Original Article

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Calculating Gross Hourly Wages – the (Structure of) Earnings Survey and the German Socio-Economic Panel in Comparison

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Abstract: The statutory minimum wage in Germany was set as an hourly wage. Thus, valid information on gross hourly wages must be calculated from monthly wages and weekly working hours. This paper compares the German Socio-Economic Panel (GSOEP) and the (Structure of) Earnings Survey (SES/ES). The sampling and collection of data on employees in the household survey GSOEP, and on jobs in the administrative surveys SES/ES exhibit fundamental conceptual differences. Accordingly, there is variation in the definition of types of employment and in the distribution of the observed units regarding central characteristics. Monthly wages, weekly working hours and gross hourly wages differ especially in the lower range of the respective distribution. Against this backdrop specific implications can be derived for minimum wage research.

JEL Classification: J08, J30, J31, J33

1 Introduction

In the context of empirical labor market research, the analyses of wage distributions and the development of wage inequality are of great importance. Thus

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research is dependent on reliable data in order to reach credible results. Analyses based on monthly wages can be conducted with a comparatively large number of data sets. For hourly wages, however, only a small number of applicable data sets are available and they differ in the way and detail of recorded earnings and working hours. Consequently, the operationalization and analysis options vary depending on the employed data sets and therefore impact the validity of the results and can lead to diverging findings (Fitzenberger 2012). The Structure of Earnings Survey (SES) and the Earnings Survey (ES) on the one side and the German Socio-Economic Panel (GSOEP) on the other – are the most relevant data sources regarding hourly wages in Germany.

Since a statutory minimum wage was introduced in Germany in January 2015, being able to define earnings and working hours as well as calculating gross hourly wages based on different data sets has become more important. Since the statutory wage in Germany refers to a gross hourly wage, quantitative empirical research projects on the impact of the statutory minimum wage depend on reliable information regarding gross hourly wages.[1] Given the situation that the large German surveys do not directly ask for hourly wages, this information must be calculated retrospectively from monthly earnings and weekly working hours. A direct survey of gross hourly wages would not produce highly reliable information given that only approximately 4.3 million of the 20.3 million German employees covered by collective agreements hold contracts which stipulate gross hourly wages (Bispinck 2016). Hence, collective bargaining agreements for the most part set monthly wages and less often gross hourly wages. When it comes to minimum wages, the situation is quite the opposite. According to the 2015 earnings survey, approximately 1.4 million employees earned less than € 8.50 per hour and only 20 % of those employment relationships were subject to collective agreements (Mindestlohnkommission 2016). As a result, it can be expected that employees in lower income brackets to a greater extent know the hourly rates they make, whereas those in higher income brackets and those covered by collective agreements should more often know their monthly earnings. Additionally, information concerning earnings and working hours differ depending on the specific data sets. Research conducted in Great Britain (Williams 2004; Fry/Ritchie 2012; Ritchie et al. 2014, 2016, 2018; le Roux et al. 2013) has shown how important it is to know about the strengths and weaknesses of the various data sets when

1 In January 2016, 22 out of 28 EU member states had statutory minimum wages. There are no minimum wages in Denmark, Austria, Italy, Finland, Sweden, and Cyprus. Minimum wages based on hours were introduced in Germany, France, Great Britain, and Ireland. In Malta, minimum wages are defined as weekly wages and in the other 17 EU countries, the national minimum wages are defined as monthly wages (Eurostat 2016a, b).

researching income and working hours with respect to minimum wages. For Germany, comparable studies are currently not available. The only study available used the GSOEP for the year 2012 and the SES 2010. Using similar delimitations of the populations surveyed and a projection of wages for the year 2013, the study shows similar wage distributions and percentages of employees below the minimum wage limit of € 8.50 in both data sets (Falck et al. 2013).[2]

Since the survey wave 2014, the SES/ES surveys have changed substantially – among others they now include small establishments and the agriculture sector. These supplements are of major importance to capture the low-wage sector. Given that substantial differences in the survey designs of the GSOEP and the SES/ES remain, the previous results of Falck et al. (2013) regarding similar hourly wage distributions are rather surprising. Against this backdrop, we show in more detail similarities and differences between the designs of the GSOEP and the SES/ES and analyze differences in the wage distributions before and after the minimum wage introduction.

Chapter two contrasts the survey designs of the two data sources and discusses possible effects on measuring earnings, working hours and gross hourly wages. The most comparable way of calculating gross hourly wages in the two data sets is presented. Chapter three provides detailed descriptive comparisons of the sizes of samples and covered populations and the respective distributions of earnings, working hours and gross hourly wages. Based on these comparisons, we derive implications for minimum wage research and assess the strengths and weaknesses of the two data sets in chapter four.

2 Survey designs and calculation of hourly wages

2.1 Data set descriptions and survey designs

Most studies that consider hourly wages[3] to analyze the development of wages and wage inequalities in Germany employ data provided from either the German Federal Statistical Office (Statistisches Bundesamt) known as the "Structure of

2 Older data set comparisons between the GSOEP, the structure of salary and wages survey which is the predecessor of the Structure of Earnings Survey and the European Household Panel can be found in Jacobebbinghaus (2002).

3 Strictly speaking, there have been neither 'wages' nor 'salaries' but merely 'remunerations' since 2005. The MiLoG [Minimum Wage Act], however, refers to hourly wages. For the sake of simplicity, we use the terms of 'wages', 'salary' and 'remuneration' synonymously.

Earnings Survey" or, by the German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung) known as the "German Socio-Economic Panel".[4] Different to data collected through the employment statistics of the Institute for Employment Research (Institut für Arbeit und Beschäftigungsforschung) they contain information on weekly working hours.[5] Since the survey designs of these data sets differ considerably, we will first contrast them.

The Structure of Earnings Survey is an official, mandatory survey conducted in companies (Günther 2013; Statistisches Bundesamt 2013). The collected data mainly refer to employment relationships in the surveyed companies (linked-employer-employee data), which can be differentiated into full-time, part-time and marginal employment. Marginal employment refers to jobs with maximum earnings of 450 euros gross per month, which are exempt from social security contributions for employees. Data collected on the employment relationships by the SES primarily stem from the respective companies' payroll accounting. For most of the civil service employees, the data is taken from the staff statistics, which also includes data from payroll accounting. Hence, wage information gathered there is comparatively accurate and corresponds with the wages paid through company's internal accountancies. SES data collected on working hours, however, is less accurate since the documentation on working hours outside manufacturing is often incomplete (Statistisches Bundesamt 2016b). For the special case of companies which only have marginal employees information on marginal employment is entirely generated by means of nearest-neighbor-imputation using information on marginal employment from companies that additionally employ workers subject to social security contributions. The SES is conducted every four years as a cross-sectional survey. The last regular SES was conducted in April 2014 for those employees who were employed during the entire month (ibid.).

In 2014, the SES survey was broadened to also include very small businesses with less than 10 employees and to cover companies in the economic sectors of agriculture and forestry as well as fisheries. Including nearly all sectors, except for employments in private households, exterritorial organizations and corporate bodies, fulfils the prerequisites to evaluate the statutory

4 For analyses with gross hourly wages using the GSOEP's database, see e. g. Brenke and Müller (2013) or Amlinger et al. (2016) with further references.

5 The German Federal Statistical Office's employment statistics merely contains information on full-time or part-time employment. The problem of the lack of information on working hours in the German Federal Statistical Office's data also occurred during the first evaluations of minimum wages for specific industries. Here, König and Möller (2008) tries to determine an approximate value by means of probabilistic models.

minimum wage. In order to achieve an evaluation of the introduction of the statutory minimum wage, a voluntary follow-up survey (ES) was conducted in 2015 in those companies surveyed in the 2014 SES.

SES and ES samplings are conducted in two steps. In the first step, companies are drawn as a stratified sample from the German Federal Statistical Office's business register (URS), taking into consideration sectors, regions, and company sizes. In the second step, a simple random sample of jobs is drawn, whereby the selection probability in smaller companies is smaller than in larger ones. For the SES 2014, 1 million employment relationships (jobs) in approximately 60,000 companies were made out. The ES 2015 rests on data collected in more than 6,000 companies and also offers detailed information on employment relationships. Due to the above-mentioned expansion of the basic population, for the first time the extrapolated (weighted) number of employment in the SES 2014 was comparable to the German Federal Employment Agency's coverage of the entire population (census). On the establishment level, the projection was carried out by means of an extrapolation method using auxiliary information available at the projection stage (grossing). On the individual worker level, the projection was carried out by means of simple extrapolation using information from the sample only. The extrapolation factor is the reciprocal of the selection probability and final projection factors result from the product of the two steps (Statistisches Bundesamt 2016b). In regard to the employment relationships and jobs, it needs to be specified that both the SES and the ES are case and not personal or individual surveys and that neither information on the number of employees nor whether a job is held as main or additional occupation is available.

The German Socio-Economic Panel (GSOEP) is a household survey of a representative sample of Germany's residential population and has been conducted annually since 1984. Information on about 28,000 people in about 16,000 households is collected (Wagner et al. 2008). Employees living in private households are included in the sample. Similar to the SES/ES, the GSOEP allows retrieving information about employment, earnings and working time. By means of an individual questionnaire, the survey asks detailed questions about the employees' principal occupation. GSOEP-wave v32 (2015) consists of eight main samples including FiD[6] and the migration sample[7] (A to H). The GSOEP findings given below are based on the main sample and all 26 partial refreshment samples. They are generally drawn using a two-step sampling method. First the primary units from the electoral districts (samples A, D (partly), E, F), counties and/or autonomous cities (sample

6 Subsample for the evaluation of marriage- and family-related allowances in Germany.

7 The migration sample takes account of changes in the structure of migration since 1995.

B), communes and/or rural districts (sample C) and municipal districts (sample H) are selected. Then the secondary units are determined in the form of households (samples A, C, D, E, F, G, H) and/or of persons from the register of foreign nationals. Samples are drawn systematically and proportional to size through the arrangement of the primary units by regional criteria and through weighting by size (number of households of the primary units), and as regards the secondary units by means of a random-route method with a random start address and fixed intervals. The data are projected to the statistical population cross-sectionally and in three steps. First the projection factor results as the reciprocal of the sampling probability from the selection process multiplied by the probability-of-survival factor. This factor is then trimmed to a size amounting to ten times the amount of the sample-specific median. Finally, a marginal adjustment to the microcensus is made according to household size, nationality, sex, and age of the breadwinner of the household to correct a possible under-representation (Wagner et al. 2008).

There are further differences between the two data sources as regards the definition and/or the collection of data on full-time and part-time jobs and marginal employment. Individuals classed in the category of marginal (part-time) employment are not in any case a subject to the statutory unemployment and health insurance and pension schemes. It is for those working only a few hours per week or month with max. 450.00 EUR/month and for short-time workers. Marginal employment can be a primary and a secondary type of employment (Table 1). While the distinction between full-time and part-time jobs in the GSOEP is based on the threshold value of 30 working hours per week, in the SES and ES it is defined by the regular weekly working hours in a company. Both SES and ES collect data on people in marginal employment in both principal and secondary occupation; employment gaps at the time the survey is conducted lead to an under-representation of this type of employment. In the GSOEP, extensive information on people in marginal employment is collected only as regards their principal occupation; people, whose marginal occupation is a secondary occupation, are only surveyed for fewer features. Employment gaps may result in the under-representation of this employment type in the GSOEP as well. No information is available about the extent of the under-representation of temporary marginal employment in either of the surveys.

When looking at response quality and information provided on earnings and working hours in the SES/ES and the GSOEP, we need to consider in general that these represent different perspectives. In the earnings structure surveys, employers are polled or the information is obtained directly from a company's payroll; in case of smaller companies, it is obtained from their tax advisers or providers

Table 1: Comparison of GSOEP and SES/ES surveyed populations.

Features	GSOEP 2014, 2015	SES 2014 (ES 2015)
Survey design	Household survey of a representative sample from the residential population Longitudinal Place-of-residence concept	Official survey in companies with at least one employee liable to contribute to social security Information taken from payroll accounting Cross-sectional Place-of-work concept
Core population	Principal occupation Little information on secondary occupation Ca. 13,000 employees Private households included	Employments (full- and part-time positions) 60,000 (6,000) companies with 1.0 million (70,000) jobs Without private households or exterritorial organizations and corporate bodies
Full-time employment	Needs to be defined >= 30 h (contractual weekly working hours)	Jobs with normally regular weekly working hours in the company, not including marginal employment relationships
Part-time employment	Needs to be defined < 30 h (contractual weekly working hours)	Jobs with normally fewer than the regular weekly working hours in the company, not including marginal employment relationships
Marginal employment	Respondents' self-assessment, verifiable through payroll information	Jobs as defined in Sect. 8 Subsect. 1 No. 1 of the German Code of Social Law IV Companies without employees subject to social insurance contributions are not covered by the Federal Statistical Office. Information about marginal employment in these companies is generated by means of nearest-neighbor-imputation procedures using observations on marginal employment from the regular VSE survey.

Source: Own chart, based on the GSOEP-DTC and SES/ES methods report.

of external payroll accounting services. Thus, data on wages is very valid, while information on hours or individual characteristics (e. g. qualification) is less accurate. Response quality in the mandatory SES is very high with a response rate of 97.7 %. However, information on marginal employment in companies without employees subject to social insurance contributions is entirely generated (Statistisches Bundesamt 2016b). In the voluntary ES response rates considerably declined to 12.8 % and it suffers from selective response rates depending on the impact of the minimum wage on a company (Statistisches Bundesamt 2017). Regarding information pertinent to working hours, it is assumed "(...) that due to the Minimum Wage Act [Mindestlohngesetzgebung], the now stricter obligations to keep records could result in more accurate reporting" (Zimmer 2015) (translated by the authors). The GSOEP surveys employees information on wages and working hours as well as on other variables is based on voluntary response. Although respondents are asked to use the pay statement to answer the question about remuneration, rounding errors, recall bias and social desirability bias can undermine the validity of the data. Certainly, this panel study is rich of information on individual and household characteristics as well as subjective items (e. g. self-reported job satisfaction or health). In the GSOEP the cross-sectional total rate amount to 89.5 % (Gerstorf/Schupp 2016). Panel attrition amounts to about 6 % to 11 % each year (Kroh et al. 2015).

In the empirical study (Section 3) on similarities and differences regarding the analysis of hourly wages, the data sets used were narrowed down in a similar manner where possible. Against the background of the evaluation of the impact of the statutory minimum wage, the respective population was narrowed down to such persons to whom the minimum wage pursuant to Section 22 of the MiLoG [*German Minimum Wage Act*] applies. The scope of the Minimum Wage Act covers employees working in Germany with the exception of five groups of persons: (1) young persons under the age of 18, who have not completed vocational training, (2) trainees in vocational training, (3) interns doing an internship of no more than three months, (4) long-term unemployed people in the first six months following the beginning of their employment and (5) voluntary workers. In addition, employees in certain industries were to be excluded, to which the transitional provisions pursuant to Section 24 of the MiLoG apply until January 31, 2017 and which can pay wages below the minimum wage (Mindestlohnkommission 2016). Self-employed persons, work order contractors and so-called crowd workers are not entitled to payment of the minimum wage in general and thus were excluded from the population surveyed. Additionally, the minimum wage does not apply to all wage and salary earners but merely to employees. Consequently, people working in job-

creating programs or in sheltered workshops, employees in block-model partial retirement in the voluntary unemployment stage or work in penal institutions were excluded from the data sets to the extent possible.

2.2 Types of gross hourly wage calculation

Both surveys allow the calculation of gross hourly wages based on the gross monthly wages and weekly working hours surveyed. However, the specific items to collect information on earnings and working hours and the concepts used for the calculation of hourly wages differ between SES/ES and GSOEP. Both surveys include questions about contracted and actual working hours and consider the kind of overtime compensation, such as paid overtime. The following passages present the methods of hourly wage calculation which have been applied so far in minimum wage research in Germany. For our analysis we choose the calculation of gross hourly wages that is most consistent across the SES/ES and the GSOEP.

In the SES/ES, information provided on earnings refers to the month of April of the respective year. Total gross earnings without annual bonuses are the main variable. The SES/ES allows to separately identify total overtime pay (including overtime premiums) and the sum of other premium payments (for shift work, night work, and work on Saturdays, Sundays as well as public holidays). In minimum wage related studies, these two items often are subtracted from total gross earnings in order to adjust premiums, which might legally be irrelevant to the payment of the minimum wage (as applied in Falck et al. 2013; IAW 2011a, b, c; Mindestlohnkommission 2016).[8] This is however only a broad approximation of the legal minimum wage definition, which generally refers to each performed working hour. Jurisdiction has by now clarified that premiums can contribute to the legal fulfillment of the minimum wage.[9] Other wage components that should be eliminated from the hourly wage calculation are not covered in the SES/ES (e. g. contributions to capital formation) (Statistisches Bundesamt 2017). In this study we compare hourly wages in the SES/ES and the GSOEP and therefore place importance on similar measures of earnings and hours across the surveys. Hence, (unadjusted) total gross wages are used in both data sets, since premiums cannot be identified in the GSOEP.

8 Correspondingly, overtime is then not included in working time that is used to calculate hourly wages.

9 The German Federal Labor Court ruled on February 25, 2016 (5 AZR 135/16) that special payments fulfill an employee's entitlement to payment of the statutory minimum wage, unless they are unrelated to an employees' work performance.

The survey of working hours in the SES/ES refers to different working hour concepts in April of the respective year. Three working hour components are surveyed: Firstly, respondents are asked about regular weekly working hours which refer to the working hours agreed under the employment contract if applicable.[10] Secondly, the monthly paid working hours (without overtime) and thirdly, the monthly hours of paid overtime are surveyed. If companies did not provide information on the monthly hours paid, monthly hours paid are approximated by the contractually agreed weekly working hours multiplied by 4.345 (Statistisches Bundesamt 2016a). This is the case for about 40 % of the observations in the ES 2015. In both data sets and particularly in the GSOEP, information on contracted hours is regarded more reliable than the other available measures of "actual working time" or paid and unpaid overtime. Therefore, and because we aim at consistency across the two data sets, we use contracted weekly working hours multiplied with 4.33 in this study (see Formula 1). The inclusion of overtime payments in the numerator, while confining hours of work to contracted working hours in principle, leads to an overestimation of hourly wages.

$$\text{Hourly wages SES/ES} = \frac{\text{Monthly gross wages (including overtime pay; without annual bonuses)}}{\text{Contracted weekly working hours* 4.33}} \quad (1)$$

In the GSOEP, gross and net monthly wages earned for the principal occupation including overtime remuneration (hourly remuneration including overtime premiums) and without annual bonuses are surveyed. The GSOEP collects data on weekly working hours by means of two questions, which can be checked by additional questions. The contractually agreed working hours are established by asking the respondent: "How many hours per week without overtime do you have to work under your employment contract?" The question "And what are your average actual working hours per week including possible overtime?" aims at the amount of an employee's actual hours worked per week. These questions are followed by other questions regarding overtime, the number of overtime hours and their compensation in the form of time off or payment (Holst/Bringmann 2016; TNS Infratest Sozialforschung 2014, 2015). Thus, hourly wages can be

10 "If no specific provisions regarding the working hours of full-time employees have been agreed upon, the regular weekly working hours in a company or the collectively agreed working hours can be entered instead" (Statistisches Bundesamt 2016a) in explanation 13 to the employee questionnaire.

computed using these different wage and working time information.[11] In accordance with the procedure in SES/ES, the calculation of weekly working hours in the GSOEP in Formula 2 is also based on contractually agreed working time.

$$\text{Hourly wages GSOEP} = \frac{\text{Monthly gross wages (including overtime pay; without annual bonuses)}}{\text{Contracted weekly working hours*} 4.33} \quad (2)$$

The calculation methods selected demonstrate that the determination of hourly wages for a specific point of time and/or a specific time interval is not trivial. Surveys typically collect month-related information on earnings, which usually refer to the previous month, whereas working hours are based on a week and surveyed as such. A general problem results from this fact, i. e. that these two reference periods have to be aligned in wage analyses. This is particularly true when evaluations are carried out at the hourly-wage level and when specific wage and working time components – such as overtime and overtime premiums, shift and nightwork, shift and nightwork premiums, bonus payments etc. – have to be taken into account or excluded.

Special earnings patterns in specific income brackets or industries are also problematic, such as basic wages plus performance bonuses where the payment of the performance bonuses promised may be made in a different time interval. A time rate wage is also possible; it is based on standardized performance targets and not necessarily on the actual time needed to do the job (e. g., cleaners). In addition, the number of employees with trust-based working hours and thus no contractually fixed working hours is increasing – which is not only true for employees exempt from collective agreements. Flexible working hours whose time frames exceed one week, such as lifetime accounts of working, make the allocation of hours worked to one specific week difficult. What is also problematic is the recording of working hours in case of short-term employment, such as seasonal work in particular, and in case of homeworkers (Low Pay Commission 1998).

11 For example, the method of Brenke and Müller (2013) combines different aspects. According to this method, the actual working hours are used if unpaid extra work is done. The contractually agreed working time, which is usually less than the actual working time, is used if no extra work becomes necessary or if extra work is compensated by payment or time off. If the 'shorter' contractual working time was used in all cases, this would result in higher hourly wages. If the 'longer' actual working time was used in all cases, this would result in lower hourly wages. Consequently, the Brenke and Müller (2013) method can be considered to be a moderate variety, which provides values between these poles as a result.

3 Empirical findings

Based on the surveyed population narrowed down to the scope of application of the statutory minimum wage (see Section 2.1), the weighted number of employment relationships in Germany amounts to about 35 million in the SES 2014 and to about 36 million in the ES 2015 (not displayed in Tables). The GSOEP shows about 33 million and 34 million employees for both 2014 and 2015 (not displayed in Tables). The smaller sample sizes in the GSOEP can mainly be attributed to the fact that the information provided usually refers to persons and their principal occupations and that other professional activities are not considered. On an aggregate level, the scales are thus comparable with the employment statistics on the entire population by the Federal Employment Agency which is considered as benchmark regarding employment.[12]

Table 2, however, displays the sample after removing observations with missings on the variables monthly wage, contractual working hours, sex, region, type of employment, qualification, age and company size. It becomes obvious, that the number of employment relationships decreases to about 33 million in the SES 2014 and to about 30 million in the ES 2015. This is a strong indication for different response behavior of employers in the mandatory SES-survey and the voluntary follow-up ES-survey because missings significantly increased between 2014 and 2015. The GSOEP provides data for approximately 30 million employees for both 2014 and 2015.

The differentiation of the respective population by further features demonstrates differences in the proportions of the unweighted and weighted sample sizes between the data sets. Weighting in the GSOEP leads to a considerable adjustment of sex and type of employment. In the SES/ES population weights notably correct for sex, region, type of employment and company size. In the following we predominantly compare unweighted numbers so as not to obscure differences in the sources and to avoid an artificial comparability.

While according to the unweighted GSOEP, about 70 % of employees lived in West Germany and 49 % were male workers in 2014, in the unweighted SES about 76 % of employments were executed in West Germany and about 52 % by

12 SES/ES is primarily a survey on earnings in Germany; GSOEP is a household panel survey. Against this backdrop employment statistics of the German Federal Employment Agency provide a benchmark to compare respective marginal distributions. The statistics of the German Federal Employment Agency (Bundesagentur für Arbeit) establishes about 36 million employees for April 2014 and about 37 million employees for April 2015. This calculation comprises employees liable to contribute to social security and people in marginal employment (principal and secondary occupation), with the exception of trainees (Bundesagentur für Arbeit 2015, 2016).

Table 2: Distribution of employment in the GSOEP and in the SES/ES in 2014 and 2015*.

	GSOEP 2014				GSOEP 2015				SES 2014				ES 2015			
	Sample size in k	Percentage of sample	Population size in k	Percentage of population	Sample size in k	Percentage of sample	Population size in k	Percentage of population	Sample size in k	Percentage of sample	Population size in k	Percentage of population	Sample size in k	Percentage of sample	Population size in k	Percentage of population
Total	12,91	100	30,036.10	100	12,48	100	29,841.73	100	930,56	100	33,462.58	100	62,38	100	30,420.36	100
Men	6,26	48.52	15,722.94	52.35	6,10	48.86	15,602.39	52.28	481,47	51.74	17,266.88	51.60	35,49	56.89	16,170.23	53.16
Women	6,65	51.48	14,313.17	47.65	6,38	51.14	14,239.34	47.72	449,10	48.26	16,195.69	48.40	26,89	43.11	14,250.13	46.84
West Germany	8,98	69.59	21,215.61	70.63	8,76	70.22	21,182.54	70.98	707,66	76.05	27,478.37	82.12	46,49	74.53	25,061.61	82.38
East Germany	3,93	30.41	8,820.49	29.37	3,72	29.78	8,659.19	29.02	222,90	23.95	5,984.20	17.88	15,89	25.47	5,358.75	17.62
Full-time	8,88	68.81	21,591.41	71.88	8,67	69.49	21,712.52	72.76	613,84	65.96	21,024.12	62.83	43,25	69.33	19,534.87	64.22
Part-time	2,84	22.03	5,896.78	19.63	2,75	22.00	5,824.39	19.52	224,41	24.12	8,312.35	24.84	12,73	20.41	7,229.73	23.77
In marginal employment	1,15	8.92	2,466.26	8.21	1,02	8.20	2,164.20	7.25	92,31	9.92	4,126.11	12.33	6,40	10.25	3,655.77	12.02
Unknown Qualification	0,31	2.43	936.68	3.12	0,29	2.32	909.76	3.05	5,72	0.61	255.69	0.76	0,56	0.89	283.59	0.93
No completed vocational training	0,93	7.25	1,995.18	6.66	0,93	7.48	1,926.02	6.48	117,13	12.59	4,158.23	12.43	7,26	11.64	3,877.63	12.75
Vocational training	8,25	64.05	19,542.63	65.24	7,84	62.98	19,232.67	64.75	554,31	59.57	21,647.13	64.69	42,97	68.88	20,960.64	68.90
Polytechnic or university degree	3,38	26.26	7,479.95	24.97	3,39	27.22	7,632.66	25.70	253,41	27.23	7,401.53	22.12	11,59	18.58	5,298.50	17.42
Age: 18–25 years	0,85	6.58	2,436.70	8.11	0,84	6.73	2,294.20	7.69	65,29	7.02	2,461.12	7.35	4,14	6.64	2,055.43	6.76
Age: 26–65 years	11,91	92.29	27,152.29	90.40	11,50	92.15	27,086.62	90.77	851,12	91.46	30,383.04	90.80	56,90	91.22	27,617.96	90.79
Age: 66 years and older	0,15	1.13	447.11	1.49	0,14	1.12	460.92	1.54	14,15	1.52	618.42	1.85	1,33	2.14	746.96	2.46

(*continued*)

Table 2: (*continued*)

	GSOEP 2014				GSOEP 2015				SES 2014				ES 2015			
	Sample size in k	Percentage of sample	Population size in k	Percentage of population	Sample size in k	Percentage of sample	Population size in k	Percentage of population	Sample size in k	Percentage of sample	Population size in k	Percentage of population	Sample size in k	Percentage of sample	Population size in k	Percentage of population
Company size: Less than 10 employees	1,94	15.03	4,255.42	14.17	1,91	15.30	4,131.96	13.85	77,28	8.31	5,473.02	16.36	9,43	15.12	5,898.00	19.39
Company size: 11–100 employees	3,51	27.19	7,769.21	25.87	3,33	26.71	7,764.18	26.02	306,72	32.96	11,579.39	34.60	25,97	41.64	11,500.78	37.81
Company size: more than 100 employees	7,46	57.78	18,011.47	59.97	7,24	57.99	17,945.60	60.14	546,56	58.73	16,410.17	49.04	26,98	43.25	13,021.58	42.81

*GSOEP: Employees in principal occupation; SES/ES: employment relationships (principal and secondary occupations).
Source: SES2014, ES2015, GSOEP v32, own calculations.

males. Differences regarding region and sex significantly increase between both surveys (GSOEP and ES) in 2015. According to the GSOEP, about 69 % of employees worked full-time, around 22 % part-time, and about 9 % exercised marginal employment as their principal occupation. On the other hand, it can be inferred from the SES that about 66 % of employments were full-time jobs, about 24 % were part-time jobs, and about 9 % were marginal employments. The quite small differences between GSOEP and SES/ES in unweighted data as regards the respective types of employment considerably increase after weighting. This especially accounts to marginal employment in 2015. Further differences become obvious regarding qualification structure. This particularly applies to the numbers of those who did and did not complete vocational training. In the GSOEP about 7 % and in the SES 13 % of employees did not successfully complete a vocational training. The proportions of those with vocational training differ between 64 % in GSOEP and 60 % in SES. This finding indicates that information on education is less reliable in employer surveys since they are not related to the purpose of the administrative reporting process producing the data (see also Fitzenberger et al. 2006). The shares of company size vary greatly between both data sets because small companies with less than 10 employees were more often observed in the GSOEP (15 %) than in the SES (8 %). That is important for minimum wage research because of higher rates of low payed jobs in small companies (Bruttel et al. 2017). However, there are more middle-sized companies with 11 to 100 employees in the SES (33 %) compared to the GSOEP (27 %). The partially significant differences between the surveys as regards the numbers of employment by region and type of employment may be attributed in particular to the fact that the distinction between full- and part-time employments differs and that secondary occupations are recorded in the SES/ES but not in the GSOEP. Secondary work is mainly performed in marginal employment. In addition to this, marginal employment is under-represented in both surveys, but in the GSOEP in particular.[13] One typical characteristic of marginal employment is the comparatively low wage (Burauel et al. 2017).

In the next step we focus on differences in the distribution of employment compensated with less than 8.50 euros in 2014 in both data sets (Table 3). In the raw sample 11 % of employees in the GSOEP and 10 % of employment in the SES are paid less than 8.50 euros. Weighting adjusts the proportion of employees covered by the new minimum wage in both data sets to around 10 %.

13 According to the statistics of the German Federal Employment Agency, the number of people working exclusively in marginal employment is about five million in April 2014 and April 2015. The number of people in marginal employment as a secondary occupation is about 2.5 million (Bundesagentur für Arbeit 2015, 2016).

Table 3: Distribution of employment compensated with less than 8.50 euros in 2014 in the GSOEP and in the SES*.

In K	GSOEP 2014						SES 2014					
	Number of employees in the sample earning below 8.50	Percentage of employees in the sample earning below 8.50 (column percentage)	Percentage of employees in the sample earning below 8.50 (row percentage)	Weighted number of employees in the population earning below 8.50	Percentage of employees in the population earning below 8.50 (column percentage)	Percentage of employees in the population earning below 8.50 (row percentage)	Number of employment in the sample compensated with less than 8.50	Percentage of employment in the sample compensated with less than 8.50 (column percentage)	Percentage of employment in the sample compensated with less than 8.50 (row percentage)	Weighted number of employment in the population compensated with less than 8.50	Percentage of employment in the population compensated with less than 8.50 (column percentage)	Percentage of employment in the population compensated with less than 8.50 (row percentage)
Total	1,45	100	11.23	3,018.11	100	10.08	89,18	100	9.58	3,316.14	100	9.91
Men	0,39	26.63	6.17	967.07	32.04	6.17	33,47	37.53	6.95	1,250.12	37.70	7.24
Women	1,06	73.37	15.98	2,051.04	67.96	14.35	55,71	62.47	12.40	2,066.57	62.32	12.76
West Germany	0,87	60.44	9.75	1,805.34	59.82	8.53	57,40	64.37	8.11	4,748.26	68.86	8.31
East Germany	0,57	39.56	14.61	1,212.76	40.18	13.79	31,77	35.63	14.25	497.29	31.18	17.28
Full-time	0,67	46.27	7.53	1,469.73	48.70	6.81	21,79	24.43	3.55	727.43	21.94	3.46
Part-time	0,27	18.46	9.39	490.31	16.25	8.31	22,09	24.77	9.84	836.22	25.22	10.06
In marginal employment	0,51	35.27	44.31	1,058.06	35.06	42.90	45,30	50.80	49.07	1,752.77	52.86	42.48
Unknown Qualification	0,06	3.87	17.83	140.08	4.64	14.96	0,15	0.16	2.54	4.55	0.14	1.78
No completed vocational training	0,24	16.74	25.91	462.47	15.32	23.18	25,91	29.05	22.12	934.35	28.18	22.47
Vocational training	1,02	70.26	12.32	2,159.68	71.56	11.05	57,34	64.30	10.34	2,160.38	65.15	9.98
Polytechnic or university degree	0,13	9.13	3.90	255.88	8.48	3.42	5,79	6.49	2.28	216.86	6.54	2.93

(*continued*)

Table 3: (*continued*)

In K	GSOEP 2014						SES 2014					
	Number of employees in the sample earning below 8.50	Percentage of employees in the sample earning below 8.50 (column percentage)	Percentage of employees in the sample earning below 8.50 (row percentage)	Weighted number of employees in the population earning below 8.50	Percentage of employees in the population earning below 8.50 (column percentage)	Percentage of employees in the population earning below 8.50 (row percentage)	Number of employment in the sample compensated with less than 8.50	Percentage of employment in the sample compensated with less than 8.50 (column percentage)	Percentage of employment in the sample compensated with less than 8.50 (row percentage)	Weighted number of employment in the population compensated with less than 8.50	Percentage of employment in the population compensated with less than 8.50 (column percentage)	Percentage of employment in the population compensated with less than 8.50 (row percentage)
Age: 18–25 years	0,23	15.98	27.21	616.27	20.42	25.29	16,17	18.13	24.77	531.60	16.03	21.60
Age: 26–65 years	1,18	81.81	9.94	2,303.21	76.31	8.49	67,65	75.86	7.95	2,576.48	77.70	8.48
Age: 66 years and older	0,03	2.21	25.00	98.63	3.27	24.86	5,35	6.00	37.83	210.39	6.34	34.02
Company size: Less than 10 employees	0,51	35.27	26.38	984.34	32.61	23.20	18,73	21.01	24.24	1,099.53	33.16	20.09
Company size: 11–100 employess	0,48	32.85	13.59	946.74	31.37	12.24	44,75	50.18	14.59	1,459.00	44.00	12.60
Company size: more than 100 employees	0,46	31.88	6.19	1,087.03	36.02	6.05	25,70	28.82	4.70	758.15	22.86	4.62

*GSOEP: Employees in principal occupation/SES: employment relationships (principal and secondary occupations).
Source: SES2014, GSOEP v32, own calculations.

However, incidence in subgroups varies between the GSOEP and the SES. The former shows that 73 % of employees earning less than 8.50 euros are female. This share is considerably lower in SES (63 %). Significant differences exist regarding type of employment. In GSOEP 46 % of employees paid less than 8.50 euros work full-time and 35 % in marginal employment, while in SES only 24 % is full-time and, however, 51 % marginal employment. This is an important fact because according to Table 2 there are only small differences between GSOEP and SES in the distribution of types of employment in unweighted data. A considerably greater share of employees with completed vocational training earning less than 8.50 euros can be found in the GSOEP (70 %) compared to the SES (64 %). In contrast, proportionately more employees with no completed vocational training are observed in the SES than in the GSOEP. Regarding age groups, in the GSOEP 26 to 65 years old employees have a greater share in those earning less than the minimum wage compared to the SES. Additionally, individuals who are compensated with less than 8.50 euros are more frequently observed in companies with 11 to 100 employees in SES (50 %) compared to the GSOEP (33 %).

The finding that there are more women in GSOEP and that they are additionally more likely to be compensated with less than 8.50 euros in 2014 in GSOEP implicates a stronger impact on minimum wage estimates of females when focusing on differences by sex. A differential impact on minimum wage estimates should occur when researching qualification groups. More individuals with no completed vocational training and with a greater likelihood of earning less than 8.50 euros can be found in SES/ES; however, this applies to those with a completed vocational training in GSOEP. Different minimum wage effects may be observed for company size. There are more workers in companies with less than 10 employees and they are more often compensated with less than 8.50 euros in GSOEP, while the same is due to individuals in companies with 11 to 100 employees in SES/ES. In contrast differences in minimum wage working are less pronounced regarding West and East Germany as well as types of employment.

In light of the composition of the populations surveyed in the SES/ES and the GSOEP, the following passages show the distributions of monthly remunerations, weekly working hours, and the hourly wages calculated on this basis.

3.1 Monthly wages

In the calculation of hourly wages, the monthly remunerations are the numerator (see Section 2.2, Formulas 1 and 2). Here we map the information provided on the total monthly gross wages by the GSOEP and the SES/ES (Figure 1). The respective

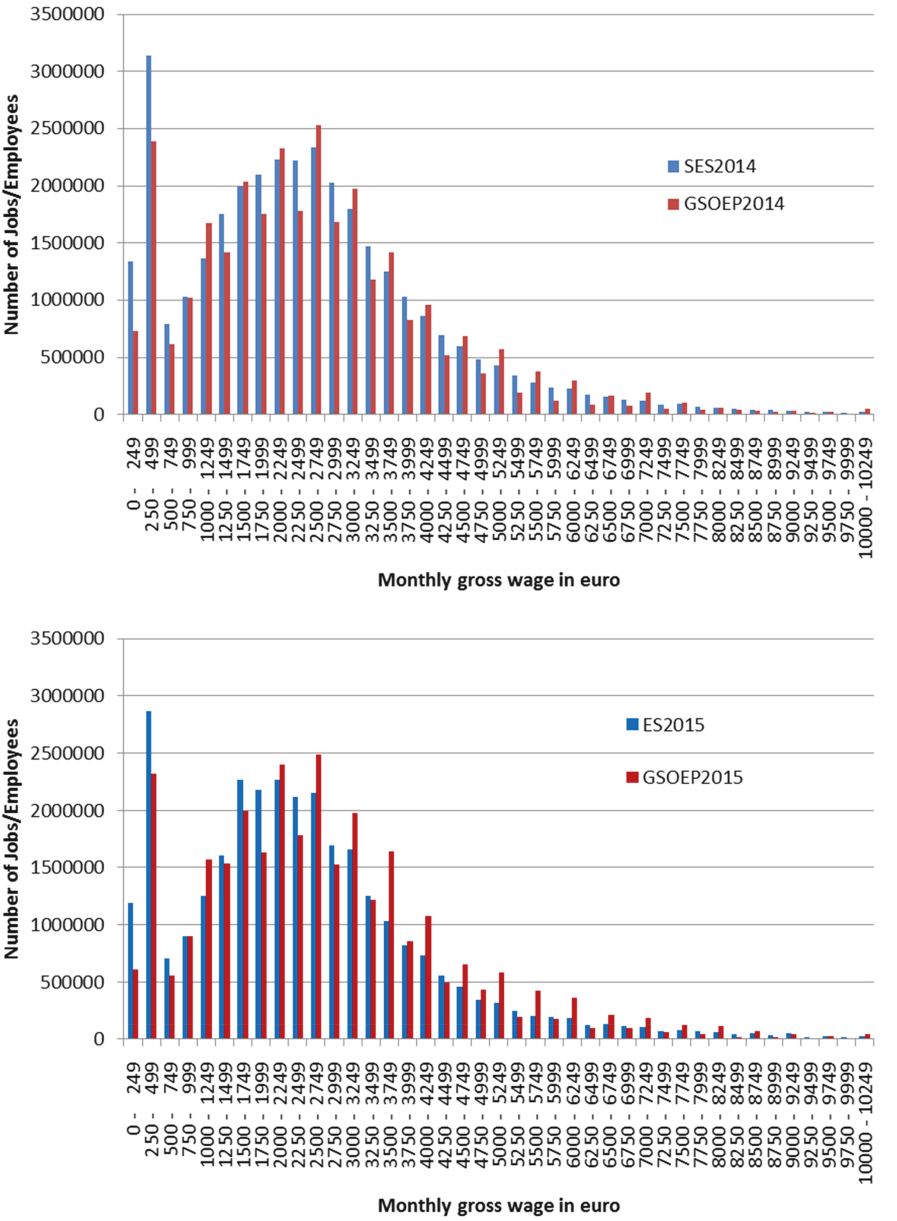

Figure 1: Distribution of monthly wages GSOEP and SES/ES (all jobs/employees).
Source: SES2014, ES2015, GSOEP v32, own calculations.

monthly average wages in the GSOEP – € 2,652 (2014) and 2,755 (2015) – are higher than those in the SES/ES (€ 2,452 and € 2,474). The observed growth of monthly wages has on average been stronger according to the GSOEP.

At first glance, the entire wage distribution looks similar in both years. However, there are considerable differences between the GSOEP and the SES/ES, especially in the range between 0 and 500 euros per month. In the two categories below 500 euros 608,004 and 747,675 more jobs can be observed in the SES than in the GSOEP in 2014. These differences become only slightly smaller in 2015 (577,448 and 554,605 jobs). This means that the SES and ES contain more marginal jobs compared to the GSOEP, but their number has reduced with the minimum wage introduction. For full-time employees working at the minimum wage rate, we would expect monthly earnings of about 1,250 to 1,499 euros. However, there is little change in the size of those earnings brackets over time in both data sets. In the ES 2015 there are even less jobs in this category compared to the previous year, while there are more jobs with earnings from 1,500 to 1,900 euros. Further, in the GSOEP there are distinctly more cases in the brackets of monthly wages that include round numbers by the factor of 500. This suggests that rounding is of greater importance in employees' survey responses than in employers' responses.

A more detailed analysis shows that the different concepts regarding full-time employment, part-time employment and marginal employment are of particular significance. In total, the SES reports about 3.4 million more jobs than the GSOEP in 2014. In order to distinguish between full-time and part-time employment, the GSOEP uses a fixed limit of 30 hours, while the SES/ES use the respective regular working hours of full-time workers in a firm, which usually are above 30 hours. This is why in most income classes there are more part-time workers in the SES/ES than in the GSOEP, except for the highest part of the distribution (Figure 5). Complementary, there are more full-time workers in the GSOEP than in the SES/ES. However, in 2015 there are more full-time workers in the SES/ES in the range from 1500 to 2000 euro, which results from hourly earnings just above the minimum wage. Regarding marginal employment, the SES/ES includes both principal and secondary employment relationships, while the GSOEP includes only principal employment. Accordingly, the absolute numbers of marginal jobs are higher in the SES/ES. Also there are relatively more marginal jobs with earnings up to 250 euro in the SES/ES, while a greater share of the marginal employed earns up to 500 euro in the GSOEP. In the years 2014 and 2015, the number of marginal employed workers has decreased according to both data sets. Summing up, after the minimum wage introduction the changes in the distribution of monthly wages are small. A greater reduction of jobs with monthly wages below 500 euros is documented in the SES/ES.

3.2 Weekly working hours

For the calculation of hourly wages, the contracted weekly working hours are stated in the denominator (Section 2.2, Formulas 1 and 2). In 2014 and 2015, the average number of weekly working hours amounted to about 34 hours in the GSOEP, while the SES/ES state around 30.5 hours. The average difference of about four hours per week remained almost unchanged over this time period. The distribution of contracted weekly working hours is displayed in two-hour brackets in Figure 2.

There are more jobs reported in the SES/ES than in the GSOEP in particular among workers with only few working hours per week. The distribution points to a tendency to report round values in both data sets, but to a stronger extent in the GSOEP. There are peaks at the values 20, 25, 30 and most clearly at the number of 40 hours per week. There are more jobs reported in the GSOEP than in the SES/ES at each of these round values and most clearly at the number of 40 hours per week. In the GSOEP more workers reported working hours above 40 hours. In contrast, there are more jobs with a small amount of weekly working hours reported in the SES/ES and a clustering is apparent at ten hours per week. Average working time has decreased according to both data sets from the year 2014 to 2015.

A further differentiation of weekly working hours by types of employment shows that the average weekly working time of full-time employees in the GSOEP is merely half an hour longer in 2014 and one and a half hours longer in 2015 than in the SES/ES (see Figure 6). The working time reported by part-time employees is about two hours longer and that of people in marginal employment is three and a half hours longer. This finding is consistent with the delimitations of employment types in both data sources, which have already been discussed above. Year-on-year, the working hours of full-time employees have decreased in the SES/ES, those of part-time employees have increased and those of people in marginal employment have slightly increased, while only a slight decrease of working hours in case of marginal employment can be found in the GSOEP.

Among full-time jobs there is a greater accumulation at the value of 40 hours in the GSOEP. Jobs with 30 and more working hours per week are full-time by definition in the GSOEP, whereas they may be coded full-time or part-time in the SES/ES. Hence, reported part-time jobs with more than 30 hours do only occur in the SES/ES. Despite from that the most important differences among part-time workers are the more distinct accumulations of reported jobs with 20 and 25 hours in the GSOEP. Regarding marginal employment there are substantially more jobs reported in the SES/ES than in the GSOEP. The most reported value for this employment form is 10 hours in both data sets. With regard to working time we can summarize that the introduction of the minimum wage shows stronger reductions of weekly working hours in SES/ES than in the GSOEP.

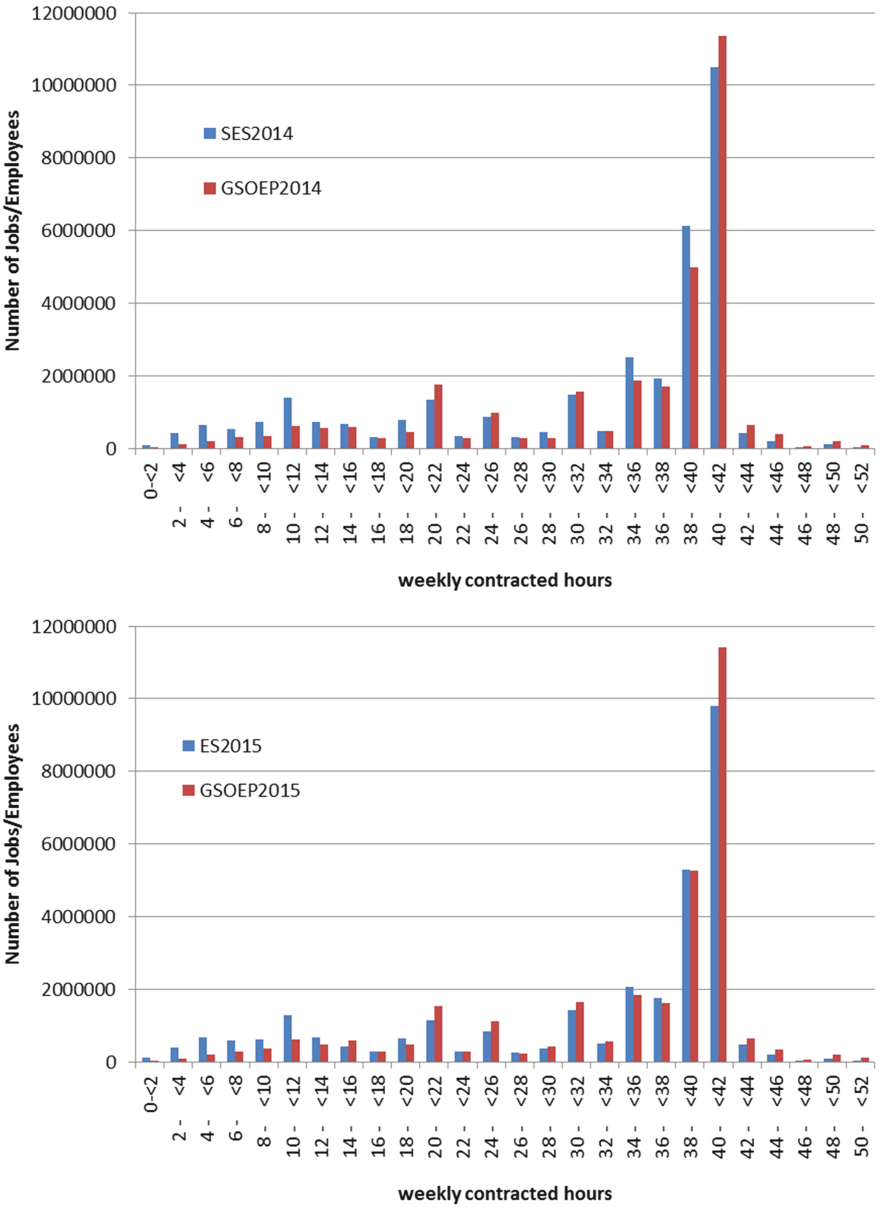

Figure 2: Distribution of weekly working hours in GSOEP and SES/ES (all jobs/employees). Source: SES2014, ES2015, GSOEP v32, own calculations.

3.3 Division: Gross hourly wages

The average gross hourly wage amounts to € 17.05 in the GSOEP 2014 and to € 17.93 in the SES 2014. In 2015, the GSOEP shows an average gross hourly wage of € 18.04 and the ES one of € 17.54. While the overall development of wages was positive from 2014 to 2015, it does not become apparent in our sample, which excludes missing values on wages and all characteristics listed in Table 2. Furthermore, the median wage amounts to € 15.58 in the GSOEP 2014 and to € 15.60 in the SES and is thus just 2 cents lower. According to the GSOEP 2015, the median wages rose to € 16.08 and declined to € 14.84 in the ES, which amounts to a difference of 1.24 euros in 2015. This means that the average hourly wages in the GSOEP and those in the SES/ES were almost the same in 2014, while they considerably differ in 2015. Against this backdrop, a closer look at the distribution of the gross hourly remunerations is taken in Figure 3.

The distribution of hourly wages shows a broadly similar structure in the two data sets in 2014. There are accumulations of many cases in the area from about 8 to 11 euros, marking the low-wage segment, and another one in the area from 13 to 15 euros. Higher hourly wages are less frequent in both data sets. The GSOEP reports more employment relationships with earnings from about 4 to 7 euros in 2014. The fact that the SES observes more part-time and marginal jobs can explain the substantially greater number of jobs with hourly earnings from seven to 12 euros, compared to the GSOEP (see also Figure 7). Wage growth for low-wage earners was more pronounced in the SES/ES from 2014 to 2015. In 2015, the GSOEP reports more employment relationship in each bracket up to eight euros and in particular between six and seven euros per hour. While both data sets report similar total numbers of jobs in 2015, the ES shows an even stronger accumulation of cases between 8 and 13 euros.

Figure 4 shows a detailed representation of the distribution of the hourly wages in one euro increments. The hourly wage distributions for the GSOEP and the SES/ES, respectively, vary widely. In 2014, a larger proportion of employments in the SES already range between eight and ten euros. Along with the introduction of the minimum wage, a large part of low wages disappear and a strong concentration in the range of 8.50 euros can be observed in the ES. Also the number of jobs with hourly wages between 9 and 11 euros has increased clearly in the SES/ES. By applying 10 cent wage brackets it was shown for the SES/ES that the greatest peak in the distribution by far is exactly at the minimum wage of 8.50 euros (Mindestlohnkommission 2016: 51). There are peaks at other focal points, too, particularly at 9, 9.50 and 10 euros. Their appearance is more pronounced in 2015 than in 2014. This shows that using round values above the minimum wage seems to be reasonable and simpler for employers.

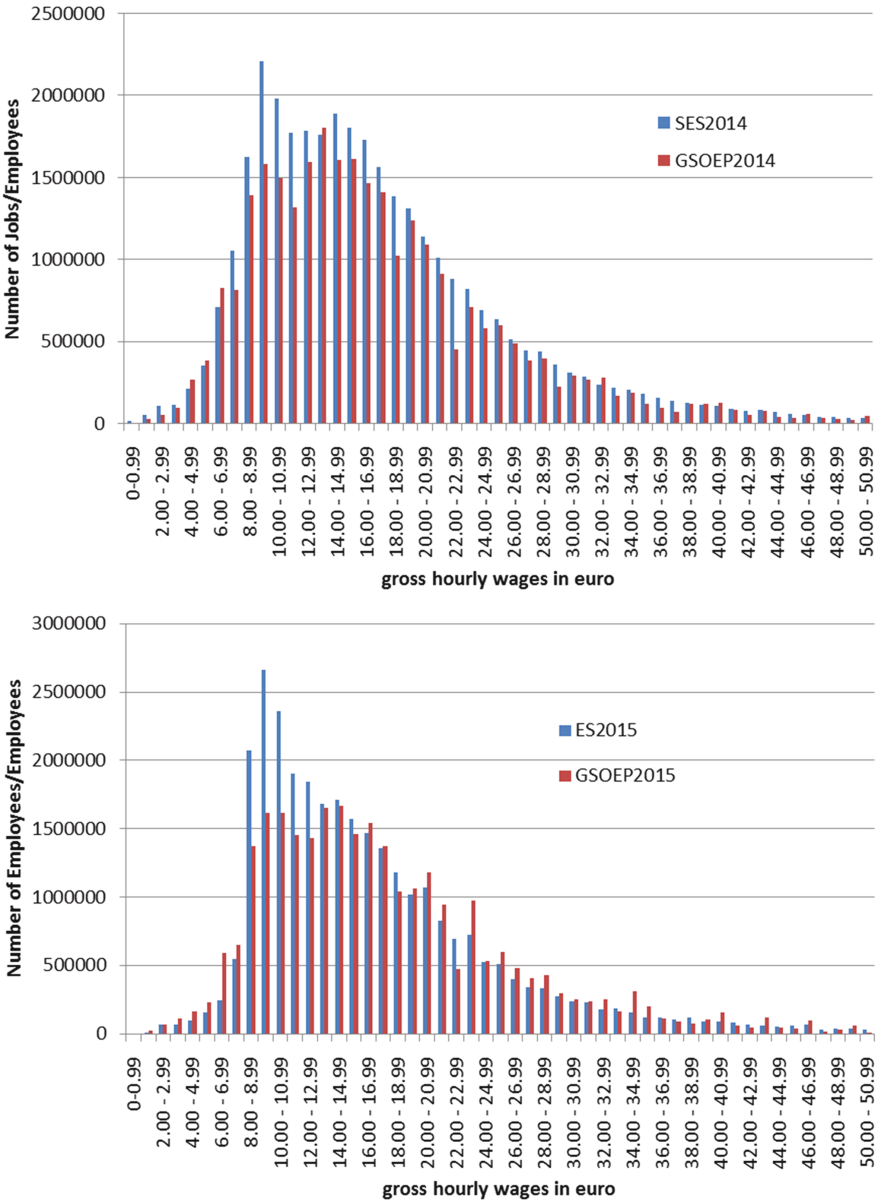

Figure 3: Distribution of the gross hourly wages in GSOEP and SES/ES (all jobs/employees). Source: SES2014, ES2015, GSOEP v32, own calculations.

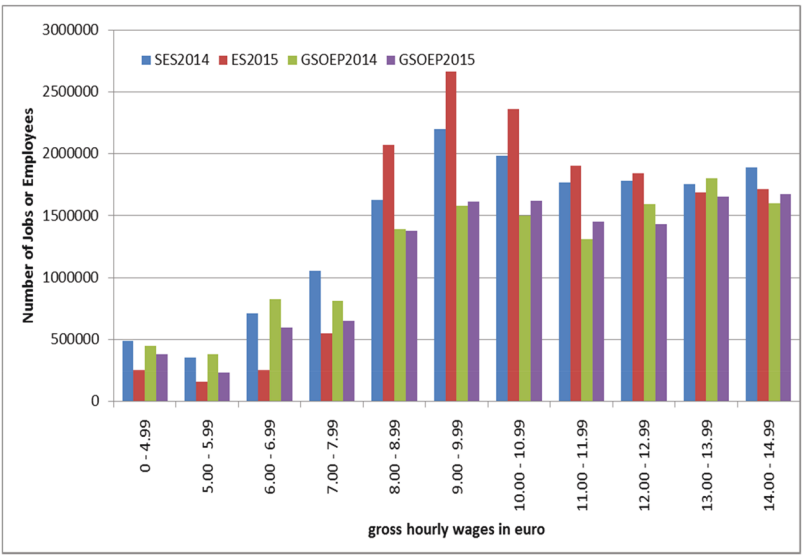

Figure 4: Distribution of the hourly wages in GSOEP and SES/ES in the range between 0 and 15 euro (all jobs/employees).
Source: SES2014, ES2015, GSOEP v32, own calculations.

Analyses of the GSOEP so far are not available in such a detailed form due to the considerably lower number of cases observed. In the GSOEP, however, a slight shift in the low income bracket can be seen with a comparatively higher number of employees still earning wages below the minimum wage in 2015 (Figure 4). Thus a notable effect of the introduction of the minimum wage is evident in the SES and the ES, while it is less pronounced in the GSOEP. Furthermore, it is important to note that especially in GSOEP there are strong differences in non-compliance depending on the working-time concept used. The amount of non-compliance significantly increases when the calculation of hourly wages is based on actual working hours (Burauel et al. 2017).

4 Discussion of results and conclusion

In empirical studies on wage distributions and the development of wage inequality there are different possibilities of operationalizing central indicators. In turn, the reliability and consistency of the results obtained depends on it (Fitzenberger 2012). The challenges regarding an adequate selection and

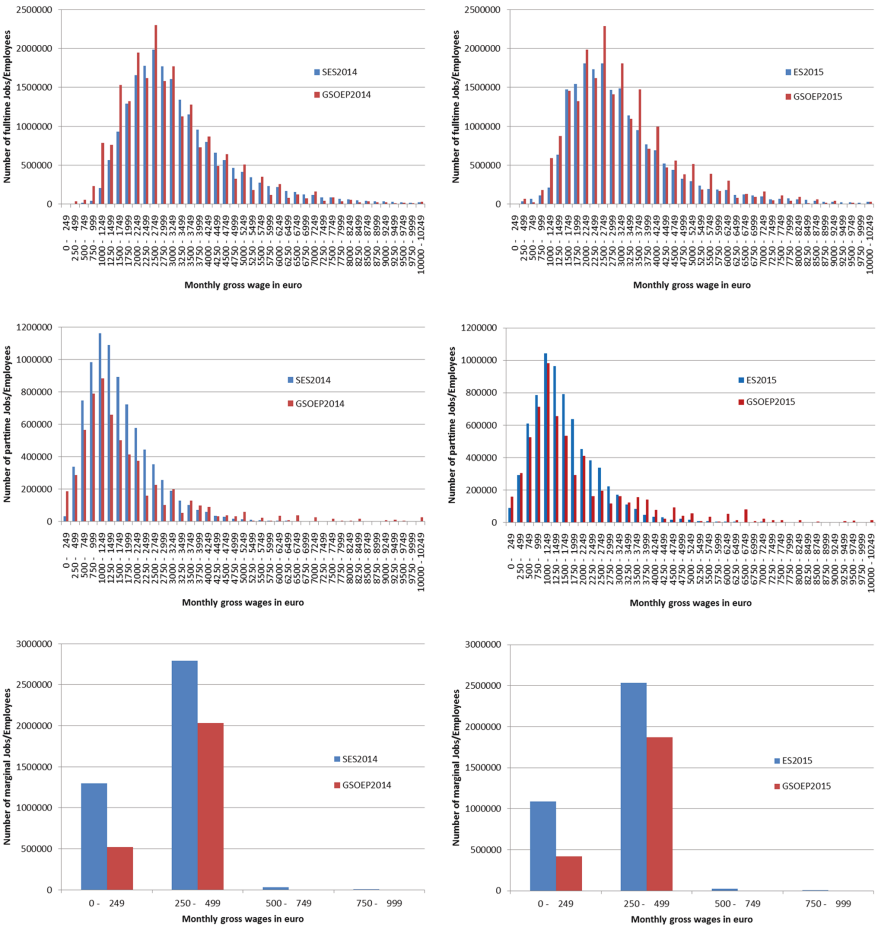

Figure 5: Distribution of monthly wages GSOEP and SES/ES by type of employment.
Source: SES2014, ES2015, GSOEP v32, own calculations.

ultimate operationalization become obvious again by the introduction of the statutory minimum wage as of January 1, 2015. The minimum wage is defined as gross hourly wage in the Minimum Wage Act. Consequently, the minimum wage has to be evaluated on the basis of the information provided on hourly wages. The (Structure of) Earnings Survey and the German Socio-Economic Panel are the most relevant data sources allowing an analysis of hourly wages in this context. Taking into account that no systematic comparative study of these data sets regarding earnings and working hours known to us is available, the present contribution tries to work out similarities and differences. For this purpose, the

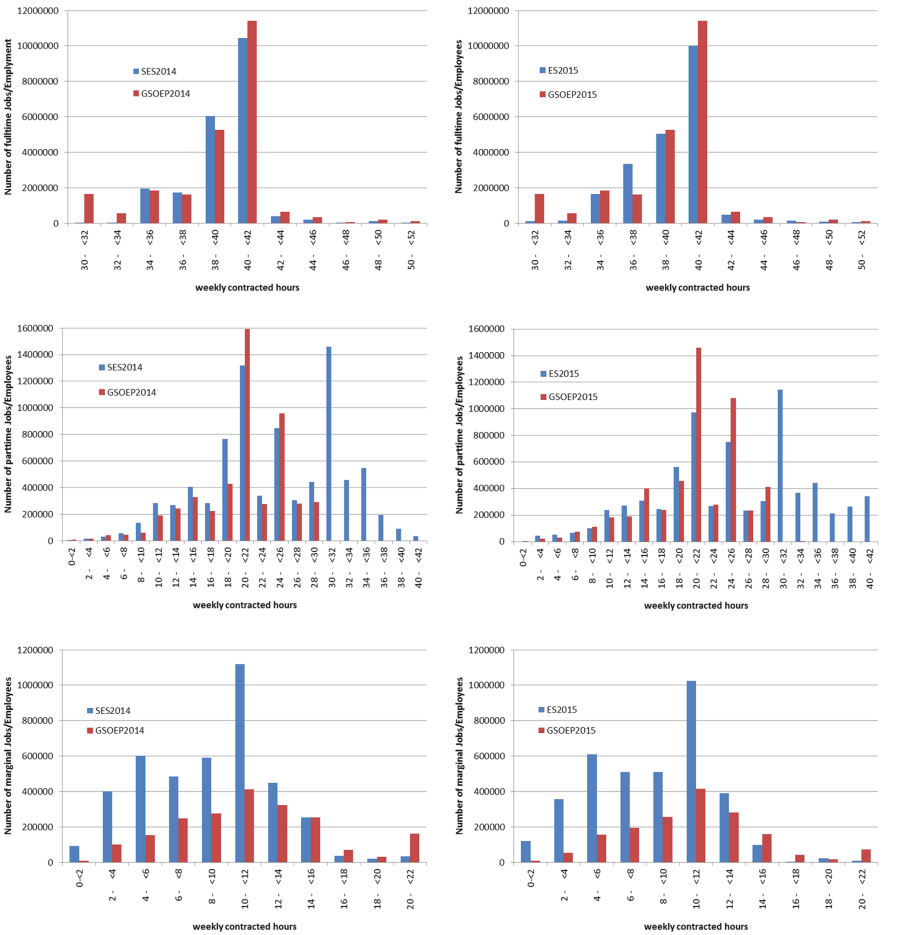

Figure 6: Distribution of weekly working hours in GSOEP and SES/ES by type of employment. Source: SES2014, ES2015, GSOEP v32, own calculations.

survey designs were delineated and descriptive comparisons of different earnings and working time concepts were made.

Regarding the designs, it became obvious that employees constitute the underlying sampling units in the GSOEP, while the SES/ES uses employment relationships including all secondary occupations as a basis. In the SES/ES, data on wages are very valid, because employers are polled or the information is obtained directly from a company's payroll. However, information on hours or individual characteristics (e. g. qualification) is less accurate because it is not related to the purpose of the administrative reporting process producing the data

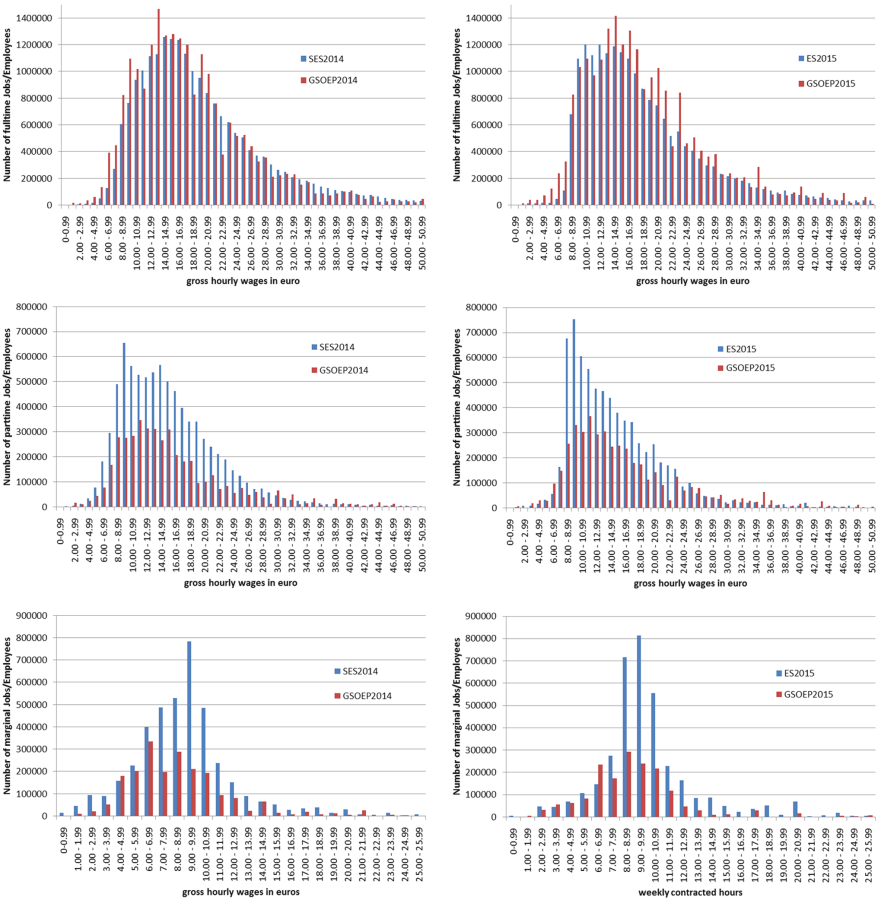

Figure 7: Distribution of gross hourly wages in GSOEP and SES/ES by type of employment. Source: SES2014, ES2015, GSOEP v32, own calculations.

(Fitzenberger et al. 2006). Additionally, it must be considered that the response rate in the mandatory SES was very high; but it declined considerably in the voluntary ES. For minimum wage research is of interest that response rates in ES were selective depending on the impact of the minimum wage on a company (Statistisches Bundesamt 2017). Information in GSOEP is based on voluntary response and, thus, rounding errors, recall bias and social desirability bias can undermine the validity of the data. Another relevant aspect for minimum wage research is that SES/ES data contain only limited information about individuals, while the GSOEP is rich of information on individual and household characteristics as well as subjective items (e. g. self-reported job satisfaction or

health). Hence, the GSOEP provides more analysis options. Furthermore the SES/ES are cross-sections but the linked-employer-employee design allows considering the variance in and between companies. The GSOEP is a panel study and can be used for year-to-year comparisons as well as causal difference-in-difference estimations. General limitations of both data sets concern the possibility of delineating the population entitled to payment of the minimum wage. Employees who remain on the margins of the labor market, like seasonal and home workers or showmen are not observed in SES/SE or GSOEP.

Both data sets vary in the unweighted and weighted number of employment covered. The weighted SES reports about 3.4 million more jobs than the weighted GSOEP in 2014. This fact as well as the greatly differing sampling and weighting should largely explain the varying distribution of the units observed. In view of unweighted data more female workers and more full-time jobs are found in GSOEP than in the SES/ES, while more males as well as part-time jobs and marginal employment exist in the SES/ES. The differences in employment types might be attributable to the varying delimitation in both data sets. Compared to the GSOEP, the SES/ES show a considerably higher number of jobs in West Germany. These differences might also be associated with the categorization of the employment relationships by place of work in the SES/ES and by the employees' place of residence in the GSOEP. Additionally, the shares of vocationally trained employees as well as the number of employees working in small as well as large companies greatly differ between both data sets. In the whole sample weighting in the GSOEP leads to a notable adjustment regarding sex and type of employment. In the SES/ES population weights considerably correct for sex, region, type of employment and company size. In addition, regarding employment compensated with less than 8.50 euros there are two marked differences. Significantly more females and less marginal employment can be found in unweighted and weighted GSOEP than in SES in 2014. Against the backdrop of sample sizes minimum wage research must take into account that the potential for analyses in subgroups is limited due to small numbers of observations in GSOEP. Furthermore, population weights influence the distribution of employment in several dimensions.

The differences between the surveys implicate a stronger impact on minimum wage estimates of females in GSOEP when focusing on differences by sex and on employees with a completed vocational training as well as on workers in companies with less than 10 employees. Stronger minimum wage effects may be observed in SES/ES for individuals with no completed vocational training and for workers in companies with 11 to 100 employees. However, differences in minimum wage working are less pronounced regarding West and East Germany as well as types of employment.

As monthly wages and weekly working hours are the most widespread basis of stating earnings, hourly wages are often an unknown variable which is not relevant for the majority of the employees and the respective information is not collected directly. Consequently, hourly wages have to be calculated from the month- or week-based information provided on earnings and working hours. The different calculation methods used in the SES/ES and the GSOEP are one of the reasons why the distribution of hourly wages may vary. This is why the present contribution compares the results obtained by similar hourly wage calculation methods in both data sets. It is based on gross monthly earnings including remuneration for overtime but excluding premiums and the contracted monthly hours worked.

In a first step, the gross monthly wages were analyzed. In the GSOEP, they consistently exceeded those from the SES/ES. Especially below 500 euros more jobs can be observed in the SES/ES than in the GSOEP because the SES/ES contain more marginal jobs. In the GSOEP, the contractual working times reported were considerably longer than those in the SES/ES. The distribution of hours worked points to rounding in both data sets, but to a stronger extent in the GSOEP with peaks at the values 10, 20, 25, 30 and 40 hours per week. In the GSOEP more workers reported working hours above 40 hours. In contrast, there are more jobs with a small amount of weekly working hours reported in the SES/ES and a clustering is apparent at ten hours per week. The introduction of the statutory minimum wage led to a major shift of the wage structure in the SES/ES and a concentration of the wages just above the minimum wage associated with it. Such a notable minimum wage effect with a concentration of the gross hourly wages at 8.50 euros could not be observed in the GSOEP. The introduction of the minimum wage was accompanied by a reduction of the proportion of employees being paid less than 8.50 euros in the GSOEP as well. The distribution of the gross hourly wages exhibited a slight shift to the right. The different recording of secondary occupations and of people in marginal employment may be another explanation of the differences between the datasets as regards the wage distributions. People in marginal employment are affected by the minimum wage to a high degree and according to the findings obtained so far, this type of employment decreased after the introduction of the minimum wage (Mindestlohnkommission 2016). This suggests that the non-recording of marginal employment as a secondary occupation and the marked under-representation of marginal employment as a principal occupation in the GSOEP also contributes to the fact that no significant concentration of the wage distribution in the minimum wage range can be identified in 2015. This finding on the hourly wage distribution leads to far-reaching consequences for minimum wage research because the treatment “minimum wage” is considerably stronger in SES/ES than in GSOEP. The fact that the treatment “minimum wage” is considerably less

pronounced in GSOEP means, that it will be more difficult to identify minimum wage effects. That is why the findings of research papers will probably vary in dependence of the data base chosen.

Besides differences and inaccuracies in the operationalization of hourly wages, the countable weekly working hours and wage components, the difference between the designs as regards the two perspectives in the SES/ES and in the GSOEP is relevant. While information from a company's payroll accounting is stated in the SES/ES, the GSOEP as an individual survey presents the perspective of employees. Thus the GSOEP is likely to also contain information on unpaid overtime which was subjectively found to be working time by respondents, while companies' payroll accounting departments always report the hours paid for. Furthermore, compliance with the actual minimum wage is often calculated in some software tools for wages accounts in Germany. Since paying below the minimum wage is an offence, employers may not want to submit such low wages and they may adjust their data before reporting (Garnero et al. 2015). Another question is, why employers paying below minimum wages should respond to voluntary official surveys like the ES 2015 (Ritchie et al. 2016, 2018). Hereafter both surveys exhibit specific problems in the collection of data on working hours and the calculation of hourly wages. Against this backdrop, qualitative studies could help to gain further insights in frame conditions and provide corroboration or denial for the quantitative studies (Ritchie et al. 2016, 2018).

In summary, we can see stronger effects of the introduction of the minimum wage in the SES/ES than in the GSOEP. Obviously, such changes in the wage floor more directly affect the payroll accounting than the response behavior of the employees. Despite methodological shortcomings, both data sets find evidence for deficits regarding the implementation of the minimum wage. For minimum wage researchers, it is important to know that the rate of non-compliance in 2015 in GSOEP is more than twice as high than in ES, when hourly wages are calculated based on contracted working hours. If actual working hours are used, non-compliance is rising.

In light of the findings observed, earnings analyses should take the respective design particularities of the data set and the different ways of operationalization into account to be able to assess the reliability of the results and the range of possible conclusions. In addition, further research on alternative specifications and further robustness tests is needed. In the end, the introduction of the minimum wage as the lowest wage rate may broaden the culture of hourly wages again and possibly contribute to according sensitization of respondents in surveys. On the other hand and as part of a world of work, which is becoming increasingly flexible, the chronological allocation of a specific wage to a specific time interval may become more demanding.

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