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NOMINAL AND REAL WAGES IN THE REPUBLIC OF SERBIA 2001-2020

Abstract

The aim of this paper is to present, decompose and analyze time series of average gross and net nominal and real wages in the Republic of Serbia. The paper presents monthly time series of wages for the period from January 2001 to December 2020. Time time series of wages are seasonally adjusted using the software JDemetra +, ver. 2.1.0 and the X13-ARIMA program. Real gross and net wages were obtained by dividing the series of nominal average gross and net wages by the retail price index (until January 2009) and then by the consumer price index (since January 2009). It has been noticed that there are three periods in the movement of time series of wages. In the period before the Global Financial and Economic Crisis (2000-2008), nominal and real wages recorded a strong upward trend. In the post-crisis period, from 2009 to 2017, there was a slowdown in wage growth. In that period, nominal wages were rising, and as a consequence of inflation, real wages stagnated. In the third period, from 2018-2020, due to wage growth in the public sector and low and stable inflation rates, both nominal and real wages have been growing. The beginning of each of these three periods coincides with changes in the methodology of calculating the average wage, which affected the appearance and variability of time series of wages, and especially the seasonal component in the series.

Key words*: average gross wages, average net wages, nominal wages, real wages, Republic of Serbia*

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НОМИНАЛНЕ И РЕАЛНЕ ЗАРАДЕ У РЕПУБЛИЦИ СРБИЈИ 2001-2020.

Апстракт

Циљ овог рада је приказ, декомпозиција и анализа временских серија просечних бруто и нето номиналних и реалних зарада у Републици Србији. У раду су приказане месечне серије зарада за период од јануара 2001. до децембра 2020. године. Временске серије зарада десезониране су применом софтвера JDemetra+, вер. 2.1.0 и програма X13-ARIMA. Реалне бруто и нето зараде добијене су дељењем серија номиналних просечних бруто и нето зарада индексом цена на мало (до јануара 2009. године) а затим индексом потрошачких цена (од јануара 2009. године). Уочено је да се у кретању временских серија зарада разликују три периода. У периоду пре Глобалне финансијске и економске кризе (2000-2008.) номиналне и реалне зараде бележе снажан растући тренд. У периоду након кризе, од 2009-2017. године дошло је до успоравања раста зарада. Номиналне зараде расту, а као последица високе инфлације, реалне зараде стагнирају. У трећем периоду, од 2018-2020., под утицајем раста зарада у јавном сектору и ниске и стабилне стопе инфлације расту и номиналне и реалне зараде. Почетак сваког од ова три периода коинцидира са изменама у методологији обрачуна просечне зараде, које су се одразиле на изглед и варијабилиет временских серија зарада, а нарочито на сезонску компоненту у серијама.

Кључне речи: *просечне бруто зараде, просечне нето зараде, номиналне зараде, реалне зараде, Република Србија*

Introduction

Traditionally, time series of wages have always occupied a prominent place in the national statistics of the Republic of Serbia. Except in regular monthly releases, data on wages in Serbia were published for the Socialist Federal Republic of Yugoslavia in the publications of the former Federal Statistical Office entitled *Index* (published monthly) and *Economic Trend* (published quarterly); for the Federal Republic of Yugoslavia, the data were published in the publications of the Statistical Office of Serbia and Montenegro, *Index* and *Economic Trend*, which continued to be published even after the break-up of the SFRY; finally, for the Republic of Serbia, data on wages have been published in the publications of the Statistical Office of the Republic of Serbia (SORS): *Monthly Statistical Bulletin* which is a monthly periodical, and *Trends*, published quarterly.

For many years, since the time of the Socialist Federal Republic of Yugoslavia, within the Federal Statistical Office, the Time Series Database functioned, first on the HOST IBM system, and from January 2014, the Time Series Database on SQL Server, under the IST application started functioning. Transfer of the analog Time Series Database on the PC platform within the IST application on the SQL server was a painstaking task which lasted from August 2011 to February 2015. The abbreviated methodology of the SORS Time Series Database on the HOST IBM system has been described in two issues of *Trends* (Đerić, Radanov-Radičev, Zlatanović & Milovanović, 2011a; Đerić, Radanov-

Radičev, Zlatanović & Milovanović, 2011b). From the first issue of *Trends*, published in 2004, until 2017, every year in the March issue of this publication, a complete list of time series of the Database Time Series was published with the presentation of time series by groups, subgroups and activities, as it has been described in Đerić & Zlatanović (2017). A number of time series, including the series of wages, were presented in graphical, index and analytical form. For selected series, a series of original monthly data, trend-cycle components and base or chain indices for the current and previous two years were published. The *Trends* published time series of nominal and real average gross and net wages in the form of series of base indices. The aim of this presentation was to monitor the dynamics of nominal and real wages.

In 2010, within the Statistical Office of the Republic of Serbia, a Dissemination Database was developed, which can be accessed via the Internet. The Dissemination Database provided access to time series to all interested users. A large number of time series of wages are also available in the Dissemination Database: average monthly wages, average wages by activities, by municipalities, by status of business entities, by qualification level, by gender and age, average wages in the public sector, monthly and annual wages indices. In addition to the Database, the Statistical Office publishes data on wages in the *Statistical Yearbook of the Republic of Serbia*, *Statistical Calendar of the Republic of Serbia*, *Bulletin Survey on the Structure of Wages*, *Monthly Statistical Bulletin*, *Municipalities and Regions of the Republic of Serbia,* monthly *Statistical Releases* and *Trends*, which is still published quarterly. The *Trends* publication today publishes basic data on wages: average wages, wages by economic activities, wages in the public sector, indices of nominal and real wages.

The paper presents time series of nominal and real gross and net average wages in the period 2001-2020. The aim of the paper was to analyse the structure of time series of wages and to show the movement of nominal and real wages. The seasonal character and variability of time series of wages were analysed. In addition, annual wage growth rates for three periods were calculated (for the period before the Global Financial and Economic Crisis, from 2000-2008; for the post-crisis period, from 2009 to 2017, and for the period from 2018-2020). Also the index series of nominal and real wages were analysed in order to gain insight into the dynamics of nominal and real wages.

After the Introduction, the second part of the paper entitled Theoretical Foundations and Literature Review gives the most important definitions used in calculating average wages, presents how the average wages have been calculated and how the methodology for calculating average wages has changed twice, in 2009 and 2018. The papers and authors who dealt with wages in the Republic of Serbia are presented and the aspects of wages they researched are reviewed. The third part of the paper, entitled Research Design and Methodology, presents the methodological details of the research, the process of seasonal adjustment of time series of wages and the model used in this process. It is explained how the indices of nominal and real wages were calculated. The fourth part of the paper, entitled Research Results and Discussions, presents monthly series of average gross and net wages and analyzes their characteristics. Monthly series of indices of nominal and real gross and net wages are also presented here and the dynamics of nominal and real wages are analysed. Finally, in the Conclusion, the most important findings are summarized. The Appendix provides charts showing the time series components of gross and net wages, tables containing descriptive statistics indicators for the series of gross

and net average wages for the period 2001-2008, 2009-2017, and 2018-2020 and also tables with monthly data on gross and net wages for the entire period from 2001-2020. It is of practical importance to know the basic descriptive statistical indicators such as standard deviation, measures of variation and ranges of variation. These indicators of descriptive statistics can be of great use in the analysis and give additional insight into the movement of wages in certain periods.

Theoretical fundamentals and literature review

The significance of time series of wages is great. Wage data are used to monitor the purchasing power of the population and as an indicator of living standards. Wage monitoring gives timely information for the analysis of economic trends and provides analysts and economic decision makers with an adequate starting point for analysing, forecasting and econometric modelling. Average wages are of the greatest importance in the analysis of wages. Average wage is a calculation category that is obtained on the basis of aggregated data on the number of employees and the mass of wages paid at the level of the business entity. Average wages serve as a starting point for calculating a large number of economic and social indicators, adjusting pensions and formulating various policies. The average wage is used to calculate the base for personal income tax, the base for calculating contributions for compulsory social insurance, for calculating the pension base and a number of other financial benefits such as unemployment benefits, severance pay, exercising the right to social assistance and so on.

Until December 2017, data on wages were collected by the Statistical Office of Serbia on the basis of the *Monthly Statistical Survey on Employees and Employee Wages* under the name *RAD-1*. The reporting units that submitted data in the survey were legal entities and entrepreneurs. For legal entities, the sample included 8,000 reporting units or about 65% of employees, and data on employees' wages working for entrepreneurs were obtained from the records of the Tax Administration. The calculation of the average wage included the wages paid in the reporting month, regardless of the month in which they were earned: "Since January 1997, and according to the instructions of the Federal Bureau of Statistics of February 21, 1997, average wages are calculated by the mass of wages paid in the reporting month divided by the number of employees according to the data of personnel records at the end of the reporting month. Data on average wages refer to all employees according to the data of personnel records, regardless of whether all of them received wages in that month" (Statistical Office of Serbia, 2009, 1). The calculation of the average wage did not include the wages of employees in the Ministry of the Interior, the Ministry of Defence, as well as the wages of employees based on contracts for temporary and occasional jobs. Data on average monthly wages were available 25 days after the end of the reporting month.

Since January 2018, there has been a change in data sources and methodology for calculating average wages. Namely, the average wage is calculated on the basis of data on wages from the records of the Tax Administration, which are collected through the electronic Tax return for withholding tax (form PPP-PD). Average wages are calculated on the basis of amounts of computed wages for the referent month and number of employees, expressed as full-time equivalent – FTE.Thus, the survey covered

all business entities that submitted to the Tax Administration an electronically completed form of tax return PPP-PD with calculated wages. In this way, a more complete coverage of wages was provided and the quality of wage data was improved. With the changes in the methodology, average wages are calculated on the basis of wages calculated for the reporting month. Data on average wages are available 55 days after the end of the reporting month. In addition to the average wage, the median wage, wage distribution, wage gap and other wage statistics are calculated.

Prior to this change in the method of collecting data on wages, there was another change in the methodology for their collecting that occurred in 2009. Starting from January 2009, the previous sample for calculating the average wage was expanded, so that in addition to wages paid to employees of legal entities, when calculating average wages, the wages paid to employees working for entrepreneurs (individuals) were taken into account. "Since January 2009, in addition to data on average wages of employees in legal entities (collected by Monthly statistical survey on employees and their wages RAD-1), data on employees' wages working for entrepreneurs (obtained from the Ministry of Finance – Tax Administration) are also included in the calculation of average salaries and wages." (Statistical Office of Serbia, 2009, 1).

In the following, we will see how this coverage expansion, which was done first in 2009 and then in 2018, reflected on the appearance and movement of time series of wages. But before that, let's state how the wage is defined and what is its coverage.

"In the research on wages (in accordance with the Labour Law and the Law on Personal Income Tax), wages encompass all payments to employees on which the corresponding taxes and contributions are paid at the expense of employees (gross wages). Wages excluding taxes and contributions (net wages) are wages without corresponding taxes and contributions. In accordance with Article 105 of the Labour Law, the wage of an employee consists of all benefits for work performed and time spent at work, benefits based on employee contributions to the employer's business success (awards, bonuses) and other benefits based on employment in accordance with the general act and employment contract. In accordance with Article 13 of the Law on Personal Income Tax, wages include compensations for work of employees outside employment (based on contracts for temporary and occasional work - Article 197 of the Labour Law), as well as personal wages of entrepreneurs" (Statistical Office of Serbia, 2019). The wage includes the following incomes: payments for overtime work, night and shift work, compensations for unperformed working hours (annual leave, paid leave), meals during work ("hot meal"), recourse, rewards and bonuses. "Hot meal" and recourse are included in wages by the amendments to the Labour Law from 2001 (Statistical Office of Serbia, 2019). Employees' wages do not include payments based on employment contracts, compensation for arrival and departure expenses (travel expenses), reimbursements for business trips in the country and abroad, severance pay, jubilee awards and similar payments on which taxes and contributions are not paid (Statistical Office of Serbia, 2018, 3).

Wages in the Republic of Serbia have so far been analysed in several scientific and professional papers. In an extensive study sponsored by the International Labour Organization (ILO), Arandarenko and Avlijaš (2011) analysed wage trends in the period 2000-2008 and the wage policy pursued at that time. Đerić and Radović-Stojanović (2012) presented and analysed the movement of wages in the period 1994-2011. Arsić

and Vuksanović (2017) analysed the level and dynamics of wages in the period 2001-2017, with an emphasis on the factors on which wages in Serbia depend. Anić and Vuksanović (2019) gave another analysis, this time with a review of the problems of inequality in the amount of wages. Kostadinović and Stanković (2020) dealt with the level of wages in the Republic of Serbia and regional differences in the amount of wages. The publication *Trends* of the Statistical Office of Serbia regularly publishes basic data on wages and analyses the movement of the index of nominal and real wages (Statistical Office of Serbia, 2021, 34-35). In all these publications, the annual data on wages are presented and analysed.

Research design and methodology

The monthly series of wages are presented here. The monthly data clearly show the characteristics of the time series of wages and the phase in the movement of wages. As will be seen below, time series of wages have a pronounced seasonal character. Seasonal fluctuations are a characteristic of many economic time series, and the course of the time series can be influenced by the effects of working or trading days, the effect of leap year and national calendar holidays and the effect of outliers - values of the series that differ significantly from other observations. The process of seasonal adjustment of time series identifies and eliminates the effects of regular and periodic repetition of these factors, i.e. the seasonal component and the effect of outliers, in order to gain a clearer picture of the dynamics of economic processes. Thus, the everyday, or rather monthly or quarterly reality is transformed into a reality in which the seasonal component is missing. We will see how the seasonal component manifested itself in the time series of wages.

The paper presents monthly data on average gross and net wages in the period from January 2001 to December 2020. Time series of wages are seasonally adjusted using the software JDemetra +, ver. 2.1.0 and the X13-ARIMA program. As a result of the seasonal adjustment procedure, the following were obtained: seasonally adjusted series, trend-cycle component and irregular component of time series of wages.

Since January 2014, the official statistics of the Republic of Serbia have started using the JDemetra + software and the X13-ARIMA program within it. Both programs: X13-ARIMA and TRAMO-SEATS within the JDemetra + software are intended for the analysis and modelling of time series of monthly and quarterly periodicals. They are designed to reliably meet the needs of professional analysts, mostly because they have the ability to work with large sets of time series in a completely automatic way. Version 2.1.0 of JDemetra + software was used in this paper. The main features of the X13-ARIMA program, within this software are forecasting and seasonal adjustment, detection of periodic fluctuations, adjustment and correction of outputs, trend assessment, calendar and seasonal factors, graphical and diagnostic effects.

Of all the models that have been used for many years, the most widely used for most economic monthly and quarterly series in the statistics of the Republic of Serbia was the Airline Seasonal Model (0,1,1) (0,1,1). However, other types of X13-ARIMA-SEATS models can be used, using diagnostic tests and criteria of JDemetra + software, but the nature of the economic series must always be taken into account, i.e. the economic activity it represents. In the seasonal adjustment of time series of wages, the Airline

model was used here.

When seasonally adjusting the time series of wages, the calendar and specifications are made according to the Instructions for seasonal adjustment of time series of the European Union. The series are seasonally adjusted using Eurostat software: Demetre 2.1.0, X13-ARIMA program, RSA5c model, log transformation and ARIMA model type, i.e. Airline model (p, d, q) (P, D, Q) = (0,1,1) (0,1,1), including the National Calendar for the Republic of Serbia, which was made according to Eurostat Recommendations for the construction of the calendar. The overall rating is Good for all 4 series. "Level shift" as a parameter is not excluded during the seasonal adjustment, in order to better notice the effect of the transition to a new methodology for calculating wages. Otherwise, when it (LS) is switched off, the trend becomes smooth even at the point of transition to the new methodology.

In the general case, the designation for the seasonal multiplicative model is ARIMA (p, d, q) (P, D, Q) s, where s represents the season period (s = 4 for quarterly series, and s = 12 for monthly series), p is the order of the autoregressive component, d is the level of integration of the time series, q is the order of the moving average component, P is the order of the seasonal autoregressive component, D is the level of seasonal integration, Q is the order of the seasonal component of moving averages. The Airline model (0,1,1) (0,1,1) stands out as a special case of seasonal ARIMA models that describe the stochastic nature of the seasonal component. This model was used to analyze the time series of the number of transported passengers in air traffic, and therefore it is called the "airline model" in the literature (Kovačić, 1995, 205). This model describes a time series characterized by ordinary and seasonal integration of the first order (d=D=1), i.e. its stationary representation is obtained by simultaneous application of the first difference operator and the seasonal difference operator. After the transformation, the time series then follows a seasonal multiplicative model of moving averages of the first order. At the same time, the Airline model is applied as a default model in several TRAMO/ SEATS and X-13ARIMA-SEATS specifications, as many studies have shown good applicability of this model to explain monthly and quarterly time series that have pronounced seasonal dynamics (Grudkowska 2016, 120).

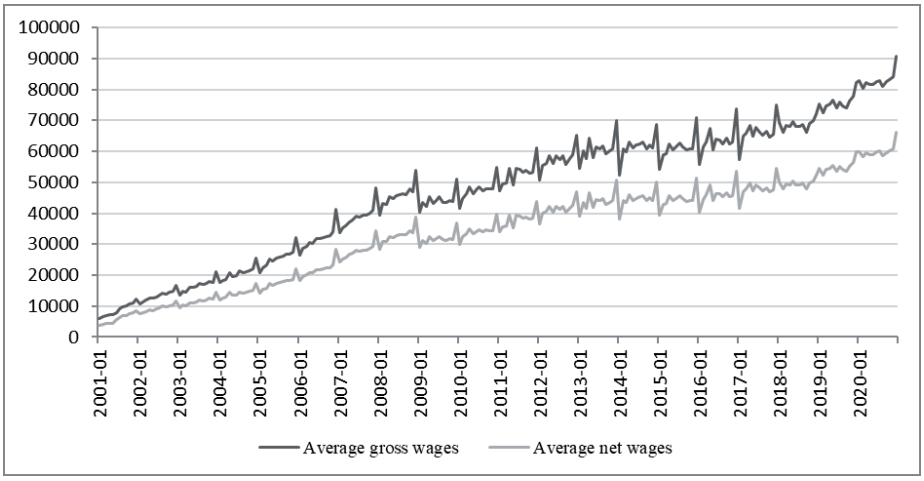
The dynamics of nominal and real wages in the paper was analysed on the basis of monthly indices of nominal and real gross and net wages. The procedure for calculating the indices of nominal and real wages in wage statistics is standard and well-known: first, nominal wages are converted into indices of nominal wages on some basis (here in the paper based on the 2019 average, since the last available data are from the end of 2020). Real wage indices are obtained by dividing nominal indices by the corresponding deflator. Here, in order to obtain real wage indices, it was necessary to form an appropriate monthly time series that will serve as a deflator of nominal wage indices. The consumer price index, which is the official measure of inflation in the Republic of Serbia and is commonly used as a deflator of nominal values, has been calculated and monitored since January 2007 and since January 2009 is the official measure of inflation in Serbia (National Bank of Serbia, 2009, 13). Until 2009, the official measure of inflation was the Retail Price Index. Accordingly, a series of deflators was formed - until December 2008, nominal wage indices were deflated by the Retail Price Index, and since January 2009, by the Consumer Price Index.

Research results and discussion

The average gross wage in the Republic of Serbia in 2001 amounted to 8691 dinars, and in 2020 it amounted to 82,984 dinars. The average net wage in 2001 was 5,840 dinars, and in 2020 it was 60,073 dinars. In the period 2001-2020. year, the average gross wage increased 9.5 times and the average net wage 10.3 times. At the beginning of the period, net wages amounted to 67.2% of gross wages, and at the end of the period 72.4% of gross wages. Gross wages increased at a rate of 12.6% on average per year and net wages at a rate of 13.1% on average per year (calculated as the geometric growth rate of average annual gross or net wages for the period 2001-2020, with data on average wages for the year taken from the Dissemination Database of the Statistical Office of Serbia).

The monthly time series of average gross and net wages are shown below.

Figure 1 Average gross and net wages in the Republic of Serbia 2001-2020, RSD



Source: Statistical Office of the Republic of Serbia; Author's presentation.

There are three periods in the movement of time series of wages: the first from 2001 to 2008, the second from 2009 to 2017, and the third from 2018 to 2020. The beginning of each of these periods coincides with the transition to a new methodology for calculating average wages.

Time series of wages show a pronounced seasonal character. Every year, wages systematically record a pronounced monthly growth in December due to various payments (bonuses, 13th wage, arrears) and an even more pronounced monthly decline in January due to holidays, celebrations, vacations. February could be marked as the month of the revival of gross wages, after a significant drop in January, which is in fact the result of a low level of wages in January, rather than a real revival of wages. As the average wage increased over the years, the seasonal component in the series of wages became more and more pronounced.

The seasonal component in the series has changed over time. After 2009, with

the inclusion of data on employees' wages working for entrepreneurs in the sample for calculating the average wage, the seasonal component is even more pronounced, especially in the second half of the period from 2009 to 2017. A more representative sample and higher coverage (inclusion in the sample data on employees' wages working for entrepreneurs since 2009) introduced additional seasonal variability in the series of average wages.

The intensity of seasonal influence in time series is affected by composition of calendar and the intensity of seasonal factor. Upon deseasoning and detrending, there remains an irregular component which captures such influences such as strikes, work stoppages, changes of economic policy, foreign trade regime, changes of measuring certain economic values – methodology. The irregular component oscillates around one, more or less depending on some immeasurable exceptional influences. Here, in the series of wages, variability of irregular components is most pronounced in the first period from 2001-2008, while in the remaining two sub-periods it is relatively stable oscillating around one (see in Appendix).

Net wages vary more than gross wages, the greatest variability in both series being recorded in the period from 2001-2008 (coefficient of variation for net salaries, and gross salaries is 53.1% and 51.2% respectively). Standard deviation is also highest in this period (see in Appendix). In the period from 2009-2017 the coefficient of variation for net salaries, and gross salaries is 13.5% and 13.1% respectively. The last period from 2018 to 2020, which covers just three years, is characterized by the smallest coefficient of variation and it is 9.5% for both gross and net salaries.

A new pattern in the movement of the series of wages can be noticed from January 2018. The change in the methodology of calculating the average wage from 2018 reduced the variability of the series and "ironed out" seasonal variations. As the calculation of the average wage now includes the wages that were calculated in a certain month (and not paid, as before), there is no longer that pronounced growth of the average wage in December which characterized the series in the previous period, and the last such seasonal increase was recorded in December 2017. In January 2018, there is no longer that sharp drop in wages after the seasonal growth in December, as before. Time series in the period from 2018 to 2020 are also characterized by an occasional increase in average wages as a result of an increase in wages in the public sector. In January 2018, wages in the public sector increased in the range of 5% to 10% (Law on Amendments to the Law on Budget System, Official Gazette of RS, No. 113/17). The next increase in wages in the public sector followed in January 2019, when these wages increased in the range of 7% to 12% (Law on Amendments to the Law on Budget System, Official Gazette of RS, No. 95/2018). Another increase in November 2019 in the range of 8% to 15% (Law on Amendments to the Law on Budget System, Official Gazette of RS, No. 72/2019) is also visible in the series of average wages, as well as the last increase in December 2020. Since December 2020, the wages of medical workers have increased by 5%, while other employees in the public sector received 3.5% in January and an additional 1.5% from March 2021. The army also received an additional increase of 10%. These last increased wages were to be paid from January 2021 (Law on Amendments to the Law on Budget System, Official Gazette of RS, No. 149/2020).

Wage growth in the period before the Global Financial and Economic Crisis (2001-2008) is characterized by a growing trend. In this period, average gross wages

grew by an average of 26.7% and average net wages by an average of 27.9% per year (calculated on the basis of annual data on wages of the Statistical Office of Serbia, as a geometric growth rate of average annual gross or net wages). However, wage growth in this period is considered to have been somewhat overestimated: "Wage growth recorded by the Statistical Office of Serbia was faster than" true "wage growth, for two reasons: (i) the inclusion of benefits in the tax base in 2001, which led to a one-off increase in gross wages; and (ii) the deviation of the RAD1 survey on companies in which the public sector and large private companies are over-represented when looking at wage developments in Serbia "(Arandarenko, Avlijaš, 2011, 23). Small, newly established private firms with low wages were not included in the sample for calculating average wages during this period. At the same time, wages in the public sector were higher not only in relation to those in the private sector but also in relation to the economy as a whole. Based on the data from the Dissemination Database of the Statistical Office of the Republic of Serbia on Wages in the Public Sector and the Economy as a whole, it can be calculated that in the period from 2003 (from when wages in the public sector are monitored) to 2008, wages in the public sector were higher on average by 20.2% of gross and 19.9% of net wages for the whole economy (calculated as the arithmetic mean of the difference in wages between the public sector and the economy as a whole by years for the period 2003-2008).

That the level of average wages as well as wage growth was to some extent overestimated can be seen from the fact that at the time when in January 2009 the sample for calculating the average wage included data on employees' wages working for entrepreneurs, there was a sharp decline in average wages. If the influence of the season is eliminated, from the seasonally adjusted data for average gross and net wages, it can be calculated that wages in January 2009 were lower than wages in December 2008 by 9.8% for gross and 9.8% for net wages. This transition to a new methodology and the decline in wages manifested itself in the time series of wages as a structural break. After the structural break, partly under the influence of the change in the methodology of calculating average wages and partly as a consequence of the Global Financial and Economic Crisis, the growth of average wages slowed down. In the period that followed the crisis, wages in the public sector were reduced several times, which was also reflected in the level of average wages and the growth rate of average wages at the level of the economy as a whole.

In the period after 2009, there was a slowdown in wage growth under the influence of the Global Financial and Economic Crisis and the stagnation of the economy that followed. Based on the annual data on wages from the Dissemination Database of the Statistical Office of the Republic of Serbia, it can be calculated that in 2008, the year of the crisis, a slightly higher growth of average wages of 17.9% for gross and 18% for net wages was recorded. Immediately afterwards, in 2009 there was a decrease in average wages by 3.3% for gross and 3.1% for net wages. After that, average wages continue to grow, but at a much slower pace compared to the pre-crisis period, while wages in the public sector have been reduced on several occasions.

There is an explanation for the growth of average wages during and after the crisis, despite the occasional decrease in wages in the public sector and the relatively low average wages in the private sector: "The fact that real wages did not fall during the crisis comes as a surprise. This suggests that the adjustment of the labour market in

the formal economy has occurred primarily through a reduction in employment, and not through a reduction in real wages" (Arandarenko, Avlijaš, 2011, 45). This explanation is supported by data on unemployment growth: the unemployment rate rose from 13.6% in 2008 to 16.1% in 2009, then 19.2% in 2010 and continued to grow (Statistical Office of the Republic of Serbia, 2011). The following explanations were offered for the growth of average wages in the period after the end of the crisis: dismissal of lower paid workers in the public sector, increase in the minimum wage at the beginning of 2009, a new methodology for calculating the average wage and, finally, an increase in coverage of wages including those in the private sector (Arandarenko, Avlijaš, 2011, 46-48).

The reduction of wages in the public sector occurred at the beginning of 2009. In January 2009, the *Law on Temporary Reduction of Wages, i.e. Salaries, Net Remunerations and Other Receipts in the State Administration and the Public Sector* (Official Gazette of the RS, No. 31/2009) froze wages, while the wages between 60,000 and 100,000 dinars were reduced for 10% and the wages over 100,000 dinars were reduced for 15%. This measure had the character of a kind of "solidarity tax" in the conditions of economic stagnation that followed the crisis. At the same time, the minimum wage was increased by 11% in January 2009 (Social and Economic Council of the Republic of Serbia, 2009), which to some extent contributed to raising the average wage in the private sector. In the period from 2012 to 2014, there was a policy of limiting wage growth in the public sector as part of a broader fiscal consolidation program, in which "... on the public expenditure side, the key measure was limited wage growth in the public sector ..." (Fiscal Council, 2015, 2). Another significant reduction of wages in the public sector by 10% followed at the end of 2014 and marked the beginning of a new fiscal consolidation (Law on Temporary Regulation of Bases for Calculation and Payment of Salaries, i.e. Wages and Other Permanent Income by Users of Public Funds, Official Gazette of the RS, No. 116/2014).

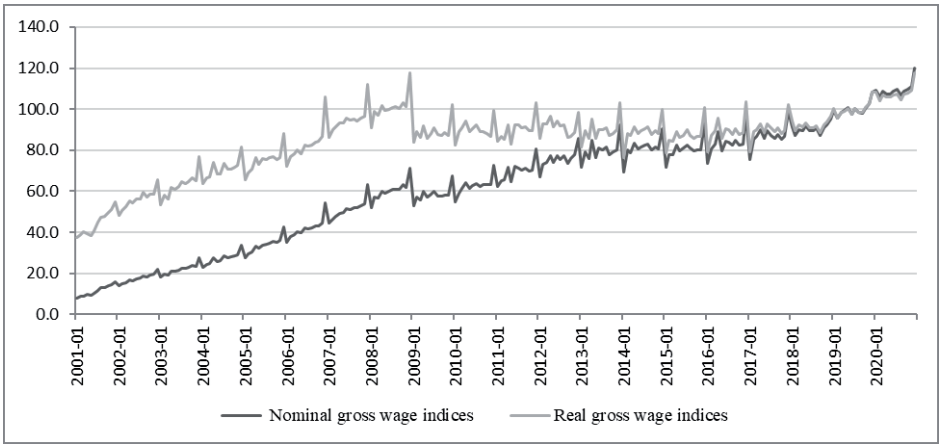
In the period of the new fiscal consolidation 2015-2017, it was planned to freeze wages in the public sector and pensions by the end of 2017 and reduce the number of employees in the public sector, but "... the decision to freeze wages and pensions was suspended twice, in 2016 and 2017" (Fiscal Council, 2017, 5). Despite the planned, wages in the public sector increased in 2016 in the range of 2-4% (Law on Budget System, Official Gazette of RS, No. 103/15) and in 2017 in the range of 3-5% (Amendments to the Law on Budget System, Official Gazette of RS, No. 99/2016). The end result of all these changes was that in the period from 2009 to 2017, average gross wages for the economy as a whole grew at a rate of 5.2% and average net wages grew at a rate of 5.3% (calculated on the basis of annual data on wages of the Statistical Office of Serbia, as a geometric growth rate of average annual gross or net wages). During this period, wages in the public sector grew more slowly than wages for the economy as a whole and increased by 2.8% (gross) and 2.9% (net) on average per year (calculated on the basis of annual data on wages for the public sector and the economy as a whole of the Statistical Office of Serbia).

In the period from 2001 to 2020, real gross wages (calculated as the ratio of nominal average gross wages and the corresponding deflator - retail price index or consumer price index) grew by 4.8% on average per year and real net wages (also calculated as the ratio of nominal average net wages and the corresponding deflator) grew by 5.2% on average per year. Real gross wages increased 2.4 times and real net wages increased 2.6 times,

which is significantly less than nominal growth - we saw that the average gross wage in this period increased nominally 9.5 times and the average net wage was nominally increased 10.3 times.

The nominal and real indices of gross and net wages are shown below.

Figure 2 Nominal and real gross wages indices (Ø2019 = 100), Republic of Serbia 2001-2020.



Source: Author's calculations

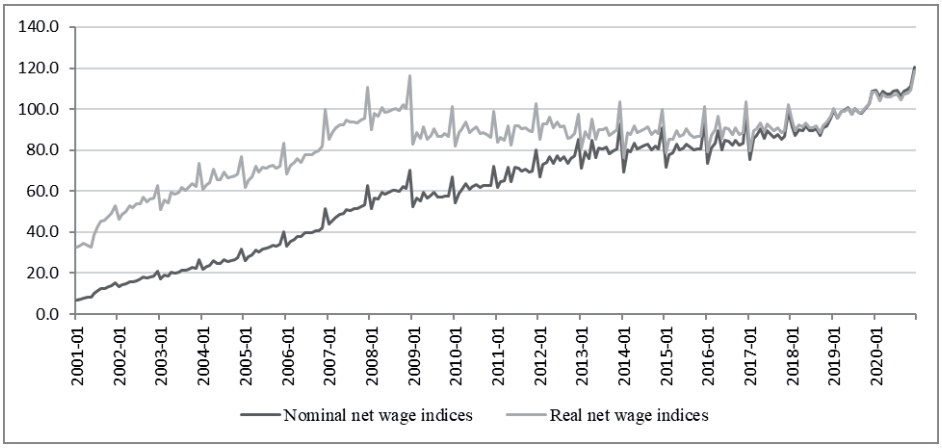
From 2001 to 2008, real wages grew. Calculated on the basis of annual indices of real gross and net wages published by the Statistical Office of Serbia, in this period the real growth of average gross wages was 13.6% on average per year and average net wages recorded a real growth of 13.2% on average per year. Thanks to the growth of nominal wages and the decline in the inflation rate, real wages were growing and the living standard of the population was increasing. The inflation rate in this period dropped from 19.5% in 2002 (Statistical Office of Serbia, 2008) to 8.6% in 2008 (National Bank of Serbia, 2021).

In the conditions of the crisis and immediately after the end of the crisis (except for 2009, as the only year in which there was a decrease in wages), nominal wages continued to grow, thus maintaining domestic demand and consumption at a level that provided GDP growth of 0.7% in 2010 and 2.0% in 2011 (Ministry of Finance, 2021). Real wages in this period remained unchanged. In the post-crisis period, from 2009 to 2017, nominal wages grew but wages stagnated in real terms. Average gross and net wages in this period recorded nominal growth of 5.2% and 5.3% on average per year, but the inflation rate was high. The inflation rate (measured by the Consumer Price Index) in 2009 was 6.6%, in 2010 it was 10.3%, in 2011 it was 7.0% and the highest inflation rate was recorded in 2012, when it reached 12, 2% (National Bank of Serbia, 2021). Slightly lower inflation rates were recorded at the end of the observed period, and as the inflation rate decreased and nominal wages increased, so did the difference between nominal and real wages. Price growth has slowed and inflation has come under control. In 2014, inflation was 1.7%, in 2015 the inflation rate was 1.5%, in 2016 inflation was 1.6%. In 2017, a slightly

higher inflation rate of 3.0% was recorded (National Bank of Serbia, 2021).

From 2009 to 2017, real wages did not increase and the annual indices of real wages (previous year = 100) are around 100. The geometric mean of the annual indices of real wages in this period is 99.9 for gross and 100.0 for net wages. Thus, after the end of the Global Financial and Economic Crisis, real wages always remained approximately at the level reached at the time of the crisis. Expressed in terms of real wages, by 2009 a certain level of living standard was reached, which was then maintained for a longer period of time. Gross domestic product in this period recorded low growth rates and a harsh winter in 2012 (when there was a decline in GDP of -0.7%) and floods (when a negative GDP growth rate of -1.6% was recorded again) hindered the already slow recovery after the crisis (Ministry of Finance, 2021). A slightly higher GDP growth rate of 2.9% was achieved only in 2013.

Figure 3 Nominal and real net wages indices (Ø 2019 = 100), Republic of Serbia 2001-2020



Source: Author's calculations

In 2018, a new growth trend in the time series of wages began. The change in the methodology of calculating the average wage coincided with the increase in wages in the public sector in January 2018. This increase in wages marked the beginning of a new phase in the movement of wages in which there is an increase in both nominal and real wages. Wage growth was due to wage growth in the public sector and an increase in the minimum wage of 10% in 2018 (Social and Economic Council of the Republic of Serbia, 2017), 8.6% in 2019 (Government of the Republic of Serbia, 2018) and 11.1 % in 2020 (Government of the Republic of Serbia, 2019). In 2018, the average wage at the level of the economy as a whole increased compared to the previous year by 4.2% (gross) and 3.7% (net), in 2019 it increased by 10.5% (gross) and 10.6 % (net) and in 2020 wages increased by 9.5% (gross) and 9.4% (net) (calculated on the basis of annual data on salaries of the Statistical Office of Serbia). At the same time, the inflation rate after 2018 was low and stable and amounted to 2.0% in 2018, 1.7% in 2019 and 1.6% in 2020 (National Bank of Serbia, 2021). Thus, thanks to the growth of nominal wages and a low and stable inflation rate, real wages grew.

Real wages increased in 2018 by 2.0% (gross) and 1.7% (net), in 2019 they increased by 8.5% (gross) and 8.6% (net) and in 2020 real wages increased by 7.8% (gross) and 7.7% (net), compared to the previous year (average real annual wages here are calculated on the basis of annual data on wages deflated by the Consumer Price Index). During this period, economic growth accelerated and GDP recorded slightly higher growth rates of 4.5% in 2018, 4.2% in 2019 and finally a smaller decline in the context of the Covid pandemic 19 of -1.0% in 2020 (Ministry of Finance, 2021). As monthly inflation has been stable during these three years, the difference between the index of nominal and real wages remained almost unchanged throughout this period, so their dynamics are uniform and the movement on the chart seems harmonized.

Conclusion

In the last two decades, there are three periods in the movement of wages in the Republic of Serbia. In the first period, from 2001 to 2008, wages grew in both nominal and real terms. The strong growing trend in the wage time series was interrupted by the Global Financial and Economic Crisis, which was felt in Serbia in 2009. In the period following the Global Financial and Economic Crisis, from 2009 to 2017, nominal wage growth continued at a slower pace than before crisis, and real wages have stagnated. Finally, from 2018-2020, time series of wages again recorded a growing trend, and as a consequence of low and stable inflation rates, there was not only an increase in nominal but also an increase in real wages.

Changes in the methodology of calculation of the average wage and the expansion of the coverage of wages, which was made first in 2009 and then in 2018, reflected on the appearance and movement of time series of wages, especially on its seasonal component. Until 2008, the seasonal component in the time series of wages is not too pronounced and grows gradually as the level of the series increases. Since 2009, the inclusion in the calculation of the average data on employees' wages working for entrepreneurs has increased the seasonal component. Finally, a significant expansion of wage coverage in the calculation of average wages from 2018 and inclusion of wages calculated in the month (instead of paid, as was previously the case), significantly mitigated the variability of wage time series and seasonal component in the series.

Real wage growth in the period from 2018 to 2020 enabled the increase of aggregate demand, stimulated economic growth and contributed to the maintenance of production in the conditions of the Covid pandemic 19. However, in the long run, if this growing trend would continue, it could cause the problem of matching wage growth with growth of other important macroeconomic aggregates. It is known that excessive wage growth can cause inflationary pressures. The growth of real wages affects the growth of imports and could affect the increase of the foreign trade deficit. The growth of wages in the public sector that are paid from the budget could affect the amount of the budget deficit. On the other hand, the incentive by wages for economic growth is important for the Serbian economy. There is also the issue of the growth of living standard, which has stagnated over a long period of time and which needs to be raised. Judging by the announcements of economic policy makers, who project the growth of average wages by 2025, the trend of wage growth will continue in the coming period, so such aspects of

analysis will become increasingly important in the future.

References

Anić, A., & Vuksanović, N. (2019). Nivo, dinamina i nejednakost zarada u Srbiji. Kvartalni monitor br. 57, april-jun 2019, str. 64-74.

Arandarenko, M., & Avlijaš, S. (2011). Iza vela statistike: otkrivanje strukturnih slabosti u Srbiji. U V. Šmit & D. Vogan-Vajthed (ured.), Uticaj krize na zarade u Republici Srbiji (pp. 23-52). Budimpešta: Međunarodna organizacija rada.

Đerić, N., Radanov-Radičev, M., Zlatanović, M., & Milovanović, M, (2011a). Struktura i metodološke osnove baze vremenskih serija (BVS) Republičkog zavoda za statistiku Srbije, Trendovi, Jun 2011, str. 6-11.

Đerić, N., Radanov-Radičev, M., Zlatanović, M., & Milovanović, M, (2011b). Struktura i metodološke osnove baze vremenskih serija (BVS) Republičkog zavoda za statistiku Srbije, Trendovi, Septembar 2011, str. 6-11.

Đerić, N., & Radović-Stojanović, J. (2012). Zarade u Republici Srbiji 1994 – 2011. Finansije 1-6/2012, Beograd, 2012, str. 118-136.

Đerić, N., & Zlatanović, V. (2017). Baze vremenskih serija u Republičkom zavodu za statistiku. Trendovi, Mart 2017, str. 8-11.

Fiskalni savet Republike Srbije (2015). Fiskalna konsolidacija 2012−2014. vs. 2015−2017: ovog puta je drugačije? http://www.fiskalnisavet.rs/doc/analize-stavovi-predlozi/fiskalna_konsolidacija_2012-14_vs_2015-17.pdf

Fiskalni savet Republike Srbije (2017). Fiskalna konsolidacija i privredni rast 2015-2017: plan, ostvarenja i pokretači, Mart 2017. http://www.fiskalnisavet.rs/doc/istrazivacki-radovi/FS%20radni%20dokument%20-%20KBF%202017%20(SRB).pdf

Grudkowska, S. (2016) JDemetra+ Reference Manual Version 2.1. Narodowy Bank Polsky. https://ec.europa.eu/eurostat/cros/content/jdemetra-reference-manual-version-21_en

Kostadinović, I., & Stanković, S. (2020). The Analysis of the Regional Disproportions in the Labor Market in the Republic of Serbia. Ekonomika, Vol. 66, january-march 2020, No 1, p.25-35.

Kovačić, Zlatko J. 1995. Analiza vremenskih serija. Beograd: Ekonomski fakultet.

Ministarstvo finansija (2021). Osnovni indikatori makroekonomskih kretanja, https://www.mfin.gov.rs/dokumenti2/makroekonomski-i-fiskalni-podaci

Narodna banka Srbije (2009). Izveštaj o inflaciji, februar 2009.

Narodna banka Srbije (2021). Osnovni makroekonomski pokazatelji, https://www.nbs.rs/sr_RS/drugi-nivo-navigacije/statistika/

Radanov-Radičev, M. & Đerić, N. (2016). Pregled razvoja metoda za desezoniranja i primena u statistici Srbije, Statistička revija, br. 1-4, 2006, Beograd.

Republički zavod za statistiku (2008). Statistički godišnjak Republike Srbije 2008.

Republički zavod za statistiku (2009). Istraživanje o zaposlenima i zaradama zaposlenih, Metodološki materijali i dokumentacija.

Republički zavod za statistiku (2011). Anketa o radnoj snazi, Beograd, 2011.

Republički zavod za statistiku (2018). Promena izvora podataka za izračunavanje prosečnih zarada. Beograd, 2018. https://www.stat.gov.rs/media/2437/zarade_brosura.pdf

Republički zavod za statistiku (2019). Zarade, Metapodaci, Periodika: Godišnja, Godina: 2019. https://data.stat.gov.rs/Metadata/24_Zarade/Html/2403_ESMS_G0_2019_2.html

Republički zavod za statistiku (2021a) Saopštenje, Tržište rada – zarade, 25.03.2021. https://publikacije.stat.gov.rs/G2021/Html/G20211080.html

Republički zavod za statistiku (2021b). Trendovi, IV kvartal , 2020., Beograd, 2021.

Socijalno-ekonomski savet Republike Srbije (2009). Odluka o utvrđivanju minimalne cene rada za period januar-jun 2009., Službeni glasnik RS, br. 8/09.

Socijalno-ekonomski savet Republike Srbije (2017). Odluka Socijano-ekonomskog saveta Republike Srbije broj 179/2017, Službeni glasnik RS, br. 88/17.

Vlada Republike Srbije (2018). Odluka Vlade Republike Srbije 05 broj 120-8569/2018, Službeni glasnik RS, br. 69/18.

Vlada Republike Srbije (2019). Odluka Vlade Srbije, 05 broj 120-9063/2019-1, Službeni glasnik RS, br. 65/19.

Zakon o budžetskom sistemu, Službeni glasnik RS, br. 103/15

Zakon o izmenama i dopunama Zakona o budžetskom sistemu, Službeni glasnik RS, br.99/2016

Zakon o izmenama i dopunama Zakona o budžetskom sistemu, Službeni glasnik RS, br.113/17

Zakon o izmenama i dopunama Zakona o budžetskom sistemu, Službeni glasnik RS, br.95/2018

Zakon o izmenama i dopunama Zakona o budžetskom sistemu, Službeni glasnik RS, br.72/2019

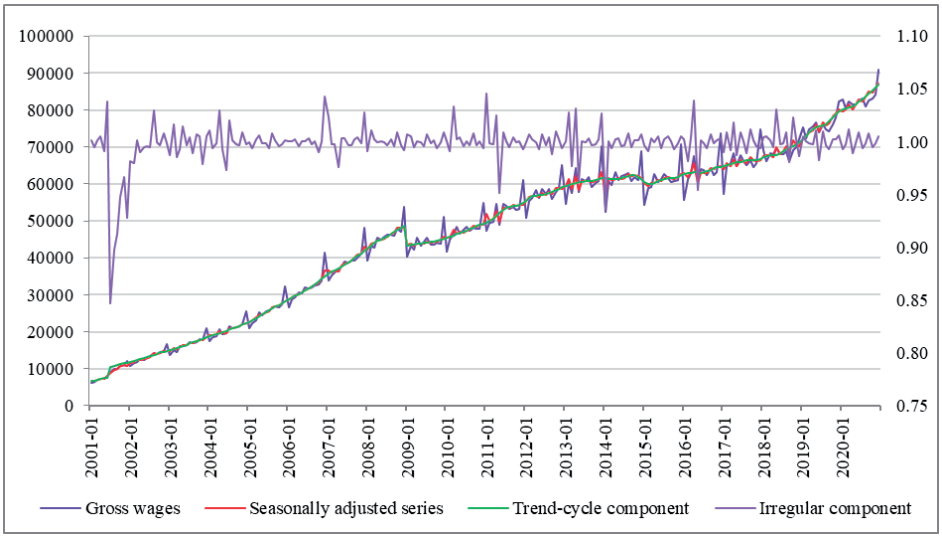
Zakon o izmenama i dopunama Zakona o budžetskom sistemu, Službeni glasnik RS, br.149/2020

Zakon o privremenom smanjenju plata, odnosno zarada, neto naknada i drugih primanja u državnoj administraciji i javnom sektoru , Službeni glasnik RS, br. 31/2009.

Zakon o privremenom uređivanju osnovica za obračun i isplatu plata, odnosno zarada i drugih stalnih primanja kod korisnika javnih sredstava, Službeni glasnik RS, br. 116/2014.

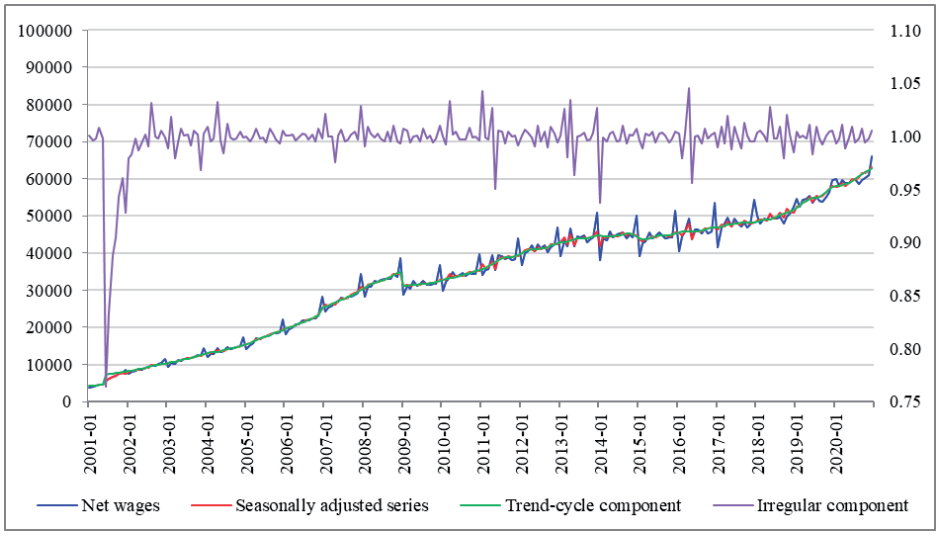
Appendix

Figure 1 Components of average gross wages, Republic of Serbia 2001-2020, RSD



Source: Author's calculations

Figure 2 Components of average net wages, Republic of Serbia 2001-2020, RSD



Source: Author's calculations

Table 1 Descriptive statistics of average gross and net wages, Republic of Serbia 2001-2020

Period	Number of observations	Gross wages				Net wages			
		Average (RSD)	Standard deviation	Range of variation	Coefficient of variation, %	Average (RSD)	Standard deviation	Range of variation	Coefficient of variation, %
2001-2008	8	25099	12850	36983	51,2	17539	9317	26906	53,1
2009-2017	9	57165	7480	21829	13,1	41346	5562	16160	13,5
2018-2020	3	75809	7178	14355	9,5	54881	5212	10423	9,5
2001-2020	**20**	**47136**	**21720**	**74293**	**46,1**	**33853**	**16010**	**54233**	**47,3**

Source: Author's calculations.Calculated from average annual gross and net wages.

Table 2 Average gross wages, Republic of Serbia 2001-2020, RSD

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual average
2001	6091	6546	6840	7256	7224	7953 (d)	9003	9799	9940	10647	11101	12143	**8691 (d)**
2002	10719	11410	11845	12590	12429	12952	13461	14317	13921	14439	14800	16643	**13260**
2003	13659	14925	14579	16018	15973	16425	17167	16932	17277	17986	17742	20975	**16612**
2004	17498	18414	18681	20807	19451	19700	21495	20823	21130	21472	22043	25392	**20555**
2005	20898	22402	23198	25153	24449	25503	25769	26252	26818	26721	27378	32244	**25514**
2006	26603	28657	29367	30572	30305	31864	31738	32098	32555	32668	33892	41294	**31745**
2007	33770	35219	36148	37117	37668	38916	38712	39302	39308	40082	41010	48122	**38744**
2008	39331	43218	42873	45355	44835	45608	46115	46222	46015	47883	46944	53876	**45674**
2009	40245 (b)	43353	42213	45304	43183	44246	45307	43597	43577	44147	43895	51115	**44147 (b)**
2010	41651	44871	46457	48525	46454	47486	48394	47190	48016	47822	47877	54948	**47450**
2011	47382	49394	49633	54532	49064	54616	54164	53285	53838	52944	53239	61116	**52733**
2012	50829	55505	56125	58465	56206	58712	57240	58503	55903	57733	58914	65165	**57430**
2013	54447	60199	57628	64249	57921	61399	60896	61797	59162	60102	60893	70071	**60708**
2014	52438	60845	59782	63167	60966	61992	62380	62992	60803	61963	60982	68739	**61426**
2015	54208	58992	59141	62532	60487	61302	62687	61538	60503	60767	60913	70763	**61145**
2016	55763	61279	63029	67464	60520	64019	63699	62474	64150	62414	63061	73641	**63474**
2017	57231	64847	65695	68246	64860	67857	66251	65094	66438	64602	65609	74887	**65976**
2018	69218 (b)	66084	68251	67901	69684	68047	68029	68831	66251	69012	69949	72167	**68629 (b)**
2019	75296	72350	74755	75441	76511	74009	76056	74768	74160	76096	77879	82257	**75814**
2020	82836	80288	82320	81486	81464	82572	83016	80901	82515	83106	84201	90849	**82984**

(b) Break in time series
(d) Differences in definition
Source: Dissemination Database, Statistical Office of the Republic of Serbia

Table 3 Average net wages, Republic of Serbia 2001-2020, RSD

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual average
2001	3821	4087	4262	4531	4497	5530 (d)	6268	6800	6900	7408	7729	8456	**5840 (d)**
2002	7435	7924	8204	8739	8635	8993	9342	9944	9674	10044	10293	11555	**9208**
2003	9468	10367	10126	11148	11043	11346	11865	11680	11953	12432	12254	14528	**11500**
2004	12078	12713	12911	14395	13455	13617	14630	14182	14444	14639	15042	17346	**14108**
2005	14263	15295	15863	17193	16731	17441	17634	17928	18345	18265	18697	22079	**17443**
2006	18191	19567	20094	20887	20713	21777	21774	21925	22259	22340	23148	28267	**21707**
2007	24122	25228	25960	26632	26981	27882	27752	28143	28161	28720	29373	34471	**27759**
2008	28230	30982	30809	32562	32147	32648	33058	33131	32969	34311	33613	38626	**32746**
2009	28877 (b)	31121	30362	32571	31086	31768	32553	31338	31319	31734	31576	36789	**31733 (b)**
2010	29929	32336	33508	34952	33463	34161	34591	33955	34570	34422	34444	39580	**34142**
2011	34009	35538	35777	39298	35362	39322	39127	38389	38763	38167	38363	43887	**37976**
2012	36639	40003	40562	42215	40442	42335	41180	42122	40258	41558	42395	46923	**41377**
2013	39197	43371	41689	46530	41821	44394	44182	44770	42866	43615	44120	50820	**43932**
2014	37966	44057	43452	45847	44184	44883	45216	45610	43975	44938	44206	49970	**44530**
2015	39285	42749	43121	45605	43964	44583	45601	44630	43925	44124	44166	51485	**44432**
2016	40443	44450	45870	49249	43951	46450	46280	45286	46558	45281	45767	53456	**46097**
2017	41508	46990	47814	49635	47136	49238	48101	47220	48212	46879	47575	54344	**47893**
2018	50048 (b)	47819	49400	49117	50377	49226	49202	49773	47920	49901	50556	52372	**49650 (b)**
2019	54521	52426	54271	54645	55380	53633	55042	54115	53698	55065	56331	59772	**54919**
2020	59941	58132	59681	58932	58892	59740	60029	58513	59698	60109	60926	66092	**60073**

(b) Break in time series
(d) Differences in definition
Source: Dissemination Database, Statistical Office of the Republic of Serbia