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The catchword

Progress made, and challenges to be met, in web scraping - automation of web-based price collection

E-commerce is continuously gaining importance. This is why prices of goods and services traded online are more and more often covered by consumer price statistics. Every month, prices of roughly 10,000 products are currently collected on the internet for consumer price statistics, in most cases manually. Price statisticians have estimated that, in base year 2010, e-commerce and the mail order business accounted for just over 5% of total household consumption expenditure. The proportion has further increased. A contributing factor is that large retailers now offer their products in online shops, in addition to selling them in real shops. The proportion of goods and services for which prices could be collected on the internet is thus gaining more and more importance.

In 2012, the price statistics unit of the Federal Statistical Office examined for the first time the opportunities of automated web-based price collection by means of web scraping and performed first tests. These activities were largely funded by Eurostat grants. Web scraping here means that individual, manual price collection activities on the internet are automated, i.e. prices that have previously been defined are automatically extracted at specific points in time. The specifications regarding the prices to be extracted are stored in an SQL input database. This allows easy handling of the specifications and ensures that low memory capacity is required. The data extracted from the internet are stored in an SQL output database, from which they can then be exported into any common format (csv, xls, txt). The information is extracted from the internet using two scraping tools: either iMacros, which navigates on the internet using its own browser, or Selenium, which is used as a plug-in in a common browser (Mozilla Firefox, Google Chrome, Internet Explorer). In price statistics, the Selenium tool is used more often now because using a common browser increases speed and markedly reduces error proneness. A program written in Java connects the SQL databases with the scraping tool. Both the SQL databases and the scraping tools are compatible with Java and can easily be integrated and controlled. In the Java program, all processes are described and data are processed. When the Selenium tool is used, the script for navigating on the web pages is written into the Java code. When the iMacros tool is used, navigation is written in special iMacros scripts, which are called up by the Java code. Although handling iMacros scripts is easier and clearer than coding Selenium scripts in Java, it is more error prone. This is why the Selenium tool will now be used more often in price statistics.

In the past five years, some manual price surveys from several areas of price statistics have successfully been automated through web scraping. For purchasing power parities, prices of overnight stays in hotels and air travels are collected. For consumer price statistics, prices of hired cars and of many types of medicines, long-distance bus and rail travels are collected through web scraping. Premiums of residential building insurances are obtained in an automated manner from the internet for the price index of owner-occupied housing, and gas and electricity prices of several energy exchanges for the producer price index. Automated price collection is performed daily, weekly or monthly, depending on the volatility of the prices. In addition, a research project has been carried out for roughly 12 months to examine dynamic pricing. In this context, 3,000 prices of 13 large online dealers have been collected on an hourly basis which, however, are not included in the calculation of the consumer price index.

Instead, the collected prices are used to study the pricing behaviour on the internet and to draw conclusions for our own price collection. Next year, the study will be extended to cover roughly 400 online retailers and over 10,000 products, so that a wide basis for data analysis will be available. As e-commerce prices can be very volatile, methods have to be developed to derive reliable price developments from such highly fluctuating prices. Various ways of imputing lacking values will also be studied. These studies are a major precondition before web scraping can

extensively be used in practice for the consumer price index and the harmonised index of consumer prices.

Since early 2017, a generic web scraping program has been under development at the Federal Statistical Office. It will help to reduce maintenance work regarding automated processes. Also, using web scraping will require less IT knowledge and, consequently, be less dependent on specific staff. This allows web scraping to be widely used as a data collection method. Since mid-2016, the IT department has been collaborating with the price statistics unit to optimise processes and define the technical requirements. The specification of requirements for writing the generic program is currently being developed, including specifically the needs of the statistics unit. Based on the specification, the IT department will write the generic program, which is expected to start in February 2018.

Web scraping in price collection involves advantages regarding data quantities and flexibility of data collection. However, it may also involve high maintenance intensity when a web page is frequently modified (technical maintenance) or when products change frequently and have to be replaced (subject-related maintenance). To keep technical maintenance to a minimum, we will use more often browser-based scraping tools (Selenium) and use robust positions on the product pages (e.g. using XPaths). Subject-related maintenance is more complicated and can be kept to a minimum only by combining various approaches. For example, it is indispensable that the relevant unit regularly checks the input and output databases because the product range in e-commerce is characterised by frequent changes.

Many technical problems have to be solved in automated price collection. Online dealers may be interested in protecting their products from being found by robots. First, they wish to protect themselves from competitors and comparison sites and, second, they want to reduce data traffic on their web pages in order to avoid customers being discouraged from shopping by long page loading times. In some cases, online dealers use Captchas to protect their web pages from excessive numbers of enquiries. They will only appear when a customer or a robot are visiting an online dealer's web pages for a longer time. Generally, customers have to enter simple sequences of numbers - shown in a picture - into a field so that they can continue shopping. For automated price collection, there is currently no specific legal basis. This means that, at present, price statisticians have to rely on online dealers accepting automated data collection by statistical offices. Another problem of web scraping is prices represented as an image. Scraping tools are mainly suited for extracting strings of characters, which can then be processed by a Java program. Although images can be extracted, too, no program will be able to transform an image into a price and store it. A third difficulty arising in automated data collection is the use of static IP addresses. Many online dealers allow direct access to specific products through IP addresses. Every product has an individual IP address. Simple, fast and robust programs can be used for web scraping if such IP addresses are available. Some online dealers, however, use the same IP address for all their products (static IP addresses), so that it is not possible to directly access the desired product.

In most cases, reprogramming to permit graded searching for the product is too costly and the process too error-prone, so that manual collection is preferred here.

In 2018, the further development of web scraping will focus on the development of a generic program and of methods for dealing with large data quantities that have been collected through web scraping. As it is expected that dynamic pricing on the internet will increase, this phenomenon will also have to be monitored and its influence on price statistics be studied.

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Methods of federal statistics – Further development

JDemetra+ - new software for seasonal adjustment of short-term statistics in the service sector

Short-term statistics in the service sector

The short-term statistics in the service sector provide quarterly data on the economic development in various service branches[1]. The results refer to the variables of turnover, number of persons employed, gross wages and salaries, and hours worked regarding the branches shown in the table.

Scope of short-term statistics in the service sector

Section of the Classification of Economic Activities (WZ, based on NACE)	
H:	Transportation and storage
J:	Information and communication
M:	Professional, scientific and technical activities (excluding WZ 70.1 Activities of head offices, WZ 72 Scientific research and development, WZ 75 Veterinary activities)
N:	Administrative and support service activities (excluding WZ 77 Rental and leasing activities, WZ 81.1 Combined facilities support activities, WZ 81.3 Landscape service activities)

By providing these statistics, data requirements of the European Union (EU) are met[2]. The data on gross wages and salaries and on hours worked are estimated and are included only in the Eurostat aggregates on the total EU. They are not published at the national level. Data on the development of turnover and of the number of persons employed are also shown at the national level, i.e. in the GENESIS-Online database[3].

The data are provided both unadjusted and in a calendar and seasonally adjusted form. Seasonal adjustment is performed by means of a mathematical statistical method eliminating from the time series the influences that occur regularly and to a similar extent in a quarter. The purpose is to make the short-term economic development and the trend more visible. The procedure may also include calendar adjustment, eliminating predictable calendar influences.

In the context of short-term statistics in the service sector, a total of 63 seasonally adjusted time series are available. Seasonal adjustment is directly applied to 59 time series. Another four time series are referred to as indirectly seasonally adjusted because they are calculated through aggregation of directly adjusted time series. The table shows the number of directly adjusted time series per statistical variable.

Number of directly seasonally adjusted time series by variable of short-term statistics in the service sector

Variable	*Number of directly seasonally adjusted time series*
Turnover	33 time series
Number of persons employed	18 time series
Gross wages and salaries	4 time series
Hours worked	4 time series

-

[1] See Fischer, H./Oertel, Dr. J.: "Konjunkturindikatoren im Dienstleistungsbereich: Das Mixmodell in der Praxis" in WiSta 3/2009, pp. 232-240 and Qualitätsbericht Konjunkturstatistik im Dienstleistungsbereich, 2017.

[2] See Council Regulation (EC) No 1165/98 of 19 May 1998 concerning short-term statistics (Official Journal L 162, p. 1), last amended by Commission Regulation (EC) No 1178/2008 of 28 November 2008 (Official Journal L 319, p. 16).

[3] See www.destatis.de/genesis, Table 47414.

New seasonal adjustment software

The software used in the past for the seasonal adjustment of short-term statistics in the service sector is X-12-ARIMA (version 0.2.8) developed by the United States Census Bureau. Since the end of November, short-term statistics in the service sector have been adjusted using JDemetra+ (version 2.2.0). The software has been developed within the European Statistical System and the European System of Central Banks and is generally recommended by Eurostat for seasonal adjustment of official statistics within the EU[1]. The open-source software is platform-independent and freely available also as a client application. Service statistics will change over to JDemetra+ as from the release of the seasonally adjusted results for the third quarter of 2017[2].

Mathematical-statistical method maintained

The software changeover does not entail a fundamental change in the mathematical-statistical seasonal adjustment method. The method applied so far - referred to as X-12-ARIMA, based on the name of the software used so far - will be maintained. Also, the individual specifications have largely remained unchanged when the previous software was replaced by JDemetra+ (see below).

The mathematical-statistical method applied is two-stage. The first stage is RegARIMA modelling; unadjusted values at the ends are extended by estimates and, were required, adjusted for calendar effects and outliers. Extending the time series by estimates is required, for instance, for the second stage of the procedure, where moving averages are calculated. The second stage is referred to as the X-11 part, or census method, and contains the actual seasonal adjustment procedure. It is an iterative smoothing process using trend and seasonal filters which are calculated from weighted moving averages. The seasonal factors of a specific month are obtained by smoothing the deviations of the unadjusted values from the trend values of that month. The trend values, in turn, are obtained by smoothing the unadjusted values[3].

In the JDemetra+ program, this procedure can be found under the X13 menu. This is why the mathematical-statistical method is now also referred to as X13. The table below gives an overview of the software used, the mathematical-statistical method applied and its name in the short-term statistics in the service sector.

Overview of software, method and names used in the short-term economic statistics in the service sector

	Software used	*Method applied*	*Name used in the metadata of the statistics*
Previously:	X-12-ARIMA 0.2.8	X-12-ARIMA	Census X-12-ARIMA
From now on:	JDemetra+ 2.2.0	X-12-ARIMA	X13 in JDemetra+ 2.2.0

Seasonal adjustment specifications largely maintained

As mentioned earlier, the individual specifications have largely remained unchanged when the previous software was replaced by JDemetra+. It is therefore expected that the effect of seasonal adjustment will be roughly the same as in the past. The specification is the total of parameters defined for seasonal adjustment of a time series. The seasonal adjustment procedure requires various parameters to be set when modelling the regARIMA regression and when defining the filter types. The parameters are set in a way so as to optimise the values of specific quality indicators. The specification is set individually for every time series to be adjusted directly. In

[1] For the Eurostat recommendation and more information on the software and for the download see http://ec.europa.eu/eurostat/web/ess/-/jdemetra-officially-recommended-as-software-for-the-seasonal-adjustment-of-official-statistics [accessed on 19 January 2018].

[2] The results for the third quarter of 2017 on the variables of turnover and number of persons employed will be released at the end of November 2017. The results on the variables of gross wages and salaries and hours worked will be supplied to Eurostat at the end of December 2017.

[3] For an overview of the method see Gericke, P.-A./ Seidel, G.: "Saisonbereinigung" in Bundesagentur für Arbeit, Statistik Methodenbericht, Februar 2014, Nürnberg.

individual cases, the specification has been simplified so as to facilitate transferring it into JDemetra+. The complete specifications can be provided upon request1. Data users thus can integrate the specifications into the client version of the freely available software JDemetra+ and duplicate the seasonally adjusted results of service statistics using the unadjusted data published. The annex contains central parameter settings for the specification of seasonal adjustment of the short-term statistics in the service sector.

Revisions caused by seasonal adjustment

For seasonal adjustment according to the above method, calendar and seasonal factors are forecast for at least a year so that, generally, the factors have to be calculated only once a year. The factors ascertained in advance can be used for four quarters to calculate the seasonally adjusted time series. This has the advantage that, within this period, no revisions of back data are required due to the seasonal adjustment. As, however, seasonal patterns and calendar effects may change over time, the forecast calendar and seasonal factors are checked - and updated where considered necessary - before any publication[2]. Where seasonal factors are updated, back data are generally revised, too. In the service sector, the calendar and seasonal factors were last calculated and forecast for the first reference quarter of 2017. Until the next forecasts are made for the first reference quarter of 2018, these factors are the basis for deciding on whether factors are to be updated. Due to the software migration, revisions of back data may exceptionally be required to a limited extent in addition to regular revisions.

Annex: Central parameter settings in the seasonal adjustment specifications

Parameter	values
Model type	additive, multiplicative
Calendar regressors	Easter, working days
Outliers	Outliers set and automatic identification (critical value 3.5)
ARIMA models and their frequency	(0,1,0)(0,1,1): 13x (0,1,1)(0,1,0): 1x (0,1,1)(0,1,1): 20x (0,1,1)(1,0,0): 2x (0,1,2)(0,1,1): 1x (1,0,0)(0,1,0): 4x (1,0,1)(0,1,0): 1x (1,1,0)(0,1,1): 8x (1,1,0)(1,0,0): 1x (1,1,0)(1,1,0): 1x (1,1,1)(0,1,1): 1x (1,1,2)(0,1,0): 1x (2,0,0)(0,1,1): 1x (2,0,1)(0,1,0): 2x (2,1,0)(1,0,0): 1x (1,0,0)(0,1,1): 1x
Sigma limits for identifying extreme values	lower limit: 1.5 upper limit: 2.5
Trend filter (Henderson filter)	5; 7
Seasonal filter	3x3, 3x5, 3x9

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[1] Any requests should be sent to this e-mail address: saisonbereinigung-indikatoren@destatis.de.

[2] In some cases, this may involve adjustment of model and filter specifications. In the guidelines on seasonal adjustment applicable in the European Statistical System, the approach is referred to as "controlled current adjustment" and, in the case of time series with a stable seasonal component, they are included under A methods (best alternative) (cf. Eurostat: ESS guidelines on seasonal adjustment, Luxembourg 2015).

Longer or shorter working hours? – Questions and answers in the microcensus and the SOEP

Introduction

According to microcensus results for 2015, over 2.7 million employed people aged 15 to 74 years wanted to work more hours (underemployed), while roughly 1 million persons in employment wanted to work less (overemployed). Underemployed people wanted to increase their weekly working time by an average of 11.3 hours, while those who were overemployed wanted to reduce it by 11.1 hours. Just under 91% of the people in employment did not want to change their weekly working time.

Based on Socio-Economic Panel (SOEP) results for the same reference year, the German Institute for Economic Research (DIW Berlin) found that just under 5.3 million employed people wanted to increase their working hours whereas approximately 18 million wanted to reduce their hours of work. On average, the underemployed wanted to work an extra 9 hours per week, while the overemployed wanted to reduce their working time by 7.8 hours. As shown by the results, more than 70% of the people in employment were dissatisfied with their working hours and wanted to change them.

The fact that an increase or reduction in working hours would involve correspondingly higher or lower earnings was pointed out to the respondents in both surveys. What are then the reasons for the different results? Are the wording, sequence and number of questions relevant key factors for measuring working time and working-time preferences?

The Federal Statistical Office investigated these questions together with DIW Berlin. This article provides a summary of the results obtained. The detailed study was published in the "Wirtschaft und Statistik" scientific journal (Rengers et al., 2017).

Working time and working-time preferences

The microcensus – including the labour force survey – is a representative household survey of official statistics (Federal Statistical Office, 2016). Using an established statistical random method, approximately 1% of the population is selected for the survey every year. A total of 691,000 members of 342,600 households were interviewed in 2015. Regarding most of the variables, there is a legal obligation to provide information.

The SOEP is a representative longitudinal survey of households which has been conducted on behalf of DIW Berlin since 1984 (Wagner et al., 2007). Currently, roughly 30,000 respondents in 11,000 households are interviewed in the survey. There is no obligation to provide information for the SOEP.

The type and the scope of questions about working time and working-time preferences differ largely between the microcensus and the SOEP. Fig. 1 and Fig. 2 show the relevant components of the questionnaires used in 2015.

Figure 1: Questions about working time and working-time preferences in the 2015 microcensus

Working time

57 How many hours a week do you usually work, including regular extra hours and standby duty ?

i See also p. 60 "Stand-by duty".

Number of hours
Round up or down to the nearest hour. .....

58 How many hours did you actually work last week ? Voluntary

i **The number of hours actually worked**
may differ from the hours usually worked because of overtime, holidays, extra shifts, public holidays, illness and the like.

The number of hours actually worked
includes continuing and advanced training, stand-by duty, work done at home provided that it is a normal part of your job, such as for teachers.

Number of hours
Round up or down to the nearest hour. .....

Did not work in the last week. .....→61.....

59 If you are an employee or public official:
Did you work additional hours in the last week, that is, hours in excess of your contractual working time ?

i **If no contractual working time is agreed,**
please enter the hours worked in addition to your usual working time.
Please enter all additional hours and round up or down to the nearest hour.

Yes, ...
... hours compensated by flexible working time or time off (e. g. working time account) .....
... hours remunerated in addition to your salary / wage (paid overtime) .....
... hours not additionally remunerated and not compensated (unpaid overtime) .....
No, did not work any additional hours. .....→61.....
No response .....

78 How many hours a week do you usually work on average in your additional job ?

Average number of hours
Round up or down to the nearest hour. .....

79 How many hours did you actually work in your additional job in the last week ?

Number of hours
Round up or down to the nearest hour. .....
Did not work in my additional job in the last week. .....

Working time preferences

80 Would you like to increase your normal weekly working hours, with a corresponding increase in earnings ? Voluntary

i **The weekly working hours include**
the main job and second or additional jobs.

Yes, exclusively by working more hours in the current job(s) .....
Yes, exclusively by starting an additional job .....
Yes, exclusively by moving to a job with more working hours .....
Yes, but without tying myself down to one of the above options .....
No .....→84.....

81 If you would like to increase your weekly working hours:
Would you be able to start working more hours within 2 weeks ? Voluntary

Yes .....→83.....
No .....

82 If you could not start working more hours within 2 weeks:
Why would you not be able to start working more hours within 2 weeks ?
If there are several reasons, please indicate the main one.
Illness or inability to work .....
Education, advanced training .....
Notice periods in the current job .....
Personal or family reasons .....
Other reason .....

83 If you would like to increase your weekly working hours:
How many hours a week would you like to work ?
i The weekly working hours include
the main job and second or additional jobs.
Number of hours
Round up or down to the nearest hour. .....→86.....

84 **Would you like to reduce your normal weekly working hours, with a corresponding loss in earnings ?**
Yes .....
No .....→86.....
No response .....

85 If you would like to reduce your weekly working hours:
How many hours a week would you like to work ?
Number of hours
Round up or down to the nearest hour. .....
No response .....

Source: Rengers et al., 2017, p. 16 (translated into English)

Figure 2: Questions about working time and working-time preferences in the SOEP 2015

79. If you could choose your own working hours, taking into account that your income would change according to the number of hours:
How many hours would you want to work?
☐☐ , ☐ hours per week

80. How many days do you usually work per week?
☐ days per week
Not applicable, because ...
– the number of days is not fixed..... ☐
– the number of days changes from week to week .... ☐

81. How many hours per week are stipulated in your contract (excluding overtime)?
☐☐ , ☐ hours per week No set hours..... ☐

82. And how many hours do you generally work, including any overtime?
☐☐ , ☐ hours per week

111. How many days per month do you work at this side job?
☐☐ days per month

112. How many hours per week do you work at this job?
☐☐ hours per week

Source: Rengers et al., 2017, Fig. 4, p. 17 (translated into English)

Comparison between the microcensus and the SOEP

Based on the concept of time-related underemployment of the International Labour Organization (ILO), underemployment in the microcensus context refers to persons in employment who have a desire or preference to work more hours and would be available to work additional hours (Questions 80 and 81 in Fig. 1). In SOEP publications, however, the term 'underemployment' refers generally to all persons in employment who want to increase their working hours. The question of whether they would be able to start working additional hours within two weeks does not play a role.

Unlike the microcensus questionnaire, the SOEP questionnaire does not contain a preceding "Yes-No" filter question regarding the desire to work more hours. Instead, such a desire is indirectly identified by comparing the information on the preferred number of working hours with the number of hours generally worked (i.e. on average) (Questions 79 and 82 in Fig. 2). Persons in employment are considered underemployed in the SOEP if the desired number of weekly working hours is higher than the number of hours worked on average. The situation is just reverse regarding overemployed people. Here the number of hours generally worked is higher than the desired weekly working time.

In the microcensus questionnaire, the questions about overemployment are also preceded by a filter question before the preferred number of working hours is enquired in concrete terms (Questions 84 and 85 in Fig. 1). The filter question is intended to find out whether there really is a desire to reduce the working time. In 2015, however, answering this question was voluntary so that a "No response" category was added to the "Yes-No" options. It should be noted that the question about the desire to reduce the working time concerns only the employed people who have answered the "Yes-No" filter question about the desire to work more hours with "No" (for visualisation purposes, the filtering arrangements in Fig. 1 are highlighted in bright red, while they are printed in black in the original microcensus questionnaire).

To determine the extent to which the wording, sequence and number of questions impact the results of measuring working time and working time preferences, a uniform definition of underemployment has to be agreed initially. As the criterion of availability is not included in the SOEP, for uniform underemployment operationalisation purposes all people who wanted to increase their working hours were also covered in the microcensus, irrespective of whether they would be able to start working additional hours within two weeks.

In addition, other influencing factors, as far as possible, had to be filtered out in order to achieve approximately ceteris paribus conditions between the microcensus and the SOEP. To this end, additional adjustments were made to both surveys. For instance, evaluations were restricted to the age group of the 20 to 64 year olds in both surveys (see Rengers et al., 2017, p. 22 ff. for further adjustments).

However, the microcensus-SOEP adjustments did not result in a clear shift regarding the differences between the microcensus and the SOEP results. Despite the limited age range (people aged 20 to 64 years), the number of underemployed persons rose to 3.024 million in the microcensus because the availability criterion was not applied. With an unchanged operationalisation of overemployment, this declined to 901,000 persons (cf. Table 1). While underemployed people wanted to increase their weekly working time by an average of 11.1 hours, those who were overemployed wanted to reduce their working time by 10.5 hours. Just over 88% of the surveyed group of employed people did not want to change their weekly working hours.

Table 1: Persons in employment by working time and working-time preferences 2015

	Persons			Weekly working time			Desired change of weekly working time		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
	1,000			Hours					
	Microcensus/labour force survey								
Population	48,930	24,586	24,343	X	X	X	X	X	X
Persons in employment	34,775	18,862	15,913	36.2	40.4	31.3	0.7	0.5	0.9
full-time employment	26,332	17,400	8,932	41.5	42.2	40.2	0.0	0.1	-0.1
part-time employment	8,444	1,462	6,981	19.7	18.8	19.9	2.8	5.3	2.3
Underemployed persons	3,024	1,402	1,621	28.4	33.8	23.8	11.1	10.4	11.7
full-time employment	1,371	971	400	39.9	40.4	38.6	6.7	6.9	6.1
part-time employment	1,653	431	1,222	18.9	18.9	18.9	14.7	18.0	13.6
Overemployed persons	901	499	402	42.0	44.4	39.1	-10.5	-11.0	-9.9
full-time employment	829	490	339	43.5	44.8	41.7	-10.8	-11.1	-10.4
part-time employment	72	9	62	24.5	22.2	24.8	-7.1	-7.1	-7.1
Discrepancies, total	3,925	1,902	2,023	X	X	X	X	X	X
	Socio-Economic Panel (SOEP)								
Population	46,793	23,702	23,091	X	X	X	X	X	X
Persons in employment	33,038	17,700	15,338	38.2	42.4	33.2	-3.4	-4.2	-2.4
full-time employment	25,741	16,452	9,289	43.4	44.3	41.8	-5.3	-5.1	-5.7
part-time employment	7,297	1,248	6,049	19.6	17.7	20.0	3.5	7.7	2.6
Underemployed persons	4,976	2,047	2,928	26.3	32.4	22.0	9.0	8.9	9.0
full-time employment	1,986	1,375	611	39.6	40.5	37.5	5.3	5.5	5.0
part-time employment	2,990	672	2,318	17.4	15.8	17.9	11.4	15.9	10.1
Overemployed persons	18,740	10,716	8,023	43.1	45.9	39.4	-8.3	-8.6	-7.9
full-time employment	17,109	10,523	6,587	45.0	46.3	43.0	-8.6	-8.7	-8.4
part-time employment	1,630	194	1,437	23.0	21.1	23.2	-5.3	-5.6	-5.2
Discrepancies, total	23,716	12,763	10,951	X	X	X	X	X	X

Persons in employment aged 20 to 64 years, after microcensus-SOEP adjustments

Source: Rengers et al., 2017, Table 3, p. 23 (translated into English)

In the SOEP, the data on underemployment and overemployment increased as the population typically covered only includes dependent employment. After the microcensus-SOEP adjustments, however, self-employed people were included, too. Table 1 shows that the number of underemployed people now amounts to 4.976 million, while that of overemployed persons totals 18.740 million. According to the SOEP, the underemployed want to work an extra 9 hours per week on average, while the overemployed want to reduce their working time by 8.3 hours. On the whole, nearly 72% would like to change their working hours.

Analysis of causes

There are many differences between the microcensus and the SOEP that cannot be described here in detail. Rengers et al. (2017) analysed a total of eight aspects which might be the causes of the clear differences in the results of working time and working-time preference measurements. Here is a summary of the most important results:

Sequence of questions and recording of different working hours:

The microcensus and the SOEP results differ markedly not only regarding the desired number of working hours but also the hours generally worked (i.e. on average). Table 1 shows that the average weekly working time is 36.2 hours (full-time: 41.5 hours) in the microcensus whereas the SOEP result amounts to 38.2 hours (full-time: 43.4 hours). This in turn can be a reason for the large discrepancies between the underemployment and overemployment results because these data were used directly for operationalisation in the SOEP. As the SOEP enquires not only the number of weekly hours generally worked, but also the contractually stipulated working time, Rengers et al. (2017) could also investigate the extent to which another working time concept would change the results of underemployment and overemployment.

Table 2: Underemployment and overemployment calculations based on the contractually stipulated working time

	Persons		
	Total	Men	Women
	1,000		
	Socio-Economic Panel (SOEP)		
	hours generally worked		
Persons in employment	30,386	16,016	14,369
full-time employment	23,690	14,982	8,708
part-time employment	6,696	1,034	5,661
Underemployed persons	4,550	1,825	2,725
full-time employment	1,873	1,289	584
part-time employment	2,677	536	2,141
Overemployed persons	17,156	9,645	7,511
full-time employment	15,607	9,458	6,149
part-time employment	1,549	187	1,362
	contractually stipulated working time		
Persons in employment	28,684	15,066	13,618
full-time employment	21,581	14,079	7,502
part-time employment	7,103	987	6,116
Underemployed persons	6,813	3,356	3,457
full-time employment	3,805	2,848	958
part-time employment	3,008	508	2,500
Overemployed persons	8,198	4,255	3,943
full-time employment	7,268	4,128	3,140
part-time employment	931	127	803

Persons in dependent employment aged 20 to 64 years, after microcencus-SOEP adjustments

Source: Cf. Rengers et al., 2017, Table 8, p. 32 (translated into English)

Table 2 shows the different SOEP results of overemployment and underemployment calculations based on the differences between, on the one hand, the desired and the contractually stipulated working time and, on the other, the desired working time and the number of hours generally worked. The surveyed group of people only included persons in dependent employment. Taking the hours worked on average as a basis, more than 71% of this group wanted to change their working hours; the vast majority of 80% wanted to reduce their working time (17.2 million overemployed as compared to just under 4.6 million underemployed people). Taking the

contractually agreed working hours as a basis, the desire to change their working time could be established for no more than just over 52% of the 28.7 million people in dependent employment who had answered all relevant questions (8.2 million overemployed and 6.8 million underemployed people). The ratio of overemployed to underemployed people in all persons in employment with working time discrepancies changed from 80:20 to 55:46.

Possibly, the information provided on different types of working hours depends on the sequence of questions. If the question about the contractually agreed working hours is put first and then followed by the question about the hours generally worked (i.e. on average), this may lead to an excessive number of hours worked because "overachievement" regarding the agreed working time is presumed to be socially desirable or at least commendable.

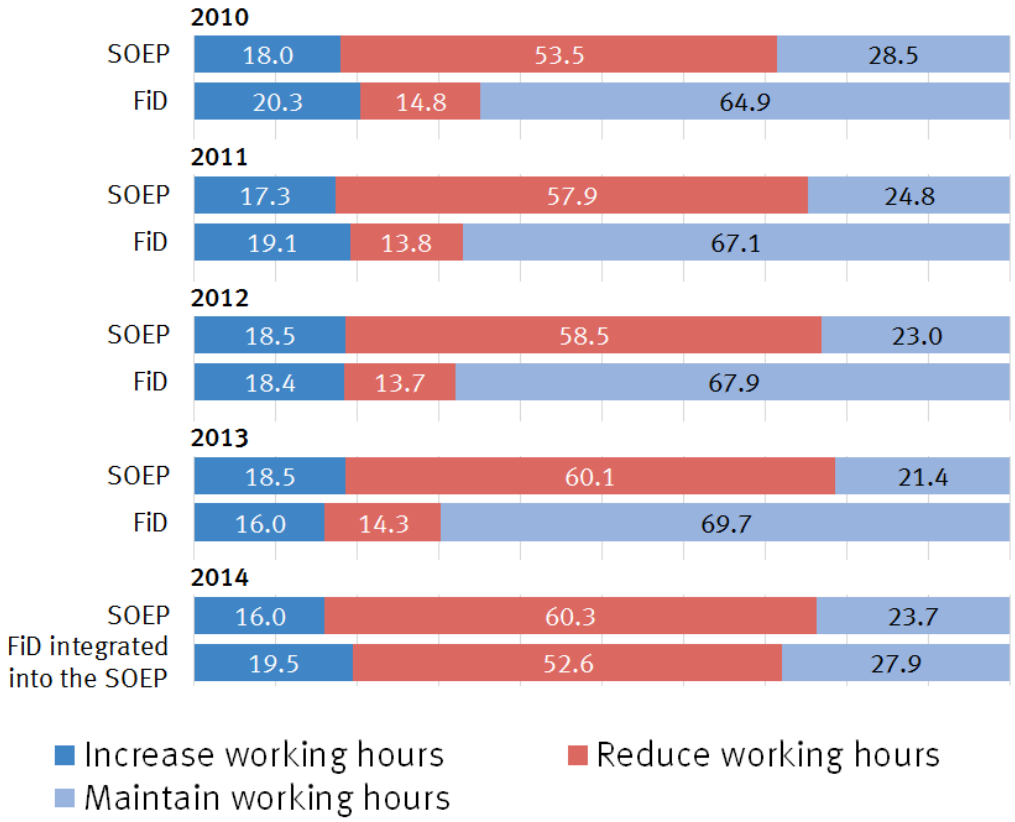
Preceding filter question:

A comparison of Fig. 1 with Fig. 2 reveals the different approaches to enquiring working time preferences in the microcensus and the SOEP. While the microcensus questionnaire includes preceding filter questions, the SOEP enquires the desired working hours right away. The respondents in the microcensus first have to answer a preceding filter question, namely a dichotomous "Yes-No" question as to whether they want to increase their working hours. Only then they are asked to indicate the concrete number of desired working hours. Only respondents who have answered the question of whether they would like to increase their working time with "No" are then asked whether they would like to reduce their working hours. Whether the microcensus results of underemployment and overemployment would be different if the sequence of the preceding filter questions changed – that is, if the question about a desired reduction in working hours preceded the question about an increase in working time – is however unclear. Another possible approach would be to include a single preceding and at the same time "neutral" filter question about the desire to change the working hours which, instead of "Yes-No" answer categories, would rather comprise variable values such as "Maintain" "Reduce" and "Increase".

Exactly this variant of a preceding filter question was used by DIW Berlin in its "Families in Germany (FiD)" survey. The FiD survey is an SOEP-compatible additional survey on a household longitudinal data basis. Since 2010, DIW Berlin has used this survey to obtain more information on families in Germany. Until 2014, the FiD survey included a filter question which preceded the questions about the desired working time. Respondents first had to indicate whether they wanted to maintain, reduce or increase their working hours. In 2014 the FiD survey was integrated into the SOEP and the wording of the SOEP questions used to enquire working time preferences. The respondents of the former FiD survey now had to answer the SOEP question about the desired working hours without a preceding filter question. Fig. 3 shows a comparison between the SOEP and the subsample of the FiD survey as well as the relevant changes in results. The average proportion of persons in employment who wanted to change their working hours increased from 32.6% in the FiD survey to 72% in the survey without preceding filter question for the same group of people.

Even though a one-to-one comparison of these results with the microcensus and its two separate filter questions is not possible, the assumption that the use or non-use of a preceding filter question might explain a large part of the differences in working time preferences identified in the SOEP and the microcensus has been substantiated.

Figure 3: Impact of the filter question effects: comparison between SOEP and FiD



Source: Own calculations, SOEP 2014, v.31. Only persons in employment with children aged under 16 / 18 years in the household. 2017 – 01 - 0706

Source: Rengers et al., 2017, Fig. 1, p. 25 (translated into English)

Explicit reference to changes in earnings:

As is known from previous studies on recording the desire to work more hours in the microcensus, an explicit reference to an increase in earnings may lead to overcoverage of underemployed people. The analyses by Körner et al. (2013) and Rengers (2014) indicate that the wording "with a corresponding increase in earnings" encourages people to formulate a desire to work more hours. As of 2008, a phrase like that has been included in the microcensus questionnaire in the "Yes-No" filter question about the respondents' desire to increase their weekly working hours. In the years before, the question did not contain this phrase. After the change, the percentage of underemployed people in all persons in employment increased by roughly five percentage points (from 8.5% to 13.7% – especially for people employed full-time).

The extent to which, vice versa, an explicit reference to a corresponding decline in earnings in the question about the desire to reduce the working time would lead the respondents to be more cautious could however not be investigated. The question about a desired reduction in working hours was incorporated in the microcensus only in 2008 and has included an explicit reference to a corresponding loss in earnings right from the beginning.

Another issue which remains open concerns the impact an explicit reference to an "adjustment of earnings" could have in a single preceding and at the same time "neutral" filter question regarding the desire to change the working hours as compared to the cumulative effects of two separate and successive filter questions – one indicating an increase, the other a loss in earnings.

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Financial accounts of health expenditure in Germany

In health expenditure accounts, the Federal Statistical Office provides information on the expenditure of the German healthcare system to the political and scientific communities and to the interested public. At the international level, the Federal Statistical Office reports health expenditure, in accordance with the System of Health Accounts 2011, to the Organisation for Economic Co-operation and Development (OECD), the World Health Organization (WHO), and the Statistical Office of the European Union (Eurostat), thus permitting international comparisons of healthcare expenditure.

In the last few years, there has been growing user demand for more detailed information on financial aspects of the healthcare system. The focus is on the question of how health expenditure is funded. The OECD, WHO and Eurostat, together with the Member States, have reacted to this demand and have updated the System of Health Accounts. The System of Health Accounts 2011 includes a classification of revenue of the institutions funding the healthcare system. Based on this classification, the Federal Statistical Office compiles financial accounts, which are integrated into the existing national health expenditure accounts, and provides data meeting international standards in accordance with the System of Health Accounts 2011. The results will be available in spring 2018.

Bases of financial accounts

Health expenditure accounts are a secondary statistical accounting system. Since 1992, it has covered any expenditure made on goods and services and directly arising from medical therapeutic treatment or a prevention, rehabilitation or long-term care measure. Expenditure is represented in a three-dimensional manner by funding institution, service type and facility. Data are acquired at the level of eight funding institutions, the largest of which being statutory health insurance. Based on the data of funding institutions, health expenditure is broken down by service type and facility.

Financial accounts are not an independent accounting system. They are part of health expenditure accounts and, as such, its purpose is to explain the financing of expenditure. By definition, a basic assumption is that expenditure in expenditure accounts equals revenue in financial accounts. Also, the overlap between financial accounts and expenditure accounts is extended by the fact that revenue data, too, are acquired at the level of funding institutions. This structure allows direct linkage between funding institutions and revenue. In addition, the structure requires that data acquisition primarily aims at the provision of information allowing a breakdown of revenue by type.

What data are provided by the new financial accounts?

Revenue is classified by its origin. At the highest level of representation, revenue is broken down by government transfers, social insurance contributions, compulsory contributions or compulsory premiums, voluntary contributions or premiums and other revenue. An item not relevant for Germany is revenue from foreign sources. At the next level, revenue is broken down by employees and employers or households and enterprises. At this level, government transfers are broken down by recipient of transfer payments, rather than by origin.

Actually, financial accounts provide a cross tabulation of funding institutions and revenue. For every funding institution, and for the healthcare system as a whole, data are provided on the financing of expenditure. The information is not limited to identifying the institutions bearing the economic burden of the healthcare system. Based on the revenue classification, information is also provided on the way in which institutions contribute to funding.

The results of financial accounts will be presented in spring 2018 together with the annual publication of health expenditure accounts. It is planned to provide the results of financial

accounts in the same way as expenditure accounts, that is, as a time series from 1992 that will be extended annually by a new reference year.

Outlook: future challenges

Health expenditure accounts are a dynamic accounting system that continuously adjusts to the legal framework conditions of the healthcare system. Consequently, they have to be continuously be developed further. The same will apply to the new financial accounts. In addition, there are two options for the future development. National health expenditure accounts are strongly based on the System of Health Accounts 2011, both methodologically and conceptually. But is also takes account of the German healthcare system and its specificities. It would thus be possible to include further specificities in financial accounts at the national level. It should especially be examined whether the tax deductibility of health insurance contributions could be covered as a government subsidy. This is not allowed under the System of Health Accounts 2011. There is a second development option regarding the identification of expenditure and revenue. With continuously improving basic data, it might be possible to exactly cover the revenue of funding institutions and, consequently, to show the surplus or deficit of individual funding institutions.

Summary

Developing financial accounts in the context of health expenditure accounts and the System of Health Accounts 2011 is a response to increasing demand for information on the financial aspects of the healthcare system. The new financial accounts will satisfy these needs and will provide data as from 1992 that meet international standards.

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Events

Conference on "Measuring Prices"

On 8 and 9 June 2017 the 21st conference on "Measuring Prices" took place in Berlin. The event was hosted by the Statistical Office for Berlin-Brandenburg in the Louise Schroeder hall of the Rotes Rathaus in Berlin. Every year, the conference provides a platform for researchers and official statisticians to exchange their ideas on issues of price statistics. The conference was attended by representatives of the Federal Statistical Office, the statistical offices of the Länder, Eurostat, the European Central Bank, the Deutsche Bundesbank, Trier University and the Senate of Berlin administration. The spectrum of topics of this year's conference ranged from theoretical and practical index issues and the approach to forecasting inflation for monetary policy purposes through to European and international developments in the area of price statistics and price comparisons at the regional level. Experts of the Federal Statistical Office's Division D3 gave four talks on the following topics:

- Pascal Böhnlein (D303): "Behandlung von Nullpreisen in der Verbraucherpreisstatistik" (Treatment of zero prices in consumer price statistics)
- Annica Böttcher (D303): "Umsetzung des Pflegestärkungsgesetzes II in der Verbraucherpreisstatistik" (Implementing the Act to Strengthen Long-Term Care II in consumer price statistics)
- Florian Burg (D303): "Verwendung von Konsummodellen in der Verbraucherpreisstatistik" (Using consumption models in consumer price statistics)
- Lisa Reinheimer (D303): "Harmonisierter Verbraucherpreisindex zu administrierten Preisen" (Harmonised Index of Consumer Prices at administered prices)

In his talk, Pascal Böhnlein explained how so-called zero prices would be taken into account in computing the national consumer price index (CPI) and the Harmonised Index of Consumer Prices (HICP) in the future. Zero prices are referred to in cases where, at a definite time, products (mostly services) are available to households free of charge. Examples are government services in the area of education, health or social protection. Regarding the scope of consumer price statistics, zero prices become relevant when products provided free of charge become chargeable or vice versa. According to European requirements, such changes have to be reflected in consumer price statistics. As the elementary indices at the lowest level of breakdown (delimitation: product type per outlet type and Land) are calculated from average prices using Dutot's conceptual approach, formally, taking zero prices into account does - in most cases - not cause difficulty. Based on the Dutot formula, average prices are calculated as the arithmetic mean of the individual prices for an elementary index delimitation so that individual zero prices can be easily included in the average price calculation. Only if all prices regarding an elementary index delimitation (and thus the average price, too) amounted to zero, a transition to a positive average price would not be possible in purely arithmetical terms. In that case, the delimitation of the elementary index level would have to be changed in a way to achieve a positive average price in both periods concerned.

Annica Böttcher showed how the Act to Strengthen Long-Term Care II has been implemented in the area of consumer price statistics since January 2017. Pursuant to the Act to Strengthen Long-Term Care II, the range of long-term care insurance services was expanded, e.g. by changing the previous three care levels into five grades of care. People in need of long-term care now have equal access to the services irrespective of the type of impairment (physical, mental or psychological). As higher amounts have been assigned, without exception, to home care services, consumer price statistics have recorded a decrease in co-payments by people insured under a statutory health insurance scheme. As a result, a marked decline in prices has been

recorded as of January 2017. Due to the new system of care grades, the existing consumption models had to be adjusted and expanded to represent the new standard benefits (e.g. expanded to include nursing care services). In the area of residential care, the financing model of care facilities was fundamentally changed by introducing a uniform co-payment for all facilities regarding people with care grades 2 to 5 insured under a statutory health insurance scheme. The former individual co-payments for each care level were abolished. A provision to maintain existing standards has however ensured that additional burdens, especially on people with lower grades of care, are offset by related allowances. On the whole, the effects on the development of residential care prices which are reflected in consumer price statistics have been rather small.

In his talk, Florian Burg discussed the use of consumption models in consumer price statistics. Consumption models, which define a product by compiling the various components/partial services, are mainly used for complex services. Consumption models are especially useful if the various components/partial services vary from provider to provider and can be selected by the consumer. This, on the one hand, facilitates the collection of prices of complex products by disaggregating them into components/partial services and, on the other, ensures the comparability of complex products of various providers. To calculate the total price, a calculation model is typically needed which, in addition to the individual prices of the various components/partial services, contains consumption patterns (weights of individual components) and auxiliary variables (e.g. transaction values for transaction-based charges). In the German consumer price statistics, consumption models are used for a large variety of product groups regarding prices that are collected decentrally by the statistical offices of the Länder and those collected centrally by the Federal Statistical Office. To harmonise the practical approaches of the individual statistical offices, a project was conducted to develop guidelines for the use of consumption models for major product groups.

Lisa Reinheimer provided information about the results of a feasibility study on the HICP at administered prices. The new European HICP framework regulation obliges the EU Member States to provide information about administered prices. This means that it has to be indicated whether the prices of the individual product groups within the HICP scope are influenced by the government. Taxes as an instrument of government influence are explicitly excluded here as effects of tax changes on the development of prices are measured by the HICP at constant tax rates (HICP-CT). A project co-funded by Eurostat was conducted to develop a new method for classifying the individual product groups as "mainly administered" and "fully administered". In this context, the pricing mechanism and the different tools of government influence are analysed and relevant rules are applied to decide whether government influence is significant. This approach can be generically used for all product groups. A list of legal bases and contacts has been set up and a system to report changes established for annually updating the above classification. This classification of product groups based on the new method is expected to be used for the first time in January 2018 when Eurostat will be provided with the next annual data delivery.

More information on the conference and the individual papers are available at: https://www.statistik-berlin-brandenburg.de/home/messung-der-preise.asp

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National accounting specialist committee

The national accounting specialist committee met in Wiesbaden on 30 November and 1 December 2017. At the meeting, new developments in national accounts were communicated to major users and discussed with them. The event was attended by roughly 50 external participants coming, among other things, from federal ministries, research institutes, statistical offices of the Länder and industrial associations. At a get-together held at the end of the first day of the event, the participants had the opportunity for more in-depth discussions.

After the welcome address by Albert Braakmann, Head of the "National Accounts, Prices" Department, Dr. Frank Thalheimer from the Land Statistical Office of Baden-Württemberg reported about recent developments in regional accounts; such results are compiled by the Working Party on the National Accounts of the Länder. He explained, among other things, to what extent the results of national accounts and employment accounts can be improved by using, as a standard procedure in employment accounts, the economic activity (WZ) code of the business register instead of the WZ code of the Federal Employment Agency.

Then Thorsten Haug (Federal Statistical Office) illustrated how the pension assets of households will in the future be represented in national accounts. In the European System of Accounts 2010, a detailed overview of households' pension entitlements has been introduced for the first time, which will be published every three years starting at the end of 2017. The presentation covered not only the methodology of the calculation model and the data sources used but also results in a provisional table.

This was followed by a speech delivered by Dr. Silke Stapel-Weber (Eurostat), who presented current developments at the European and the international level. The focus was on statistical challenges in the context of globalisation and the current efforts aimed at providing data users with more timely information through earlier data release. The latter topic was treated in more detail in a talk by Christian Müller (Federal Statistical Office). In Germany, the quarterly gross domestic product (GDP) is currently released for the first time in a first release after t + 45 days, while Eurostat publishes the GDP of the EU and the euro area as early as t + 30 days. The paper presented the results of test calculations regarding the German "GDP flash t + 30 days".

In the first paper of the second day, Veronika Spies and Susanne Goldhammer (both Federal Statistical Office) treated the issue "globalisation as a statistical challenge". The starting point was the massive increase in the Irish GDP in 2015, which had been caused by the transfer of large multinational enterprises. Based on the Irish case, the speakers explained the relevant conceptual backgrounds and showed how similar processes are represented in German national accounts.

Then Stefan Hauf (Federal Statistical Office) talked about "revisions in national accounting and major revision 2019". After giving a brief overview of previous major revisions in Germany, he reported about international activities regarding the harmonisation of revision dates and the revision approach. Then Mr. Hauf explained the content planned for the major revision 2019; also, he briefly outlined the major revision 2024, which will be harmonised at a European level, whose details have however not been specified yet.

In the last paper of the event, Prof. Dr. Roland Döhrn of Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI) outlined the "user demands to be met by national accounts", especially with a view to short-term economic analysis. He dealt with issues regarding the timeliness and accuracy of the data and their revision proneness as well as with technical aspects of the range of data offered. Also, Prof. Döhrn talked about the conflicting goals of timeliness and revision proneness of the German GDP results and what this means for his work.

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26th scientific colloquium on "Wage inequality - Facts, data, analysis"

Experts discussed wage inequality in Germany at the scientific colloquium held for the 26th time by the German Statistical Society and the Federal Statistical Office (Destatis) on 23 and 24 November 2017. The venue was Wiesbaden Museum. The event focused on the trends in eastern and western Germany, the gender pay gap and the distribution of pay in the upper and lower pay brackets.

The colloquium is a platform for the dialogue between official statistics and user groups from the scientific community, business community, politics, administration and associations.

More than 150 persons attended the event. Sibylle von Oppeln-Bronikowski, Head of the 'Strategy and Planning, International Relations, Research and Communication' Department of the Federal Statistical Office, welcomed the guests on behalf of the President. The colloquium was moderated by Bernd Fitzenberger, Professor at Humboldt University of Berlin, who also introduced the subject.

Talks were given by the following experts from the Federal Statistical Office: Norbert Schwarz ("Income development as reflected in national accounts"), Martin Beck ("Gender pay gap"), Ralf Droßard and Kathrin Frentzen ("Adjustment and effect of the statutory minimum wage"). From an EU perspective, Ines Kolakovic of Eurostat reported on "Wage inequalities in the EU".

It was important to the hosts to provide a forum for representatives from institutions which look at the issues from different angles. Prof. Dr. Gustav A. Horn of the IMK (Macroeconomic Policy Institute) within the Hans-Böckler-Foundation, Düsseldorf, dealt with the "Causes of wage inequality". These were analysed also by Dr. Hans-Peter Klös of the Cologne Institute for Economic Research in his talk about "Implications of the gender pay gap for economic policy". Prof. Dr. Dr. h.c. Joachim Möller from the Nuremberg Institute for Employment Research gave a talk about the "Long-term trend of gross earnings inequality".

Dr. Christina Boll from the Hamburg Institute of International Economics (HWWI) also contributed to the controversial debate on the pay differential between men and women with her talk on the "Potential effects of minimum wage on the gender pay gap in Germany".

Prof. Dr. Miriam Beblo of Hamburg University presented her research based on a "Wage inequality experiment", which analyses influencing factors that are difficult to cover in official statistics or surveys.

Please go to www.destatis.de › Methoden › Kolloquien for the programme of the colloquium, short versions of the papers and the presentations.

At the end of the first day of the colloquium, the Gerhard Fürst Award was given to outstanding scientific projects closely related to official statistics.

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Federal Statistical Office grants the 2017 Gerhard Fürst Award

Every year since 1999, the Federal Statistical Office (Destatis) has granted the Gerhard Fürst Award for outstanding scientific projects closely related to official statistics. This year three projects won an award. For his doctoral thesis on "Wages and Unemployment before and after the German Hartz Reforms", Dr. Michael Weber received the 2017 Gerhard Fürst Award of the Federal Statistical Office in the "doctoral thesis" category. This doctoral thesis was supervised by Professor Dr. Marcel Thum at Technische Universität Dresden. The award money is 5,000 euros.

In the "Master's/Bachelor's thesis" category, the Master's thesis by M.Sc. Patricia Dörr on "Comparison of Methods for Combining Surveys over Time" was assessed as an outstanding performance and therefore won the 2017 Gerhard Fürst Award and the award money of 2,500 euros. This Master's thesis was supervised by Professor Dr. Ralf Münnich at Trier University.

Another junior academic received a Prize for Young Researchers. B.A. Marcel Stechert was awarded the prize for his Bachelor's thesis on "A Critical Analysis of Selected Effects in the Context of Introducing the Statutory Minimum Wage in Germany" which was supervised by Professor Dr. Beate Jochimsen at the Berlin School of Economics and Law. The award money of the Prize for Young Researchers in the "Master's/Bachelor's thesis" category is 1,000 euros.

The awards were presented at the 26th scientific colloquium on "Wage inequality - Facts, data, analysis" held by the Federal Statistical Office together with the German Statistical Society in Wiesbaden on 23 and 24 November 2017.

During the awards ceremony, Professor Dr. Walter Krämer (TU Dortmund University), Chairman of the Gerhard Fürst Award expert jury, gave the speeches in honour of the award winners.

These speeches by Prof. Dr. Walter Krämer were published in the 6/2017 issue of the "WISTA - Wirtschaft und Statistik" journal of the Federal Statistical Office. In 2018, the award winners will publish detailed articles on their papers in that journal.

Short versions of the award-winning papers and more detailed information on the presentation of the Gerhard Fürst Awards are available on the Federal Statistical Office's website at http://www.destatis.de/gerhard_fuerst_preis.

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