Lyuboslav Kostov

The impact of labour productivity on wages in Bulgaria, 2000-2017

Abstract

In the post-crisis period, the traditional relationship between labour productivity and wages has been called increasingly into question as a result of recent changes in the labour-capital ratio. There is a growing public debate on this issue, but the available literature within Bulgaria has not, up to now, examined the link directly. This article reports the findings of a new study, specifically from the starting point that labour productivity is not a main factor in the dynamics of average wages in Bulgaria in the period 2000-2017. Through an econometric model, the author concludes that the impact of gross value added in terms of the change in average wages in Bulgaria has diminished as a result of the crisis; and that the dynamics of gross value added per employee do not play a decisive role in explaining the dynamics of average wages. The author points to the significance of this finding for future research, adding also that, at a time again of technological advance, innovation is likely to be one factor which further distorts classical understanding of the interdependence of labour productivity and wages.

Keywords: *productivity, wages, economic crisis, 4th industrial revolution*

Theoretical background

The relations between wages and labour productivity have become a major debate after the economic crisis and amid the emerging imbalances between the labour markets of EU member states. According to the ILO, the labour-capital ratio has changed in the last two decades. ILO data[1] show that the growth in labour productivity exceeds the growth in real wages over the period between 2006 and 2015: during this period, labour productivity on a global scale has grown 2.3 times whereas real wages have grown 2.1 times (ILO, 2017). The difference between the growth rates of the two variables is not substantial, but it is important to stress that, in the period before 2006, this ratio was reversed, with wage growth being higher than the growth in real labour productivity up to 2006 (ILO, 2017). A similar reversal of this ratio was also true during the recession in the United States in 1929 (Hart and Darby, 2002). According to Inklaar (2009), the high degree of technological development in 1929 led to technological shocks which were among the main causes of the Great Depression.

1 The ILO study is based on data for all member states of the organisation – a total of 187 countries.

This structural change is also the basis for modern research in the field that highlights the reasons for the differences in the rates of change between the two indicators. These differences raise a major debate about the ratio of labour productivity to wages and the changes experienced in this over time.

In Bulgaria[2] as in other EU countries, a wide public debate has begun on whether the growth in the average wage is dependent on the increase in labour productivity.[3] Therefore, this problem has both national and international dimensions.

This relationship has already been studied within the framework of the Bulgarian economy, but in a different context. During the last ten to fifteen years, there has been a number of studies in Bulgaria.

Chobanov (2012), for example, explores the impact of wages on labour productivity, arguing that there is a significant link between wages and labour productivity considering that achieving full employment while preserving price stability is the key to the symmetrical growth of both variables. For this purpose, he makes recommendations on monetary policy and analyses its impact on changes in the link between labour productivity and wages, also making specific recommendations to employers, employees and government to be used in the context of negotiations on sectoral and national agreements.

In other studies in Bulgaria on this topic, individual authors study other variables that affect labour productivity and average wages, such as: minimum wages (Mancheva and Stamatev, 2017); demographic processes (Cholakov, 2012); human capital (Shishmanova, 2008); unemployment (Pavlov, 2008; Pirimova, 2007); the hidden economy (Nonchev, 2011); and labour market flexibility (Tzanov and Beleva, 2004). On the basis of their examinations, all these studies draw conclusions about the link between labour productivity and wages, but only indirectly, i.e. as a result of other indicators. However, none of them specifically examines the impact of labour productivity on wages, with the exception of Chobanov (2012).

The lack of available research into this link has prompted the author in that direction, with the aim of contributing to an understanding of the importance of this link in the Bulgarian economic literature.

It is important to emphasise that the European institutions have, increasingly, been actively debating labour-related issues and contribution to the economy, including the link between labour productivity and wages (EESC, 2017; CEDEFOP, 2015). That is why the results and conclusions of this article are located firmly within the international debate on this topic and are intended, in that context, to provoke other authors into further comparisons.

The object of this study is the impact of labour productivity on the average wage in Bulgaria in the period 2000-2017. Its subject is the dynamics behind this impact. The main thesis of the study is that *labour productivity is not a main factor in the dynamics of wages in Bulgaria for the period 2000-2017*, with the relationship be-

2 See, for example CITUB's 2016 Campaign to Increase Income – http://iskamoshte100lv.com/wp-content/uploads/2016/12/press-07-12-2016.pdf.

3 *Opinion* of the BIC on the problems of the income and human resources policy in the Republic of Bulgaria, May 2017.

tween labour productivity and wages changing over time under the impact of the global economic and financial crisis. The time span covers the period from 2000 to 2017, with quarterly data obtained at broad sector level (services, agriculture and industry).

According to the National Statistical Institute of Bulgaria (NSI), wages in Bulgaria are presented in gross format, i.e. remuneration received for work done officially within the law, irrespective of whether the contract is permanent or temporary and whether working time is complete or incomplete (NSI, 2014). In this context, unlike the United States, where the share of wages in total labour compensation has declined in recent years (Feldstein, 2008), this share in Bulgaria and the EU-28 has remained relatively stable over time, even showing a small rise (Eurostat, 2018).

The author focuses on wages in the present study and considers it as a major part of the compensation of hired labour. That is precisely why, in drawing conclusions on the basis of estimated wages, these conclusions can also be considered valid with regard to the income of all workers in the case of Bulgaria.

Procedure for the collection and processing of data

From a methodological point of view, the study is, however, characterised by certain limitations in its scope.

This study interprets wages and labour productivity based on NSI definitions and data collection. The available statistics for Bulgaria allow us to construct a good database in a timely manner.

In the context of the studied literature on the problem, Gross Added Value (GVA) per employee is the most accurate indicator measuring the productivity of labour in Bulgaria. GVA data per person employed, in its original version, is in 2010 prices,[4] converted to the rate of change on the respective quarter of the previous year. This is done in order that the data may be prepared for mandatory stationarity tests, which are an essential attribute of any empirical study. Information on average wages is drawn by NSI in nominal terms per quarter in Bulgarian leva (BGN).

Given that information on GVA per employee is at the 2010 rate of prices, it is necessary to compare average wages in a comparable way. Therefore, these have been adjusted for inflation during the relevant period. As a measure of inflation, the Consumer Price Index (CPI) has been used on the basis of the first quarter of 2010. By means of the CPI, nominal wages can be converted into real ones.

Finally, the BGN value of real wages is calculated as the rate of change on the corresponding quarter of the previous year. In this way, the labour productivity and wages database is comparable and capable of being subject to econometric modelling and interpretation.

4 The database constructed for the survey can be viewed at: https://drive.google.com/file/d/1p9MudwL58vhU5ygSQsBKrkaiAj1MIGOe/view.

Before constructing a model and conducting the survey, it is necessary to check the stationarity of the collected data. Stationarity indicates the statistical lines that do not depend on the moment they are measured (Marinova, 2016). If the data is not stationary, it is difficult to model because it can overestimate the real relationship between the variables or the significance of the coefficients. Therefore, they either have to be staged by appropriate transformations (which, however, usually lead to the loss of information) or made subject to attempts to prove that they are co-integrated (Engle and Granger, 1987).

A stationarity check of the data rows for Bulgaria shows that the gross value added data at absolute 2010 prices are stationary, according to the Im-Pesaran-Shin stationarity test. The data on real average wages in absolute terms are, however, not stationary according to the same test in all its specific variants. Nevertheless, data on the change in gross value added per employee is stationary, as are the data on changes in the real average wage.

Although Dickey-Fuller's test of the rows has essentially been checked, this test can also be done with Dickie-Fuller and the Im-Pesaran-Shin test for additional reliability. A review of the literature shows that this test has greater applicability when examining time series panel data. Im-Pesaran-Shin can be considered to be a more specific test and, additionally, it works with fewer restrictions.

Furthermore, a verification procedure has been carried out for an optimal number of labour productivity lags that could be included in our econometric model. The literature on the correlation between labour productivity and wages requires such a prescreening before proceeding with an assessment of the model. This is carried out to uncover the link between labour productivity and wages, in particular because both the theoretical and the empirical literature show that there are lagging elements in this interrelationship. In this sense, the optimal number of lags that can be included in a study of the impact of gross value added per employee on the real average wage is four.

Model

Based on the stationarity tests that we carried out and the procedure for establishing the optimal number of lags, a model can be defined on which the survey of the situation in Bulgaria may be carried out. This model will be used to assess the impact of gross value added on the quarterly dynamics of wages in Bulgaria at sectoral level:

(1)

$$\Delta rAW_{st} = f_s + f_t + \beta_0 \Delta GAV_{st} + \beta_1 \Delta GAV_{st-1} + \beta_2 \Delta GAV_{st-2} + \beta_3 \Delta GAV_{st-3} + \beta_4 \Delta GAV_{st-4} + \Delta \varepsilon_{st},$$

where:

ΔrAW_{st} – the change in the real average wage in period t and sector s

f_s – fixed effects at sectoral level; f_t- fixed time effects

ΔGAV_{st} – the change in gross value added per employee over period t and in sector s

$\beta_1 \Delta GAV_{st-n}$ – the change in gross value added per employee over period *t-n* and sector *s*

$\Delta \varepsilon_{st}$ – the change in standard error.

This equation can be simplified and presented in the following way:

$$\Delta rAW_{st} = f_s + f_t + \sum_{n=0}^{4} \beta_n \Delta GAV_{st-n} + \Delta \varepsilon_{st}$$

Results

The results are set out in Table 1, covering the period from the first quarter of 2000 to the fourth quarter of 2017 at sector level (services, agriculture and industry).

Table 1 – The impact of labour productivity on average wages in Bulgaria (Q1 2000 to Q4 2017)

	[1]	**[2]**	[3]	**[4]**
	ΔrAW	ΔrAW	ΔrAW	ΔrAW
ΔGAV	0.282	0.268	0.103	0.103
	(0.158)	(0.160)	(0.058)	(0.065)
ΔGAV(t-1)	-0.077	-0.077	-0.020	-0.020
	(0.192)	(0.192)	(0.066)	(0.034)
ΔGAV(t-2)	0.065	0.055	0.141*	0.141
	(0.200)	(0.202)	(0.069)	(0.075)
ΔGAV(t-3)	-0.009	-0.007	0.034	0.034
	(0.187)	(0.187)	(0.065)	(0.061)
ΔGAV(t-4)	0.054	0.032	0.141*	0.141
	(0.151)	(0.156)	(0.056)	(0.081)
ΔGAV^	-0.566*	-0.586*	-0.078	-0.078
	(0.241)	(0.244)	(0.089)	(0.096)
ΔGAV(t-1)^	0.050	0.030	0.095	0.095
	(0.276)	(0.278)	(0.100)	(0.058)
ΔGAV(t-2)^	-0.229	-0.230	-0.244*	-0.244
	(0.288)	(0.289)	(0.103)	(0.119)
ΔGAV(t-3)^	-0.138	-0.151	-0.033	-0.033
	(0.279)	(0.281)	(0.101)	(0.040)
ΔGAV(t-4)^	-0.218	-0.220	-0.112	-0.112

	[1] ΔrAW	**[2]** ΔrAW	[3] ΔrAW	**[4]** ΔrAW
	(0.249)	(0.250)	(0.092)	(0.107)
N	192	192	192	192
R-sq	0.02	0.01	0.90	0.91

Levels of statistical significance: *** p<.10; ** p<.05; *** p<.01**

Note: The table presents the results of linear regressions with included fixed effects in the study (time and sectoral). The results illustrate the impact of labour productivity, expressed in terms of gross added value per employee, on the level of the real average monthly wage in the period 2000-2017, by quarter, for the Bulgarian economy. The econometric test was carried out on four different models, which will be subject to comparative analysis. The first column [1] illustrates the final results of panel LSM (least squares method). The second column [2] is again pLSM, but it presents the results with added fixed effects at sectoral level (services, agriculture and industry). The third column [3] presents the results with fixed sectoral effects and fixed effects at time level. The fourth column [4] presents the results of pLSM with fixed time level and clustered sector-specific standard deviations.

In the table, apart from the variables of the independent variable (GVA), its standard deviations, the level of statistical significance, the explanation of the models, the constants and the number of observations are also recorded.

The results show that the impact of labour productivity, expressed in terms of gross value added per employee, on the dynamics of average wages in Bulgaria for the 2000-2017 period is in a straight/positive direction. All four variations of the model show that a 1% growth in gross value added per employee leads to wage growth in the current period of between 0.10% and 0.28%.

In a one-year lag, all values have a negative sign which speaks of weak feedback bending to zero. In a two-year lag, the relationship is straightforward and, in the case of the addition of fixed effects at sectoral level and at a time level, it may be noticed that the value of the coefficient is already statistically significant. In a three-year lag, the relationship again tends to zero and, in a four-year lag, it is once again positive with only one coefficient of the model with fixed effects at sectoral and time level.

The change in the impact of GVA per employee on wages in the post-2009 period is negative in all periods – from the current one to the inclusion of a four-year lag. This suggests that the impact of gross value added in terms of the change in the average wage in Bulgaria has diminished as a result of the crisis. The values of the coefficients are statistically significant, in the current period for ordinary regression, as well as for a two-year lag for a fixed segment model at time level. All other coefficients after 2009 are statistically insignificant, but with a negative sign.

The explanatory capability of the first two models (simple regression and sectoral fixed effects) is very low and bends towards zero (2% for Model 1 and 1% for Model 2). On the other hand, the explanatory power of the last two models (with fixed time effects) is very high (90% for Model 3 and 91% for Model 4). This means that, in this case, the dynamics of gross value added per employee do not play a decisive role in explaining the dynamics of average wages and the inclusion of time-based fixed effects that reflect the effects of all current data but without time variation. In this

way, different constants for each unit of sector observation at quarterly level have been obtained.

Conclusions

This article has examined the problem of the impact of labour productivity on wages in Bulgaria. The theoretical grounds for studying this relationship are well-explored in the economic literature. At the same time, new empirical studies are putting on the agenda a re-thinking of the relationship in the post-crisis period. It is precisely this re-think that this article is aiming at.

Based on the results for Bulgaria on a quarterly basis by sector, several conclusions can be made:

1. first of all, the sharp change in the explanatory capability of the models with the addition of fixed time effects suggests that the dynamics of wages in Bulgaria depends, to a great extent, on other unobservable variables that have an impact on the country's economy over a certain period
2. given the growing discrepancies between practice and classical assumptions about the interaction of individual economic indicators, it is necessary to re-think the role of labour productivity as a key factor in measuring and determining wages in Bulgaria
3. the main motive for wage growth in the private sector over the years has always been the availability, or lack, of sufficient productivity generated by the labour factor. It is, therefore, necessary to take into account other factors, such as the degree of technological progress, in the formation of wages
4. the impact of labour productivity on wages has weakened in the aftermath of the crisis in Bulgaria. This creates the preconditions for a disappearance of this link in the future. Future research on this issue should address the reasons for the gradual disappearance of a statistically significant relationship between the two variables.

The development of the world as the fourth industrial revolution grows apace goes hand-in-hand with the need to retrain the workforce and continually improve skills and knowledge. Therefore, technological innovations are likely to distort classical theoretical understanding of the interdependence of labour productivity and wages. This study shows that wages are not influenced by labour productivity but by other factors. At the same time, overall productivity is rising, placing the workforce in a complex situation of the need for continued retraining so as to remain competitive on the labour market.

Increasing international competition and technological change may lead to the point at which wages are not a major result of labour productivity but rather more to other side factors. The lack of a statistically significant link between the variables for Bulgaria puts it precisely within this category of countries. We need therefore to raise the question of the influence and the unobservable variables in different periods, the influence of which is reported in the model for Bulgaria. The inclusion of these factors will significantly improve the explanatory power of the models.

Future studies for Bulgaria on this issue can be directed precisely in this direction – to explore which additional factors affect wages, apart from labour productivity.

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Author's note: a link to the database collected and designed for this study is available here: https://drive.google.com/file/d/1p9MudwL58vhU5ygSQsBKrkaiAj1MIGOe/view.