entire business unit is already considered before the survey. There is therefore no evidence of systematic surveying errors for the extrapolation procedure of the IAB Job Vacancy Survey.

8.2.3 Differences in durations

Furthermore, the durations available from both data sources were analysed. Deviations between the registered duration and the actual duration of corporate personnel search would also lead to deviations in the portfolio of vacancies at a certain due date. To illustrate this, we will consider an establishment with two different scenarios: Due to employees departing into retirement, an establishment has had a regular requirement for replacement (ceteris paribus) of one person per quarter for some time (cf. Figure 8.11).

Figure 8.11
Difference in the portfolio of vacancies with a constant corporate requirement (for replacement) of one new person per period, with a search duration of 2 and/or 3 periods per recruiting process



Source: IAB Job Vacancy Survey

The measured duration from the start of the search to its end is two quarters. The recruiting process takes three quarters on average in the second scenario. Here, too, one recruiting process is initiated per quarter, In both cases, the establishment staffed four new persons and thus filled four job vacancies at the end of the year. This leads to distortions in the duration of only a few days affecting the portfolio of vacancies recorded at a certain due date/measurement time. If the establishment were observed at a certain due date/measurement time, this would result in two job vacancies in the first case and three job vacancies in the second case.

It becomes apparent that durations based on the IAB Job Vacancy Survey in the latter case of a completed staffing and/or search abortion are generally shorter than

durations based on registered jobs of the BA at the due date. As a consequence of the sampling structure deviating from the population of the IAB Job Vacancy Survey, the extrapolated durations for temporary employment providers are below the unweighted average (cf. Table 8.3).

Table 8.3
Search durations and duration in temporary employment in days

Key figure:	un-weighted	old extra-polation	new extra-polation
New hires*	N=144		
Days start of search until desired start of employment	38	24	30
Days start of search until staff decision	45	33	33
Days start of search until actual start of employment	59	43	40
Search abortions*	N=47		
Days start of search until desired start of employment	69	104	87
Days start of search until abortion/decision	97	93	96
Abortion rate*	9 %	13 %	14 %
Mean new hires + abortions*			
Days start of search until desired start of employment	46	30	34
Days start of search until decision	58	37	38
Registered jobs of the BA**	N=143		
Start of registration until desired start of employment	109		

Note: Abortion rate = percentage of search abortions from the total of new hires and search abortions

Source: Calculations based on unweighted data, ** = BA statistics, * = IAB Job Vacancy Survey, special analysis of temporary employment providers of waves 2013 and 2014

It must be pointed out that both data sources measure the durations of different jobs.[10] Nevertheless, these systematic differences do not change the central statement to be derived from the analyses: On average the durations of registered jobs in the portfolio measured at the BA are thus longer for the temporary employment providers evaluated here than the average duration establishments reported in the questionnaire of the IAB Job Vacancy Survey for a complete recruiting process (start of search until actual start of employment and/or search abortion).

The following Figure 8.12 shows the absolute difference between the IAB Job Vacancy Survey and BA statistics in the portfolio of registered jobs of an establishment

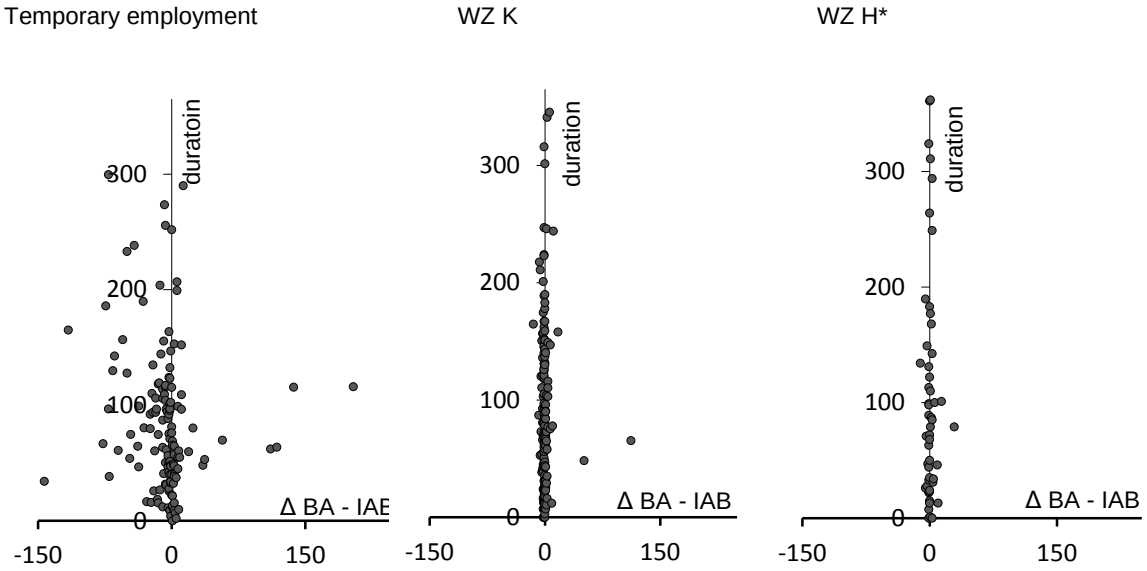
[10] The new hires/search abortions recorded within the framework of the IAB Job Vacancy Survey are not part of the (registered) job vacancies surveyed in parallel since this refers to concluded recruiting processes. The calculation basis, too, is different since establishments in the IAB Job Vacancy Survey, among others, report in the additional questionnaire about concrete new hires from the recent past but are currently not necessarily searching new staff. The calculation for new hires and search abortions also does not consider whether this new hire/search abortion had been reported to the BA as job vacancy.

On the other hand, the LIFO principle can, over time, due to later increases of the portfolio of jobs during an observable placement order (Stea_ID) in case of filling some of these jobs, lead to slight distortions of the average durations of jobs reported to the BA by an establishment measured until the due date if the placement order has not been finished.

on the X axis. The Y axis shows the average duration of the registered jobs of an establishment in BA statistics. It can be seen that temporary employment providers with a higher portfolio of registered jobs have longer average durations by tendency for this portfolio of jobs at the BA.

Figure 8.12
Average durations of registered jobs of an establishment in BA statistics, differentiated by the difference between the number of reported job vacancies in the IAB Job Vacancy Survey and the number of reported jobs in BA statistics

- Establishments with registered jobs at the BA, start of registration until desired start of employment in days -



Note: * Establishments with durations > 365 days are not included

Source: BA statistics, IAB Job Vacancy Survey: Special survey of temporary employment providers of waves 2013 and 2014

A direct comparison of both statistics regarding the duration of reported jobs is only possible in restricted terms, because they are based on different concepts. However, the sample comparison shows that the previously planned duration of a registered job is longer in BA statistics than the duration of recruiting processes in the IAB Job Vacancy Survey. The establishments examined here report an average search duration of new hires and search abortions in the IAB Job Vacancy Survey of 46 days from the start of the search until the desired start of employment. The average duration from the start of the search until the decision (when the jobs should theoretically be deregistered with the BA) is 58 days. In BA statistics, these establishments have an average duration of 109 days at the due date from the start of the registration until the desired start of employment.

9 Summary and conclusions

The new extrapolation procedure for the IAB Job Vacancy Survey provides statistically reliable results with an improved quality as compared to the previously used procedure for aggregate number of vacancies.

When compared with the previous procedure, there is a downwards revision of job vacancies. Additionally, it becomes apparent that the number of job vacancies registered at the BA is lower according to the survey than according to the BA register statistic.

The difference is essentially based on differences in methodology between both statistics and strategic behaviour of temporary employment providers. They sometimes report job offers to the BA although these do not actually refer to job vacancies to be currently filled or only deregister job vacancies with a delay (cf. Table 9.1). This behaviour can be attributed to the special business model of the temporary employment sector.

Table 9.1
Overview: Differences between the IAB Job Vacancy Survey and the BA's register-based statistics

	BA's register-based statistics	IAB Job Vacancy Survey
Definition "registered job" and/or "registered job vacancy"	Regsitration of a search for new employees with placement order with the BA.	Current search for employees, job vacancy reported for placement with the BA.
Survey form	Total survey/register-based statistics - Regsitraion by establishment	Sample - Interview of establishment
Possible reasons for deviations	- Delayed deregistration/registration ⇨ Chapter 8.1.4 - Formation of applicant pools (temp. emp.) or similar ⇨ Chapter 8.1.3 - Due-date-related processing of registered jobs. ⇨ Chapter 8.2	- Sample error ⇨ Appendix 2 - Non-Response ⇨ Chapter 3 - Surveying dates are spread out across the quarter. ⇨ Chapter 4.3

Source: own illustration

The IAB accounts for the new insights presented in this research report with its job vacancy survey. For example, since wave IV.2015 the sample for the temporary employment sector has been increased significantly to further increase the quality of the estimation results for this special economic sector. Results regarding aggregate number of vacancies and job vacancies reported to the BA are identified separately for the economic sector N without temporary employment and the temporary employment sector to account for the special influence of temporary work agencies.

The IAB publishes a rate (also for the revised time series) where the number of registered vacancies according to the survey is put in relation to the total number of vacancies according to the survey. The previous calculation of a rate as share of

registered vacancies from BA statistics in aggregate number of vacancies from the IAB survey is no longer applicable for reasons of methodology.

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Appendix 1
Economic sectors and size classes in the IAB Job Vacancy Survey

Table A1.2
Economic sectors and size classes in the IAB Job Vacancy Survey

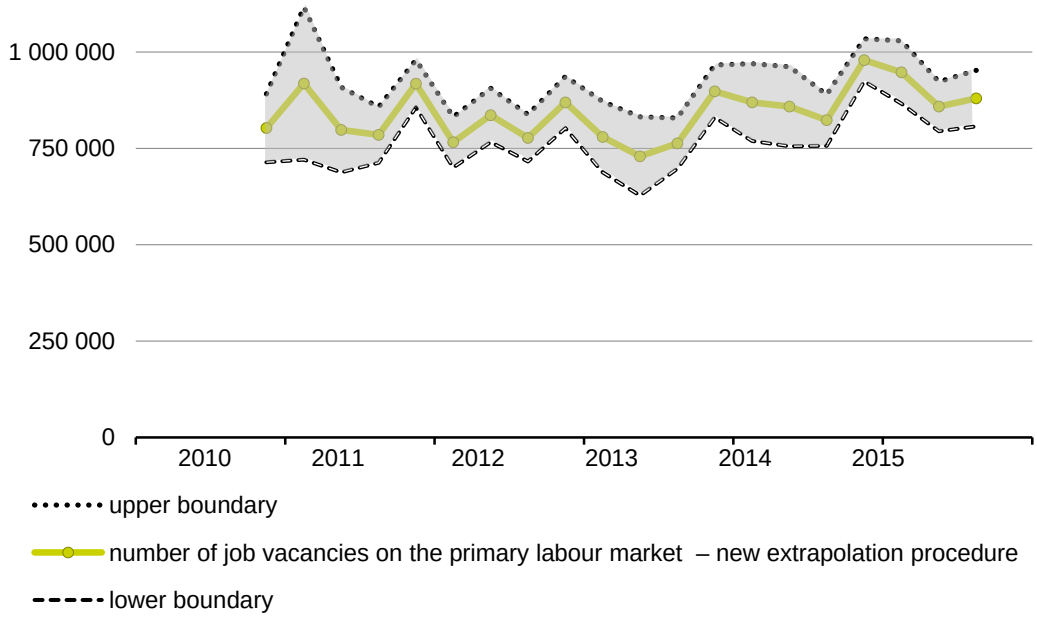
WZ	Designation	Section of WZ08	*WZ*	Designation	Section of WZ08
1	Agriculture and forestry	A	*13*	Accommodation and food service	I
2	Mining and quarrying	B	*14*	Information and communication	J
3	Food and beverages, textiles, clothing, furniture, etc.	C1= 10-15, 31-32	*15*	Financial services and insurances	K
4	Wood, paper, printing	C2= 16-18	*16*	Real estate activities	L
5	Chemicals, plastics, glass, construction materials	C3= 19-23	*17*	Freelance scientific and technical services	K
6	Metals, metal production	C4= 24-25	*18*	Other economic services (without temp. emp.)	N1= N without N2
7	Machinery, electrical engineering, vehicles	C5= 26-30, 33	*19*	Temporary employment (temp. emp.)	N2= 782, 783
8	Energy supply	D	*20*	Public administration	E
9	Water supply and waste disposal	E	*21*	Education	P
10	Construction	F	*22*	Health and social sector	Q
11	Trade, repair	G	*23*	Arts, entertainment and recreation	R
12	Traffic and storage	H	*24*	Other services	S
Size class		Employees subject to social insurance contributions	*Size class*		Employees subject to social insurance contributions
1	Micro-entities	1 to 9	*4*	Medium-sized enterprises	50 to 249
2	Very small enterprises	10 to 19	*5*	Large enterprises	250 to 499
3	Small enterprises	20 to 49	*6*	Very large enterprises	500 and more

Source: IAB Job Vacancy Survey

Appendix 2
Error estimation

A major advantage of the new extrapolation procedure is the direct derivation of the error estimation from the GREG estimator. This allows for an immediate analysis of the (theoretical) errors of the extrapolation result. As depicted in Figure A2.1, the development of the job vacancies can be shown with a confidence interval around the estimated values. It can be clearly seen that the confidence intervals are dependent on the sample. In the written surveys of the fourth quarters, the confidence intervals are smaller than in the telephone surveys, which have a smaller sample size.

Figure A2.1
Number of job vacancies with 95 % confidence interval; new extrapolation procedure, Germany, IV.2014 to III.2015

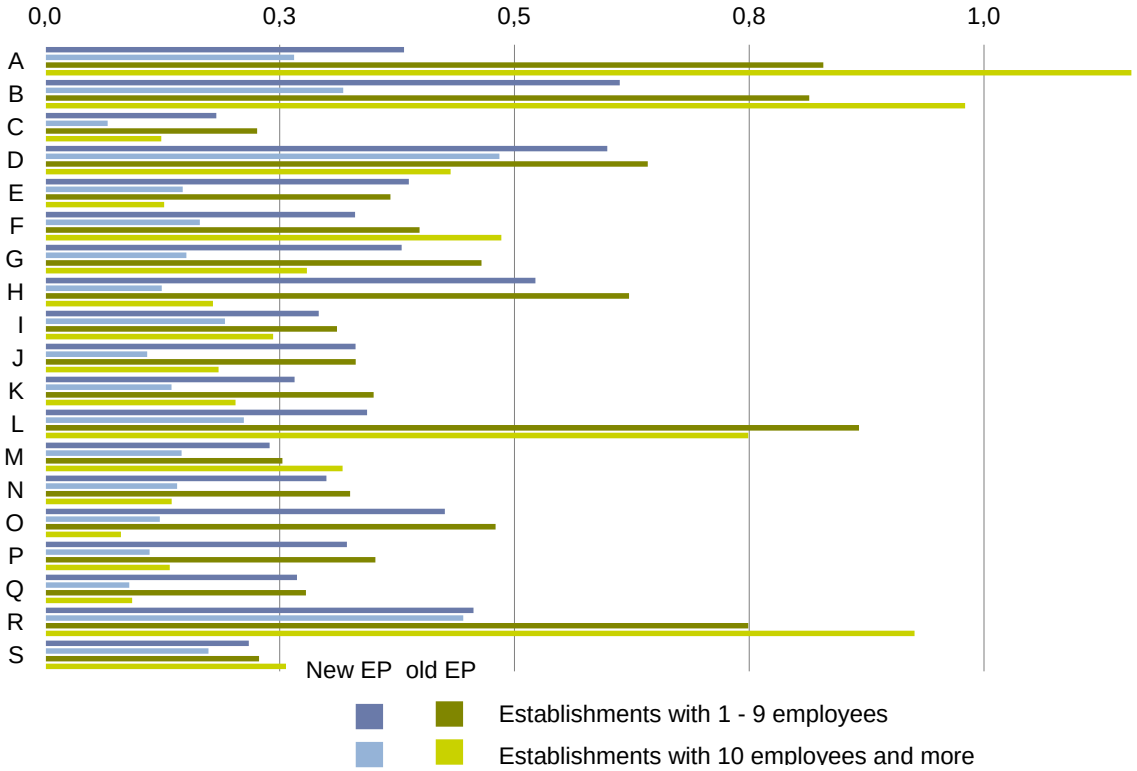


Source: IAB Job Vacancy Survey, Economix

Overall, the new extrapolation procedure improved the variances to be expected thus confirming its higher efficiency. There are lower standardised error values than in the old extrapolation. This does not mean that they show lower values at all times and in all sectors, but that the values are, however, clearly improved compared to the old extrapolation.

In Figure A2.2, the estimated coefficient of variation (CV) is calculated by way of example for the fourth quarter of 2013. The improved values in the new extrapolation method can be clearly recognized in almost all economic sectors. The application of the new procedure leads to an increase in the quality of the survey and the survey results.

Figure A2.2
Coefficient of variation (CV); old and new extrapolation procedure IV.2013



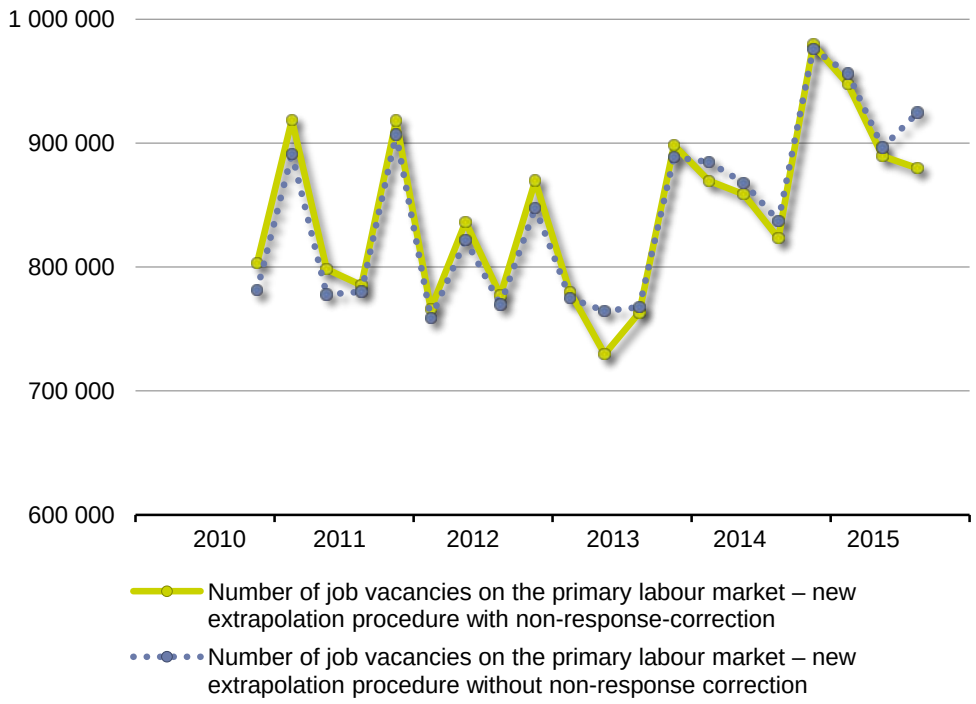
Source: IAB Job Vacancy Survey, Economix

Appendix 3
Impact of the non-response on the estimation of job vacancies

One of the new elements in the extrapolation procedure is the non-response correction. It usually improves the extrapolation, in particular if the non-response can be estimated well. Conversely, an insufficient estimation of the non-response probability can also lead to a deterioration of the extrapolation.

The extrapolations with or without adjustment to the non-response (Figure A3.1) show only marginal differences in their results. This results, in part, from the relatively little impact of the non-response weights: For the present data, they account for just a small part of the variation between responding and non-responding establishments. All variables used here are usually significant in the tested models, i. e. they affect the respective response behaviour (see Röttger et al. 2013). The method allows continuous development of the non-response correction. The advantage is that this method can be optimized in the long run.

Figure A3.1
Number of job vacancies; comparison new extrapolation procedure with and without non-response correction, Germany, IV.2014 to III.2015



Source: IAB Job Vacancy Survey, Economix

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