

THE INTENSITY OF IMPACT OF LABOR SUPPLY REDUCTION ONTO THE GROWTH OF WAGES IN REPUBLIC OF SRPSKA

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Abstract: *The aim of this research is to determine the level of intensity of the impact of labor supply reduction onto the growth of wages in Republic of Srpska. Simple linear regression is the main tool that is used in this research. The model of the relationship is established between two variables, the labor supply reduction and growth of wages in order to draw conclusions about the behavior of one, based on the behavior of the other variable. Concerning the results, we have seen that there is a marked reduction in labor supply at the level of the entire economy of Republika Srpska and a significant growth of wages. More importantly, the wage growth is very strongly influenced by labor supply reduction. By statistical regression analysis, we have determined the statistically significant, strong impact of the reduction of labor supply on wage growth ($y = -0.004x + 2365.3$; $R = -0.91$; $R^2 = 0.83$; $p < 0.01$). There is a general trend of wage growth that the pandemic crisis has not stopped and which will certainly continue in the post-crisis period. However, the key question is whether this kind of growth is sustainable. Unfortunately, there is a decline in labor productivity. The decline in gross value added per worker or labor productivity has been more or less pronounced in the three observed years. Current wage growth, with declining productivity, is not sustainable in the long run. If things with productivity remain as they have been for the three observed years and if the wage growth continues, it will inevitably lead to reduced competitiveness of the economy. The RS economy can avoid this trap if productivity starts to rise again. Improving productivity requires large investments in knowledge and technology, and companies need public sector support in this area.*

Key words: Labor Supply, Wages, Labor Productivity, Competitiveness

JEL Classification: E24.

INTRODUCTION

At the level of the overall economy of Republika Srpska, there is a significant decline in labor supply. This decrease in labor supply has a negative impact on the entire economy; however, labor-intensive economic sectors are more negatively affected, and geographically the most vulnerable are underdeveloped areas where the local economy has not developed in a way that creates enough quality jobs. Average gross and net wages continued to rise in this environment. From 2010 to the present, wages have constantly increased. However, salary growth has been particularly strong since 2017. Despite the pandemic health and economic crises, wages continued to rise in 2020.

The main problem addressed in this research is the impact of labor supply reduction onto to growth of wages. The main hypothesis in this research is that labor supply reduction very strongly influences growth of wages. This paper presents the results of that analysis and also some projection of trends in the labor market of Republika Srpska. The aim of this analysis is to determine the level of intensity of the impact of labor supply reduction onto to growth of wages and also to provide certain estimates related to labor market developments in the Republic of Srpska in the period 2021-2026, based on an analytical approach and exact indicators. The result of this analysis is a comprehensive estimation of the impact of declining labor supply on wage growth in the medium term, based on current trends.

In addition to the introduction, this document consists of five other parts. The second part reviews the literature that investigates relations between labor supply and wages. The third part presents the methodology, and the fourth the empirical data of labor supply, wage growth and productivity trends in the labor market of Republika Srpska. The fifth part of this paper is presenting results and discussion of results - correlation and regression between falling labor supply and rising wages. The sixth part provides some concluding remarks.

LITERATURE REVIEW

The large body of research that investigates relations between labor supply and wages can be divided into two categories. The first is concerned with the micro level. According to significant research of the micro supply of labour (Meghir & Phillips, 2010) (Saez, Slemrod, & Giertz, 2012) labor economists agree that relations between labor supply and wages are not very strong. Extending this approach to include all potentially significant sources of dynamism, like human capital accumulation, has been considered by a number of academics. This research has demonstrated that, even if the genuine model comprises different sources of dynamics, the data must be seen through the lens of the basic model. This research has demonstrated that if the genuine model comprises other sources of dynamics but the data is evaluated via the lens of the basic model, estimations of supply of labour changes will tend to underestimate their true values significantly.

The macro perspective is the focus of the second branch. Macroeconomists, on the other hand, frequently use equilibrium models with large Hicks and Frisch labor supply elasticities (Chetty, Guren, Manoli, & Weber, 2011). This research focuses on challenges related to aggregating in the relatively large margin. Small elasticities at the individual level might be compatible with large elasticities at the macro level, according to the research.

There is one thing that each of these literatures have in common. There is a direct link between parameters of individual level preferences and Hicks and Frisch elasticities at the aggregate level in MaCurdy's basic life cycle model (MaCurdy, 1981). That direct link is broken by all of the extensions to the basic model. This isn't to argue that personal preferences aren't still important.

The relation of labor supply and wages is a function of all other characteristics of the economic environment as well, not just supply itself: The wage process (e.g., how human capital is acquired), production technology (e.g., how productivity varies with hours), and so on are all examples of this. Individual preferences alone are insufficient to describe labor supply in these more complex situations. In general, structural modeling of the entire economic environment is required to predict the impacts on changes in wages. Also, changes of after-tax salaries can have a wide range of effects on labor supply, due to the nature of the adjustment, how long it's been in force, and the age range affected.

THE METHODOLOGY

Simple linear regression is the main tool that is used in this research. It is statistical method used when we want to model the relationship between two variables, or draw conclusions about the behavior of one, based on the behavior of the other variable. In particular, simple linear regression gives us information on how much variation of the response variable Y is described by the explanatory variable X . The linear relationship between the response variable Y and the explanatory variable X means that

$$Y = \beta_0 + \beta_1 \cdot X$$

As in practice we will not come across data that can be perfectly described by direction, ie there will inevitably be noise among the data, an approximation error will occur and therefore the model of simple linear regression is

$$y_i = \beta_0 + \beta_1 \cdot x_i + \varepsilon_i,$$

where:

- y_i value of the dependent variable for the i -th data
- x_i value of the explanatory variable for the i -th data
- ε_i error value (which we cannot observe) for the i -th data
- β_0 unknown parameter, cross-sectional parameter
- β_1 unknown parameter, slope parameter

What we assume in the model so far is that the linear relationship between the dependent and independent variables is reasonable. In order to be able to draw statistical conclusions, we must introduce assumptions about the error that represents the deviations of the response variable from the adjusted direction.

Also, certain projections were created in this research. The basic method in creating projections on the labor market in the Republic of Srpska is the statistical method of extrapolation of the trend. Extrapolation of a trend consists of predicting the situ-

ation or future movements based on the situation or past movements. The subject of the analysis is a set of chronologically determined values of selected variables in the field of wages, employment and unemployment of labor force, labor productivity, etc.

In this research, we used three different methodologies, ie. trend extrapolation models:

- Linear trend model that explains the linear movement (positive or negative) of the values of the observed time series over time
- Exponential trend model that explains nonlinear exponential motion, ie. exponentially increasing values of the observed time series over time
- A polynomial trend model that explains a pattern in data that is curved or detached from a real linear trend, in a large data set that contains many fluctuations, and graphs with curved trend lines are generally used to show a polynomial trend.

We used all three models for each time series, and the choice of which model to choose for which time series depended on the coefficient of determination (R^2). The coefficient of determination is the ratio of the sum of squares of deviations interpreted by the trend model and the sum of squares of total deviations. The coefficient of determination shows what percentage of the sum of squares of the deviation of the value of the variable Y from the arithmetic mean is interpreted by the trend model. Simply put, how much the movement of the phenomenon can be explained by the trend. The trend model is more representative the closer this indicator is to 1 or 100%. The representativeness of the trend model is higher in cases where there are small differences between the original values of the time series and the trend value. For each time series that we analyzed, we chose to extrapolate the trend according to the model that is most representative, ie. where the coefficient of determination is the highest.

We used the linear trend model in the following form:

$$Y_t = \beta_0 + \beta_1 X + \varepsilon_i$$

where:

Y - value of the time series; dependent variable,

β_0 - parameter indicating the expected value of the dependent variable in the initial period

β_1 - indicator of change in each subsequent period

X - time; independent variable,

ε_i - a random component that shows that there are positive and / or negative deviations from the original values around the line of a specific linear trend model.

We used the exponential trend model in the following form:

$$Y_t = \beta_0 \cdot \beta_1^{Xt}$$

where:

Y_t - the expected value of a variable whose movement we interpret as a trend

β_0 - parameter that indicates the expected value of the dependent variable in the initial period

β_1 - indicator of change in each subsequent period

X_t - variable time

We used the polynomial square trend model in the following form:

$$Y_t = \beta_0 + \beta_1 X + \beta_2 X^2$$

where is:

Y_t - the expected value of a variable whose movement we interpret as a trend

β_0 - parameter that indicates the expected value of the dependent variable in the initial period

β_1 - indicator of change in the first period

β_2 - indicator of change in the second period

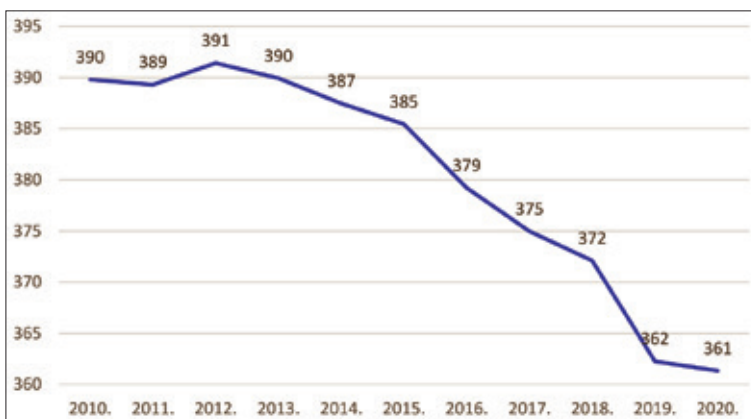
X_t - variable time

The basis for this survey were standard reports of statistical institutions (Statistical Yearbook, Labor Force Survey, etc.), but also special reports generated for the specific needs of this survey.

EMPIRICAL DATA

The workforce in Republika Srpska has been at a fairly stable level of some 390,000 workers for many years. The decline in the total population, which exists as a long-term trend in the Republika Srpska and Bosnia and Herzegovina (Kadušić & Suljic, 2018), (Pasalic & Pasalic, 2016) until 2015, did not significantly affect the stability of the labor force. This is especially due to the fact that the Republika Srpska has a large number of people in the category of economically inactive population, so during the entire period until 2015, the loss of labor could be compensated by entering the economically inactive labor force.

Graph 1. Labor force in Republika Srpska (in thousands of workers)



Source: Republic Statistical Office of Republika Srpska

However, since 2015, we have seen a very pronounced trend of declining labor force, ie, a decline in labor supply in the Republika Srpska. A larger reduction in the labor force compared to a reduction in the inactive population means that fluctuations

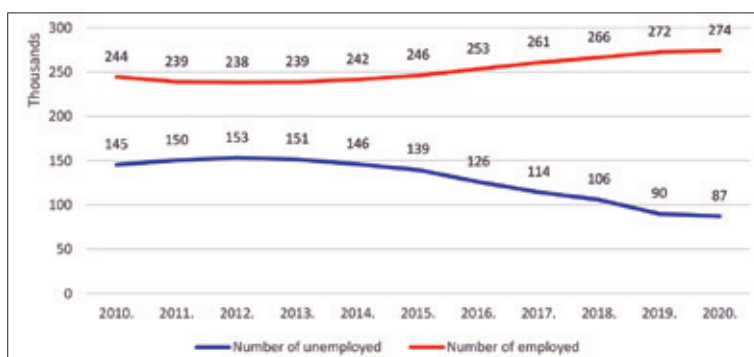
from the inactive to the active contingent are more difficult. This fluctuation increases the costs for companies in the field of training of newly arrived workers (Apgar IV, 2002) and lasts for a long time, compared to the outflow of “finished” skilled workers abroad.

As in the part where we talked about economic growth, here we see a strong impact of economic expansion in the European Union (Popović & Erić, 2018). As much as that expansion contributed to the growth of RS economy, in the same way it led to the outflow of labor to the countries of the European Union that were expanding at that time and which lacked labor. These countries could and can offer significantly higher salaries compared to the Republika Srpska and Bosnia and Herzegovina.

This trend is much better visible when we compare the data on the number of employed and unemployed, as we see in the chart below. The number of employees has been growing almost all the time, especially since 2015. If we look at all 10 years, we see that the number of employees increased from 244,000 in 2010 to 274,000 in 2020. This means that in this ten-year period, about 30,000 new jobs have been created in the economy of Republika Srpska.

However, when we look at the number of people registered as unemployed in the RS Employment Bureau, we see a much more pronounced decline. Thus, in 2010 there were 145,000 unemployed, while in 2020 that number was 87,000. This means that 58,000 unemployed people have stopped being registered as unemployed in the records of the Employment Bureau.

Graph 2. Number of employed and unemployed in Republika Srpska (in thousands)



Source: Republic Statistical Office of Republika Srpska

Here we can perform a simple calculation. About 30,000 of these unemployed people were employed in the 30,000 jobs created during this period. The other 28,000 people probably found work elsewhere¹.

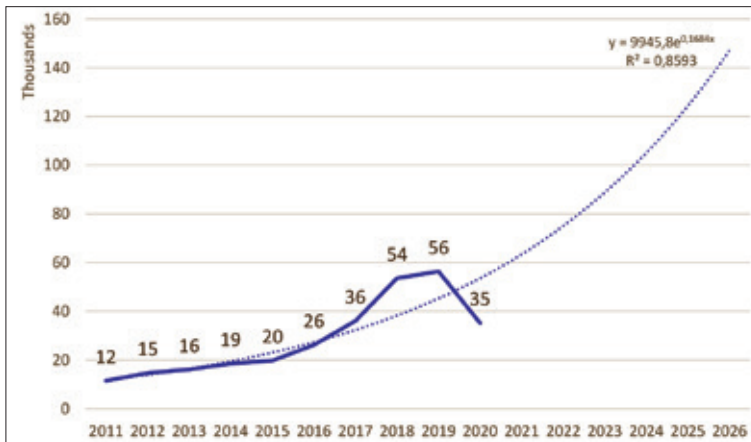
Where could that number of people find work? It is known that due to the migration outflow, the Republika Srpska is losing a significant number of young, working

¹ It is probable that there are those in this number who were removed from the records for some other reason, but that number is relatively small.

age population. In this analysis, we will use data on newly issued residence permits for BiH citizens in EU countries², which are kept in Eurostat databases. In this research, we will use the assumption that the trend of migration of the population of BiH is very similar, if not the same, as the trend of migration from RS. It must be emphasized here that only legal migration has been recorded here, where people obtain residence permits and join the formal sector. Also, there is a part of the population that “illegally” moves to EU countries, and that number is estimated at at least 15-20% of the number of migrants who move through official channels.

The five key countries to which BiH migrants have moved are: Germany, Slovenia, Croatia, Austria and Italy (Zoppi, 2019). What is particularly worrying is that the number of those emigrating from BiH has been growing year by year. As we can see in the chart below, the pandemic slowed down this process. Primarily due to restrictions on movement because the pandemic has led to numerous restrictions on population movement between countries.

Graph 3. Projection of the number of migrants from BiH to the EU (in thousands)



Source: Eurostat, <http://ec.europa.eu/eurostat/web/population-demography-migration-projections/migration-and-citizenship-data/database> and author calculations

There is also the impact of the EU’s economic slowdown, as there are fewer jobs available. Overall, the pandemic and recession of the EU economy have temporarily slowed the departure of the population from BiH, and the assumption of this projection is that this process will continue when the pandemic and recession pass.

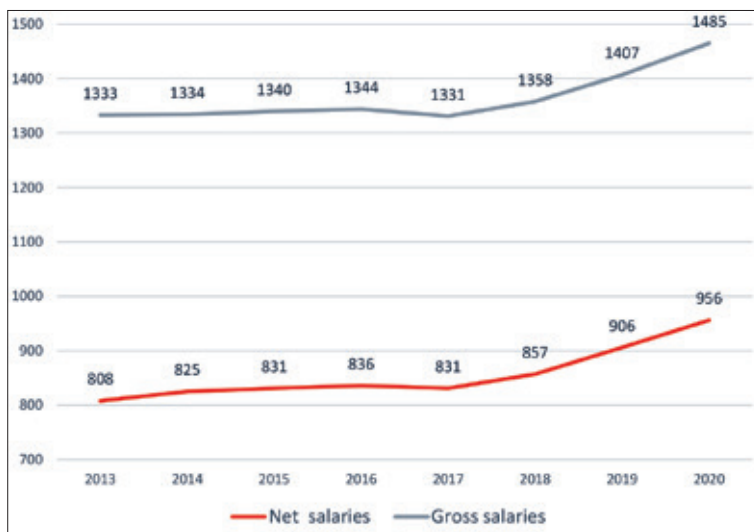
In this situation, average gross and net wages continued to rise. Even in 2020, despite the pandemic health and economic crisis, gross salaries increased by 78 KM, and net salaries by 50 marks, to the level of 1485 and 956 marks, respectively.

Wages have risen throughout the period from 2010 to the present. However, wage growth since 2017 is particularly pronounced, as we can see in the chart below. It

² Eurostat has data only for BiH. At the moment, it is not possible for the Republika Srpska to reach exact migration indicators.

is obvious that the growth of demand for work by companies, and the decline in labor supply due to people going abroad, led to an effect that came to the fore only in 2017, therefore, with a delay of two years.

Graph 4. Gross and net average salaries in Republika Srpska (in KM)



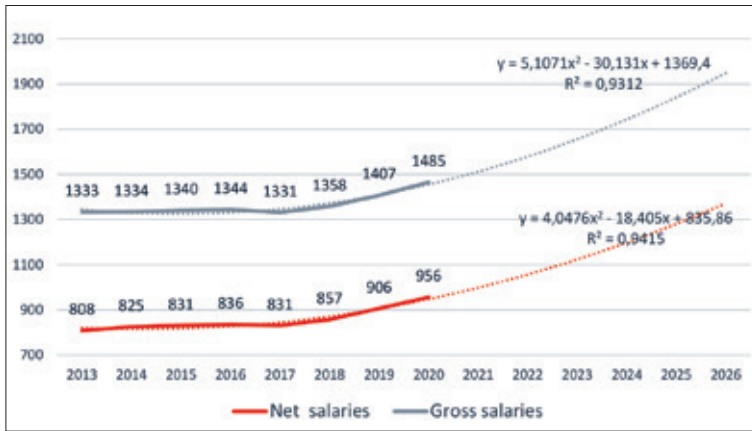
Source: Republic Statistical Office of Republika Srpska

This trend does not differ from the trend in other countries in the region such as Serbia and Croatia (Astrov, Leitner, Mara, Podkaminer, & Weinberger-Vidovic, 2020). A similar trend exists in the countries of the European Union, where most working age people from Bosnia and Herzegovina and Republika Srpska go.

All this will not be without an impact on the future level of salaries, in the next five to six years. When we look at the projection of wage growth in the economy of the Republika Srpska in the chart below, we see that this growth is much more pronounced in the period 2021-2026 than in any previous period. Thus, the average net salary in the Republic of Serbia will, in the period 2021-2026. increase by about 300 KM³.

³ Wage growth calculation was obtained based on the equation of the polynomial trend ($y = 4.0476x^2 - 18.405x + 835.86$) and projected for 2026

Graph 5. Projection of gross and net average salary in Republika Srpska until 2026 (in KM)



Source: Republic Statistical Office of Republika Srpska and author’s calculations

RESULTS AND DISCUSSION - CORRELATION AND REGRESSION BETWEEN FALLING LABOR SUPPLY AND RISING WAGES

As already noted in the review of literature the relationship between labor supply and labor prices is well known in economic theory. Economic theory implies that changes in supply for labor also lead to changes in the price of labor. This means that it is completely logical to expect that a reduction in the supply of labor leads to an increase in its price. In this study, we supported this theoretical concept with exact econometric analysis, using statistical regression analysis. The goal here is to determine how strong is this relation. As part of this research, we analyzed the relationship between the decline in labor supply and growth of wages by the method of linear regression.

Linear regression was used to determine the impact of labor supply reduction (x - independent variable) on the amount of average net wage (y - dependent variable).

Regression line equation:
 $y = 2365.3412 - 0.004006x$

X predicted Y, $R2 = .83$, $F(1,9) = 44.31$, $p < .001$.
 $\beta = -.004$, $p < .001$.

Regression ANOVA

Source	DF	Sum of Square	Mean Square	F Statistic (df1,df2)	P-value
Regression (between \hat{y}_i and \bar{y})	1	20005.3338	20005.3338	44.3078 (1,9)	0.00009305
Residual (between y_i and \hat{y}_i)	9	4063.5752	451.5084		
Total (between y_i and \bar{y})	10	24068.9091	2406.8909		

R Square (R²) equals 0.8312. It means that 83.1% of the variability of Y is explained by X.

Correlation (R) equals -0.9117. It means that there is a very strong inverse relationship between X and Y.

Goodness of fit. Overall regression: right-tailed, F(1,9) = 44.3078, p-value = 0.00009305. Since p-value < α (0.01), we reject the H₀.

The linear regression model, $Y = b_0 + b_1X + \epsilon$, provides a better fit than the model without the independent variable resulting in, $Y = b_0 + \epsilon$.

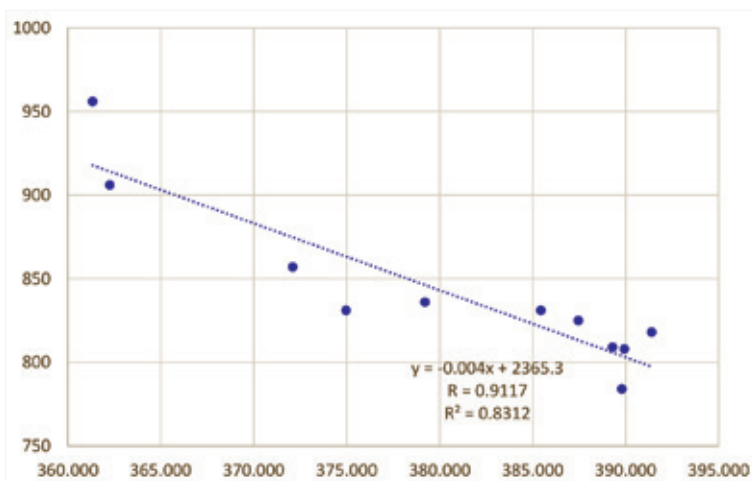
The Slope (a): two-tailed, T(9) = -6.6564, p-value = 0.00009305. For one predictor it is the same as the p-value for the overall model.

The Y-intercept (b): two-tailed, T(9) = 10.331, p-value = 0.00002727. Hence b is significantly different from zero.

Residual normality. The linear regression model assumes normality for residual errors. Shapiro will p-value equals 0.9966. It is assumed that the data is normally distributed.

A very strong negative correlation was found ($R = -0.91$, $p < 0.01$), with a coefficient of determination (R²) of high 83.1%. Simply put, regression analysis shows that there is a very strong cause-and-effect relationship between the reduction in labor supply and the increase in average net wages in the Republika Srpska.

Graph 6. Regression line of the impact of falling labor supply (x variable) on average net wages (y variable)



Source: Republic Statistical Office of Republika Srpska and author's calculations

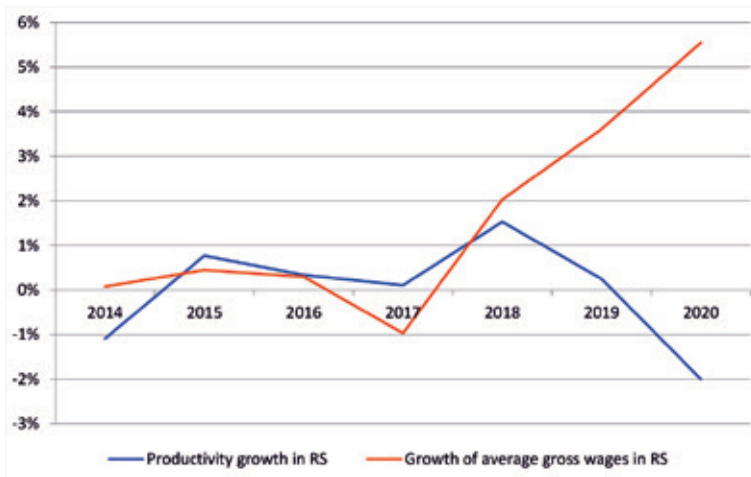
Based on the linear regression equation ($y = -0.004x + 2365.3$; $R^2 = 0.8312$), we can calculate the extent to which the decline in the labor force affects wage growth. For example, if the labor force from 2020 is reduced by 5% (about 18,000 workers), the net average salary at the level of Republika Srpska will increase by 72.3 KM (this refers only to the impact of falling workers, other impacts on wage growth are not included).

Regression statistical analysis shows that wage growth will inevitably happen and that is why it is important to start activities in time that can help the economy to adapt to these trends. The biggest problem in the labor market at the moment is the complete opposite of wage growth and labor productivity. It is known from economic theory, as well as economic practice, that if we want wage growth, it must be accom-

panied by productivity growth (Cahuc, Carcillo, & Zylberberg, 2014). If this is not the case, then the increase in wages inevitably leads to a deterioration in the competitiveness of the company, a reduction in profits and, ultimately, a reduction and jeopardization of the business itself.

In the chart below, we see that until 2018, wages and labor productivity followed each other. However, since 2018, we see an extremely pronounced divergence between wages and productivity, so wages continue to grow in all three years, at significantly higher rates than it was until 2018. In the same period, we have a marked decline in labor productivity.

Graph 7. Wage growth and productivity decline in Republika Srpska (in%)



Source: Republic Statistical Office of Republika Srpska and author's calculations

If the decline in productivity continues and wages continue to rise, it cannot be sustainable in the long run. Simply put, if there is no at least equal or higher productivity growth in the domestic economy, this increase in wages will significantly reduce their competitiveness, especially in the international market.

This is especially true for labor-intensive sectors, such as leather and footwear, textiles, and all companies that perform so-called *lohn jobs* (Hanson, 2021). The key competitive advantage of such companies is cheap labor, and when it becomes more expensive, this advantage is lost. Therefore, it is crucial to increase the productivity and added value of such and other companies, because that is the only way to compensate for this increase in wages.

CONCLUSION

At the beginning of this analysis, we asked ourselves how strong is the impact of the current reduction in labor supply on wage growth in the Republic of Srpska? What did we conclude?

First, we have seen that there is a marked reduction in labor supply at the level of the entire economy of Republika Srpska. This reduction in labor supply has a nega-

tive impact on the whole economy, however, some parts are more negatively affected - labor-intensive economic sectors such as footwear and clothing, and geographically the most vulnerable are underdeveloped areas where there is no economy developed in a way that creates enough quality jobs. What is even more worrying is the migration from Republika Srpska and Bosnia and Herzegovina abroad. The projections we made in this analysis show that in the previous period we had an explosive, exponential growth in the number of migrants from BiH to Europe. The projection also takes into account the impact of the pandemic on migration. This impact is, by all accounts, short-term, so it is to be expected that the departure of people from RS and BiH will continue after the pandemic. Second, we have seen that wage growth is very strongly influenced by labor supply reduction. By statistical regression analysis, we have determined the statistically significant, strong impact of the reduction of labor supply on wage growth. So there is a general trend of wage growth that the pandemic crisis has not stopped and which will certainly continue in the post-crisis period. That in itself is not a bad thing. On the contrary, it is crucial for the population to achieve a rise in living standards. However, the key question we asked is whether this kind of growth is sustainable. To recall, wage growth is only sustainable in a situation where there is equal or greater growth in labor productivity. It is an economic fact that cannot be refuted. Thus we come to the third conclusion. Third, in the last three observed years, unfortunately, there is a decline in labor productivity, i.e. decline in gross value added per worker. This increase in wages and declining productivity provides the answer to more fundamental question. Is current wage growth in Republika Srpska sustainable in the long run? Current wage growth, with declining productivity, is not sustainable in the long run. If things with productivity remain as they have been for the last three years and if the wage growth continues, it will inevitably lead to reduced competitiveness of the economy, reduced opportunities for companies to participate and compete in the European market and jeopardize survival of many economic sectors. The RS economy can avoid this trap if productivity starts to rise again. Improving productivity requires large investments in knowledge and technology, and companies need public sector support in this area. Businessmen often emphasize that the professional assistance provided by public institutions is insufficient and inadequate (Pucar, 2014). The almost complete disconnection of the scientific-research and business community, further aggravated by the weak demand for knowledge and technology by companies, indicates that much work is needed by the private and public sectors to increase the technological potential and the productivity and economic competitiveness. This requires a change in the doctrinal approach to economic policy in the post-crisis period. During the recession, as economic theory and practice dictate, it was very important to pursue an expansive fiscal policy as the only instrument available in such situations. However, this impact on aggregate demand has only a short-term effects. Generic expansionary fiscal policy cannot yield good results in the long run.

At this moment, it is necessary to turn to the management of aggregate supply, which means improving the competitiveness of the economy. It is necessary to turn to a focused policy that affects the aggregate supply, a policy that stimulates the technological development of companies, which stimulates the increase and adjustment of workforce knowledge, which stimulates the improvement of existing and new products, improving the position of RS companies in European value chains.

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