THE IMPACT OF THE MANUFACTURING INDUSTRY ON THE ECONOMIC CYCLE OF EUROPEAN UNION COUNTRIES

▪ *Marcel Behun, Beata Gavurova, Andrea Tkacova, Anna Kotaskova*

Abstract

The manufacturing industry is a key sector in many national economies and is involved in creating sustainable economic growth. At the same time, it is a sector sensitive to internal and external impacts that result in fluctuations in the economic cycle, copying its development or even outstripping the development of economic cycles. The main objective of this contribution was to identify the relationship between manufacturing and GDP, which represents the economic cycle in European Union countries. The time series of selected indicators of the manufacturing industry and GDP from the Eurostat database for Q1 2000-Q4 2016 were used for analysis purposes. An analysis of 296 time series with a quarterly periodicity from 22 EU countries (including the United Kingdom) was performed. The results of analyses indicate that the processing industry is a sector with significant cyclical behavior. In most countries, production and sales in the manufacturing industry behaved as concurrent indicators, changes in production and sales almost immediately reflected in the growth or decline in GDP. Labor market indicators have been shown to be delayed cyclical indicators. Changes in the economic development of the countries have a strong impact on employment, the remuneration of employees and the number of hours worked in the sector. Strong cyclical industries must be constantly monitored, as negative changes in these sectors will automatically exacerbate the economic cycle recession. The results of our analyses represent a valuable platform for economic policy makers and regional strategic plans.

Keywords: manufacturing industry, economic cycle, cyclical indicators, GDP, cross correlation
JEL Classification: E 32

1. INTRODUCTION

Currently, industry is undergoing rapid changes that will also affect the European population. Technological developments and processes of globalization generate new kinds of goods and services and new types of business models for their delivery (Tuček, 2016; Povolná & Švarcová, 2017; Rajnoha & Lesníková, 2016). Interactions between subjects (workers, investors and consumers) and industry also change (Szalavetz, 2017). Industry has a significant impact on all dimensions of sustainable development - economic, social, environmental and institutional. On the other hand, its state and development is also determined by the development of trade and global competition; the availability of raw materials and energy and the requirements of their more efficient use; technologies and innovations; the qualification structure of the workforce and their skills, and so on. The industry's priority in this ever-changing environment is to find effective methods, procedures and measures that would allow its flexibility to change conditions (European Commission, 2017; Nemcová, 2012; Piekarczyk, 2016; Sachpazidu-Wójcicka, 2017).

Industry accounts for a major part of the European economy, generating 24% of GDP and employing up to 50 million people, representing one out of five jobs in the EU. While many jobs have disappeared in the last ten years, employment in the medium- and high-tech industry is still growing. Europe is the world leader in the automotive, aviation, engineering, chemical and pharmaceutical industries. European companies also play a leading role in the markets for future technologies. Industry competitiveness is steadily increasing in EU countries thanks to European initiatives. Over the last three years, the European Union has implemented several active measures necessary to strengthen the industrial base in Europe (European Commission, 2017).

Many professional and research studies declare the position of the manufacturing industry as a key industry sector within the European Union. The manufacturing industry forms the basis of many national economies, which is reflected in its high share of total output, employment and revenues, and in the creation of sustainable economic growth (Herman, 2016; Eurostat, 2017). This fundamental idea is the content of a series of recent studies as McKinsey (2012), Naudé & Szirmai (2012) and Westkämper (2014). Empirical studies based on Kaldor's Law argue that the manufacturing sector in developing countries represents the engine of economic growth and development (Chakarvarty 2008; Dasgupta & Singh, 2005; Jeon, 2008). Loto (2012) notes that manufacturing represents a high export sector and pays relatively high wages, a main driver for employment in other sectors, including services, a key source of investment in research and development.

The manufacturing industry is also a sector that is sensitive to internal and external factors, resulting in cyclical fluctuations, copying its development or even outstripping the economic cycle in most EU countries. For this reason, the OECD considers manufacturing as a cyclical sector. For each country, it is important to know the cyclical relationship between the indicators of the manufacturing industry, especially from the point of view of its most important indicators such as output, employment, salaries or sales. This information is important not only for the business sector but also for the state that may be proposing fiscal policy measures (Burns & Mitchell, 1946, OECD, 2017a).

Among the countries with the greatest importance of the processing industry in terms of value added and employment, we can include the Czech Republic, Bulgaria, Germany, Estonia, Italy, Hungary, Slovenia and Slovakia. On the other hand, there are the countries with significantly lower processing industries such as Greece, Ireland, Luxembourg, Netherland, or the United Kingdom (OECD, 2017b). This does not mean that the processing industry is not cyclical in these countries. This can only be confirmed or refuted on the basis of the deeper analyses contained in the following chapter. Thematic is an article focusing on industry in the European Union with a focus on the manufacturing industry (manufacturing). The main objective of the article was to identify the relationship between components of production and GDP, which represents the economic cycle. When examining the relationship, we focused on industrial production, labor market indicators, and price indices in the manufacturing industry. The results of the analyses represent a valuable platform for formulating sectoral policies, for strategic frameworks, for regional development plans and for the development of concepts. The great importance of outputs of analyses of this nature is also visible in the process of national and international benchmarking and in the development of methodologies and a comparative database.

2. THEORETICAL BACKGROUND

Most EU countries focus on industrial production, with the processing industry accounting for a large part of it. It is a sector that contributes significantly to the sustainable economic growth of the country. The manufacturing sector is made up of over two million businesses of various sizes with a wide range of fields, such as mechanical engineering, metal processing, aircraft production or musical instruments. Revenue from the manufacturing industry is around € 7 billion each year. In 2014, 29.9 million people were employed in the manufacturing sector, of which up to 7 million were employed in Germany. At the same time, in recent years, the employment in this sector has been on the rise. Within the manufacturing sector of the EU Member States, there is a wide diversity in terms of employment and added value in the non-financial business economy. Germany ranks among the five largest EU Member States, as its processing industry contributed more than a quarter (30.4 %) of EU-28 added value in 2014. Similarly, manufacturing is one of the key sectors in the Slovak economy, influencing both the dynamics of economic growth and the level of employment. Slovakia is still a highly industrially industrialized country with a dominant position in the engineering and automotive industries (Eurostat, 2017; Luptáčik, et al., 2016).

The position and development of the processing industry is detailed by many experts in their research studies. E.g. the extensive possibilities for the development of the processing industry in Romania's national economy are emphasized by Herman (2016). The results of his research are stated by the fact that the great challenge of Romanian production is the increase in labor productivity and having medium and high technologically demanding production activities, which are very low in the country. India's Mehta & Rajan (2017) offer another view of the support of the manufacturing industry in India in particular. In their study, they call for investment to build a strong road, rail and transport network to create a new processing industry center.

Other foreign studies point to the negative impact of industry on society. The industry is a major consumer of energy and environmental pollutants (Miketa & Mulder, 2005; Egilmez et al., 2013; Zhang et al., 2017; Parker and Liddle, 2017; Štreimikienė et al., 2016). In view of growing concerns about emerging environmental problems as a result of industrial activities, sustainable production has become a topic of significant interest throughout the world. Sustainable production means the creation of products that use minimal resources, have minimal environmental impacts and provide acceptable costs to society (Singh et al., 2014). Therefore, an increased energy efficiency in industrial processes and successful policy-making are recommended to increase the share of renewable energy use (Janda et al. 2017; Czech, 2017). In the study, Egilmez et al. (2013), using the DEA analysis, investigated the eco-efficiency of manufacturing sectors in the US. Their results imply that the five manufacturing sectors, such as oil and coal products, food production, printing and related support activities, manufacturing, accessory manufacturing and motor vehicle production, were 100% environmentally friendly compared to other industries. On the other hand, it was found that approximately 90% of the US manufacturing sector is inefficient and requires a significant improvement in its life cycle. Similarly, in their studies, Zhang et al. (2017), who, on the basis of the analysis, propose a transformation towards the organic

industry. China's industrial development performance should be integrated into economic, environmental, energy and resource contexts. Energy performance on the OECD sample in the manufacturing sector between 1980 and 2009 was examined by Parker & Liddle (2017). The results from their research point to the fact that the adjustment of energy quality is important as the technological structure of production is associated with a higher relative energy efficiency. Business conditions show a strong correlation with the oil price dynamics. Sodeyfi & Katircioglu (2016) show the oil price to have a negative impact on business conditions in five selected regions over 1973-2010.

The manufacturing industry is also a sector very sensitive to internal and external impacts that result in fluctuations in the economic cycle. It is considered to be a sector which development is copying or even outstripping the development of economic cycles. Cyclical fluctuations in economic variables have a significant impact on decision-making about the execution or termination of activities in industrial enterprises. This information is also useful for the state in the process of preparing fiscal policy measures (Hornstein, 2000). This issue is addressed by several foreign studies.

For example, Sala et al. (2014) in their contribution examine the cyclical behavior of individual sectors in the Spanish economy in the period 1980 - 2011. Their aim was to find out which industries are more suitable, having less appropriately cyclical behavior over the economic cycle. Appropriate cyclical behaviors are those sectors that achieve a greater mutual movement with the economic cycle of the economy because it has a positive impact on the economic activity. The analysis results show that the economic cycle in Spain is positively influenced by the high- and medium-tech industries, namely the manufacturing industries. Similarly, in the study, Reijer (2007) analyzed the band-pass filter using the Christiean-Fitzgerald filtering the deviation cycles in the manufacturing industry in nine OECD countries. In addition to measuring cyclical fluctuations, the composer composes a composite lead indicator that replicates and predicts the deviation cycle in the manufacturing industry. It is an index composed of economic, financial and expected variables. Institutonal reform in new EU member states had a large impact on the manufacturing sector and also on the national output. Buterin et al. (2017) show that the institutional reform had a strong impact on the transitional economies output during 1996-2012. Thus, institutional framework is important for the the manufacturing sector in the transitional economies by chanelling FDI and domestic investments in manufacturing sector increasing firms' and national output.

Another important study on the economic cycle aimed at finding the direction and impact of economic conditions on the innovation activity of Polish industrial enterprises confirms the importance of monitoring these cycles to support the development of innovation in the Polish industry (Pachura, 2017; Świadek & Szopik-Depczyńska, 2014). A different view of economic cycle development in the Polish economy in the pre- and post-financial and economic crisis is reported by Lenart et al. (2016) and Jachowicz (2013). The authors surveyed a monthly industrial production time line, taking into account the level of deviations cycle and the rate of economic growth. The results of the study point to the fact that the Polish fluctuations in the economic

cycle have not changed since the recent crisis. Generally, in the EU-28 economies, the impact of the financial and economic crisis and the subsequent revival of the industrial economy can be clearly seen in two main industrial indicators, namely the Industrial Production Index and the Industrial Industrial Output Prices Index, (Eurostat, 2012). Sawtelle (2007), on the other hand, analyzes the sensitivity of the change in employment in the industrial sector to the long-term real GDP growth that occurred in 1991-2001 in the USA. The author responded to the interesting situation in the American economy - the "jobless recovery" phenomenon that was typical of the analyzed period. Only five sectors with a negative employment elasticity identify the results and point to the importance of controlling macroeconomic variables that affect the relationship between employment and economic growth. Long-term real GDP growth should be reflected in the labor market with job growth. Findings can help business economists who model their own employment in industry.

3. RESEARCH OBJECTIVE AND METHODOLOGY

The time series of selected indicators of industry as a whole, manufacturing and GDP from the Eurostat database for Q1 2000 – Q4 2016 were used for analysis purposes. This time series was the longest available time period for chosen indicators and EU countries from the database Eurostat. An analysis of 296 time series with quarterly periodicity from 22 EU countries (including the UK) was performed. From the mining industry, all available data that Eurostat reports on the NACE Rev. 2 classification of economic activities were examined in the Manufacturing category. In each EU country for which data were available, 10 indicators of the manufacturing were analyzed, namely: Production, Employment, Wages and Salaries, Volume of Work done, Domestic output price index, Non - Domestic output price index, Total output price index, Turnover domestic market, Turnover non-domestic Market, Turnover total.

Because of the need for identifying the relationship between the components of the manufacturing and GDP, which represents the economic cycle, the following methods were used:

- Seasonal adjustment of time series (seasonal indexes) – it is required to obtain the cyclical components from the original data and, therefore, we need to seasonally smooth the time series. We will use the method of smoothing through the seasonal indexes.
- Elimination of trend (Hodrick-Prescott filter) – one of the reason for choosing the HP filter was the fact that it is able to eliminate the trend component in one operation and at the same time, smoothes the entire time series (Schlicht, 2005). This allows us to get the cyclical components of the time series, which are inevitable for the analysis of the economic cycles. The disadvantage of the HP filter is a "problem of ends" that can be solved by predictions, for example, using the extrapolation method (Kranendonk et al., 2004).
- Cross-correlation – enables us to express the relation between the reference series and the time series of the cyclical indicators studied. The cross-correlations are performed with the lag of five periods forward and backward, by applying the Pearson correlation coefficient, which reflects the linear dependence between the variables (Marek, 2007). If this relation

is non-linear, which we will find out through the graph, we will make it linear by the transformation of the variables (e.g. logarithm) and then we will calculate a new correlation.

The relationship between the indicators of the manufacturing and the economic cycle of EU countries is determined on the basis of the cross-correlation values of the cyclical components. The monitored indicators can be divided into:

Cyclical Indicators - if the second highest crossover value at t-5 to t+5 is greater than 0.55. These indicators show a cyclical relationship with the reference series, which is the cyclical component of GDP. For cyclical indicators, it is possible to create three groups of indicators:

a) Leading Cyclical Indicators - The highest crossover value is achieved at time t-1 to t-5. These indicators evolve in advance of the development of the country's economic cycle and can be used to partially predict cycle development.

b) Coincident Cyclical Indicators - the highest crossover value is achieved at time t. This is a set of indicators that are evolving in line with the economic cycle of EU countries.

c) Delayed (lagging) Cyclical Indicators - the highest crossover value (The second highest cross-correlation value is tracked to confirm or displace the cyclical relationship. If only the highest value could be observed, it could only be a random high correlation at a given time without cyclic behaviour of the indicators) is reached at time t+1 to t+5. These indicators are developing late in the economic cycle, e.g. growth in employment and wages in the mining industry may be delayed by several quarters of GDP growth.

Non-cyclical Indicators - if the greatest cross-correlation value at t-5 to t+5 was less than 0.55. This set of indicators does not develop in any relation to the country's economic cycle. This means that growth, resp. the decline in the indicator develops independently of the evolution of the economic cycle, and so, the indicator is not sensitive to changes in the economic cycle.

4. RESULTS AND DISCUSSION

The results of the analyzes were structured in tree areas, which represent separate sections. The main research trajectory was the exploration of the relationship between the manufacturing and the economic cycle of EU countries.

4.1 Production in the manufacturing and economic cycle of EU

Currently, most EU countries focus on industrial production, with the processing industry accounting for a significant part of it. It is a sector that greatly contributes to the economic growth of the country. At the same time, however, it is also very sensitive to internal and external factors that result in fluctuations in the economic cycle. These assertions are supported by the data in Tab. 1, which contains the results of cross-correlations between the cyclical components of GDP at constant prices in 2010 and the production in the manufacturing industry in selected EU countries.

Tab. 1 - Cross-correlation results between the cyclical component of the manufacturing industry output and GDP at constant 2010 prices in selected EU countries for Q1 2000 - Q4 2016. Source: own calculations

Country	Production in manufacturing		Country	Production in manufacturing	
	Cross correlation coefficient	Time		Cross correlation coefficient	Time
Austria	0.9508	t	Italy	0.9559	t
Belgium	0.8482	t	Latvia	0.7838	t-2
Czech Republic	0.8495	t-1	Luxemburg	0.5425	t
Denmark	0.8373	t+1	Netherlands	0.8079	t-1
Estonia	0.8741	t-1	Poland	0.7449	t
Finland	0.9431	t	Portugal	0.5032	t
France	0.9748	t	Slovakia	0.6935	t+1
Germany	0.9440	t	Slovenia	0.9166	t
Greece	0.6961	t	Spain	0.7710	t-1
Hungary	0.8535	t	Sweden	0.9391	t
Ireland	0.5107	t+3	UK	0.8442	t

Based on the results of Tab. 1, it is possible to see a strong relationship between the production of the processing industry and GDP in selected EU countries. In addition to Greece, Ireland, Luxembourg and Portugal, the cross-correlation values of the given components exceeded 0.7, indicating their strong cyclical behavior. In the case of Ireland and Luxembourg, cross-correlation values were lower than 0.55, which means that the production indicators behave non-cyclically. For economies in which cross-correlation values reached levels above 0.7, it is possible to confirm a significant impact of the indicator on the economic development of the country. Values above 0.9 were achieved for Austria, Finland, France, Germany, Italy, Slovenia and Sweden. Changes in the production of the manufacturing industry have a significant impact on the economy and are strongly linked to the economic growth and declines in these countries.

For all EU countries, positive cross-correlation values were achieved, which means a direct dependence. With growth in production in the manufacturing industry, economic growth is on the downside and, on the contrary, the decline in the sector is reflected in a decline in GDP. For individual countries, it is also important to know whether industry indicators behave in a concurrent, overdue or delayed way. In most EU countries, production in the manufacturing industry has behaved as a parallel indicator. This means that the changes in production almost immediately reflected the growth or decline in GDP. In the analysis, we used quarterly data. It is likely that the monthly periodicity of the data would have been ascertained in advance of one, resp. two months, which is mainly due to the nature of the GDP calculation. In the countries such as the Czech Republic, Latvia, the Netherlands and Spain, the monitored indicators had the nature of leading indicators of one and two quarters in advance. This allows the use of given

industry indicators as components of the short-term economic cycle prediction of the given economy. Against this background, the country's economy can prepare for possible changes in GDP and have the same time-span to prepare remedial measures in the event of an upcoming economic downturn.

Fig. 1 and Fig. 2 illustrate the development of the cyclical component of GDP and the cyclical component of the production index of the manufacturing in two different countries Germany and Greece. In the case of Germany, it is possible to observe a significant concurrence of these indicators over time, as confirmed by the cross-correlation value at 0.9440. The reason is a strong orientation of the country to the metallurgical industry which supplies raw materials for the most important sector - engineering. In the German economy, industrial production is almost immediately on the rise, resp. the decline in the GDP of the country. Fig. 1 points out that the same development of indicators takes place both during the expansion period and during the recession. This requires a suitable strategy for managing the sector by the state with an export focus.

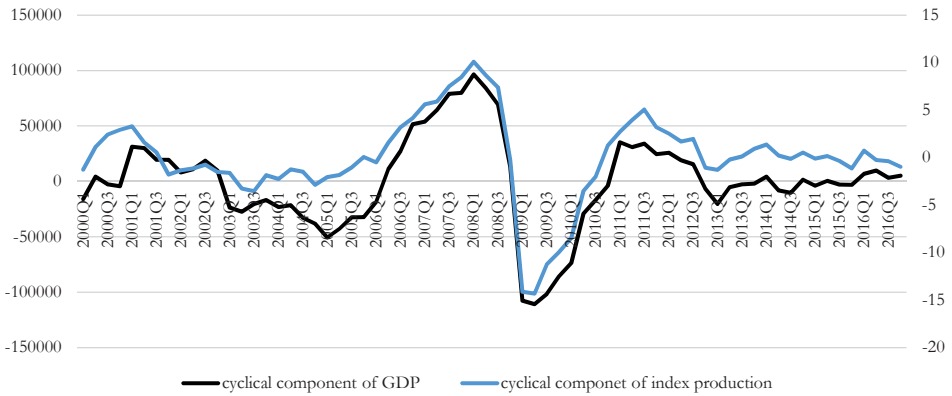

Fig. 1 - Development of the cyclical component of GDP and the cyclical component of the production index of the manufacturing in Germany. Source: authors

Fig. 2 shows a different relationship between GDP and the production index for Greece. Among the EU countries, Greece has reached one of the lowest cross-correlation values. Industry in the country does not form an important part of the economy, as is the case of Germany. The share of Greek industry in the EU market is negligible, representing only 1.26% of total production. From the point of view of the processing industry, the textile and footwear, food and metal industries are decisive. The manufacturing industry has a relatively weak domestic raw material base. Greece, as well as other EU countries, recorded growth in industry before the year 2008, which subsequently declined with the coming of the financial crisis. The Greek economic cycle is substantially more geared to agricultural development, employing up to 40% of the labor force.

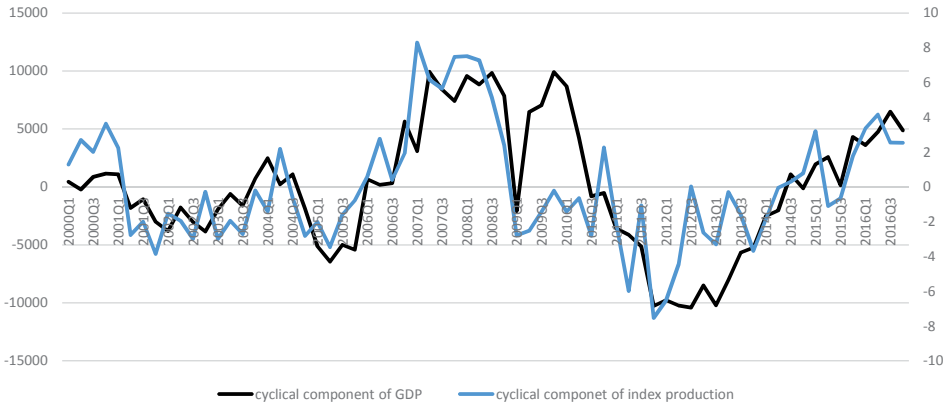

Fig. 2 - Development of the cyclical component of GDP and the cyclical component of the production index of the manufacturing in Greece. Source: authors

4.2 Price indices and receipts in the manufacturing industry and the EU economic cycle

The set of indicators reported by Eurostat for manufacturing also includes price indices and sales. Price indices are broken down into the Domestic Output Price Index, the Non-Domestic Output Price Index, the Total Output Price Index. In the case of sales, there are three other indicators: Turnover domestic market, Turnover non-domestic Market, Turnover total. To establish the cyclical relationship between manufacturing and GDP at constant prices in 2010, cross-correlations of cyclical components of all six indicators for EU countries were again made. In the case of a set of price index indicators and a set of revenue indicators, similar cross-correlation values were achieved. For this reason, Tab. 2 shows the results for total output price index and total turnover for manufacturing.

Tab. 2 - Cross-correlation results between the cyclical component of price indices and the manufacturing and GDP receipts in selected EU countries for Q1 2000 Q4 2016. Source: own calculations

Countries	Total output price index		Total turnover	
	Cross correlation coefficient	Time	Cross correlation coefficient	Time
Austria	0.6835	t+1	0.9305	t
Belgium	0.4901	t+1	0.7343	t
Czech Republic	0.2268	t+1	0.7820	t-1
Denmark	0.499	t	0.8018	t+1

Estonia	0.6375	t+2	0.8363	t
Finland	0.7713	t	0.9314	t
France	0.7802	t+1	0.9090	t
Germany	0.7712	t	0.9457	t
Greece	-0.4261	t+3	-0.241	t+2
Hungary	0.1128	t	0.8588	t
Ireland	0.5682	t+3	0.5744	t
Italy	0.6671	t+1	0.9343	t
Latvia	0.8252	t+1	0.8793	t-1
Luxemburg	0.5004	t+2	No data	No data
Netherlands	0.4822	t	0.7737	t
Poland	-0.4268	t-4	0.6542	t
Portugal	No data	No data	0.4348	t
Slovakia	0.3559	t	0.7270	t-1
Slovenia	0.5113	t+1	0.4536	t-1
Spain	0.2086	t+1	0.597	t-1
Sweden	0.4282	t+3	0.9133	t
UK	-0.3450	t-2	0.6372	t

The total output price index did not go unambiguously relative to the country's GDP. In the countries such as Austria, Estonia, Finland, France, Germany, Italy and Latvia, this index may be considered cyclical. The cross-correlation values achieved confirm that there is an increase in the price level of the processing industry products with a time lag after GDP growth. Growth in demand for the goods pushes for price increases. On the contrary, if the economy is declining, it will be reflected in a fall in the prices of production in the manufacturing industry, which producers will reduce under the influence of falling demand. However, these trends have not been confirmed in most EU countries. In these countries, the price level of production in the manufacturing industry is stable and does not respond to changes in the cyclical development of the economy. An important cyclical indicator is the revenue indicator. High cross-correlation values for this indicator for the manufacturing industry only confirm the cyclical behavior of the industry. For entrepreneurs, it is important to know the time when growth occurs or, decline in their revenues depending on the economic development of the country. The cross-correlation results showed that in most countries, sales are a parallel indicator, with almost a change in the economic situation as well as a change in sales and vice versa. Monthly monitoring of the indicators would probably indicate that sales are of one to two months ahead of GDP development. In the case of the Czech Republic and Slovakia, for example, the highest cross-correlation value was achieved at t-1, which refers to the one-quarter turnover of the manufacturing industry over one quarter. This rationale behavior is also the calculation of GDP itself, which includes goods and services made in a given quarter. Growth in demand for goods and services will be reflected in increased receipts in the manufacturing industry and consequently in rising GDP.

4.3 Labor market indicators in manufacturing and the EU economic cycle

In the case of cyclical industries, growth, resp. a decline in GDP is linked to changes in the labor market. Decreasing demand for output, which accounts for a significant part of GDP, will result in a drop in employment in the sector or a drop in wages and salaries for employees with a certain time lag. The volume of work done is also changed. Based on the cross-correlations of the cyclical components of selected labor market and GDP indicators, it can be ascertained how significantly and with which time delays to these changes occur. In order to identify cyclical behavior of labor market indicators in the manufacturing industry, cross-correlations with the cyclical component of GDP at constant prices of 2010 were calculated, as shown in Tab. 3.

Tab. 3 - Cross-correlation results between the cyclical component of labor market indicators in the manufacturing industry and GDP in selected EU countries for Q1 2000 Q4 2016. Source: own calculations

Countries	Employment		Wages and salaries		Volume of work done (hours worked)	
	Cross correlation coefficient	Time	Cross correlation coefficient	Time	Cross correlation coefficient	Time
Austria	0.9116	t+2	0.9123	t+2	0.8631	t+1
Belgium	0.6718	t+3	0.7508	t+2	0.7387	t+1
Czech Republic	0.8459	t+1	0.8733	t+1	0.7493	t
Denmark	0.9299	t+2	0.9126	t+2	0.9299	t+2
Estonia	0.9356	t+1	0.922	t+1	0.8718	t
Finland	0.6692	t+1	0.8743	t+1	0.7401	t
France	0.808	t+3	0.8601	t+2	0.8351	t+3
Germany	0.8854	t+3	0.8857	t+1	0.8979	t+1
Greece	0.5301	t+4	0.5743	t+1	0.48622	t
Hungary	0.7529	t+1	0.7456	t+1	0.7910	t
Ireland	0.6383	t+1	0.6247	t+1	0.6995	t+1
Italy	-	-	0.8314	t+1	0.8587	t+1
Latvia	0.8784	t+1	0.9347	t+1	0.8947	t+1
Luxemburg	0.7029	t+3	0.5574	t+1	0.5609	t+1
Netherlands	0.8700	t+2	0.7539	t+2	0.8496	t+1
Poland	0.7515	t+1	0.7714	t+1	0.7159	t+1
Portugal	0.7536	t+1	0.7999	t+2	0.6676	t+1
Slovakia	0.7444	t+1	0.8074	t+1	0.6942	t
Slovenia	0.8420	t+1	0.3781	t	0.4751	t
Spain	0.7781	t	0.8488	t+1	0.8287	t+1
Sweden	0.9186	t+2	0.8541	t+2	0.9168	t+2
UK	0.7445	t	0.7475	t+2	0.7132	t

Based on the cross-correlation results in Tab. 3, we can confirm the cyclical behavior of selected labor market indicators in the manufacturing industry. For the employment indicators, almost all countries achieved cross-correlation values above 0.7. In the case of Denmark, Estonia and Sweden, this was above 0.9, meaning that entrepreneurs significantly influence their demand for labor on the basis of the cyclical behavior of the economy. Manufacturing is an industry where economic growth is linked to the future strong employment growth in the sector, and vice versa, the economic recession will lead to significant redundancies. Low cross-correlation values have been recorded in Greece where it is impossible to talk about the cyclical behavior of employment in the processing industry, resulting from high employment in other sectors, such as agriculture. From the point of view of the time when the change in economic development is reflected in the change in employment in the processing industry, most countries are delayed by one or two quarters. This is the time when entrepreneurs are considering and subsequently recruiting or dismissing employees. Similarly, this is also the case for changes in salaries and rewards, which have proved to be an equally strong late indicator due to the cyclical behavior of the economy. The subsequent increase in wages and rewards is typical for the expansion phase of the economy. In the case of the recession, the rewards are reduced rather than the decline in basic salaries, which is due to the strong position of trade unions in some EU countries, for example in France. The volume of work done indicator shows the number of hours worked in the industry. Cross-correlations have confirmed the cyclical behavior of this indicator. In times of crisis, many companies have shortened working hours or prohibition of overtime. High cross-correlation values have been achieved, for example, in Austria, Denmark, Estonia, Germany, Latvia and Sweden. Most often, with a one-quarter delay, the volume of work done under the influence of the development of the economy changes. The real consequences of the economic recession on the labor market were also recorded in Slovakia in 2009. Besides redundancies, the working time was shortened to four or three working days, mainly in the engineering sector. This was reflected in a marked drop in wages and rewards, which is visible in Fig. 3.

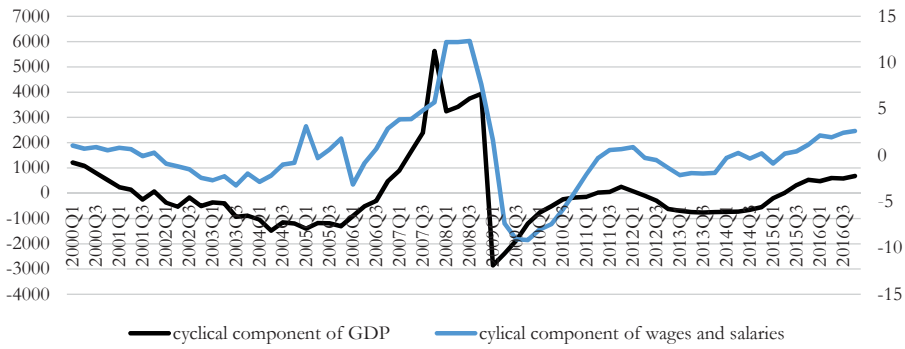

Fig. 3 - Development of the cyclical component of GDP and the cyclical component of wages and salaries of the manufacturing in Slovakia. Source: authors

The openness of Slovakia's economy and declining foreign demand (mainly in the automotive industry) has boosted the negative effects of the economic recession. With the economic re-

covery in 2010, employment growth and a return to the original wage assessment of employees gradually increased. Slovakia is currently experiencing a shortage of skilled labor in the automotive industry. It is mainly related to the strong connection of the Slovak economy to Germany's strong industry and the arrival of a new car maker.

5. CONCLUSION

Currently, EU member states are strongly oriented towards industrial production, primarily for the processing industry. The European Commission sees engineering, especially the automotive industry, as one of the most potential sectors for economic growth and as one of the fastest-growing sectors. A part of this industry has to be innovations and new technologies that will compete against strong competition from US and Chinese manufacturers. The high risk is a low production value orientation. This could have the effect of moving industrial enterprises to countries outside the European Union with cheaper labor such as Ukraine, India and China. The strong orientation of European countries on a single sector may be the potential for growth, but also due to strong economic contraction within the countries. The manufacturing industry is largely focused on the production of goods and services that are strongly linked to positive economic developments. It is, for example, the production of cars which can be classified as so- luxury properties. Demand varies considerably depending on the stage of the business cycle. In times of expansion, there is an increase in demand, but in times of recession the decline in demand for these products is significant. This fact also confirmed the economic crisis in 2008. The negative consequences of this crisis were recorded in countries with a high industrial orientation such as Germany, France, the Czech Republic, Slovakia and others. Based on the analysis, it was found that in most countries there is a strong cyclical relationship between GDP and production in the manufacturing industry. Production growth in the processing industry accelerates the economic growth of the landscape. European countries such as Portugal and Greece are considerably less industry-oriented, which is reflected in their little impact on the development of the country's economic cycle. These countries are more geared towards agriculture, employing a significant part of the labor force.

Growth of production in the processing industry also increases sales in this sector. Revenues in industrially oriented European countries are cyclical with a highly positive correlation with the development of the country's economic cycle. In Greece, Portugal and Slovenia, there was no cyclical relationship between the indicators. By examining the relationship of GDP and the prices of goods in the processing industry, it was shown that there is not a sufficiently strong relationship between them, expressed by the cross-correlation value. This means that revenue growth is not due to price increases but to the growth in total production in this sector.

When looking at the relationship between the manufacturing industry and the cyclical development of the economy, it is important to focus on the labor market. Industrially-oriented countries employ the largest number of employees in this sector. On the basis of the analysis carried out, employment in the processing industry, wages and salaries as well as the number of hours worked are strongly linked to the cyclical development of the economy. This development is delayed by GDP growth. The processing industry's labor market is reacting with a one-quarter lag

behind the economic development of the country. These findings are important for businesses in the sector, which can adjust the demand for labor or change the remuneration of employees. This business reaction was the last to have occurred since 2008, when the effects of the global financial crisis resulted in significant redundancies, shortening working hours and lowering employees' salaries, which was particularly typical for cyclically-performing industries. In addition to business, information on cyclical behavior in the sector is also needed for the state. For example, if the employment indicator responds strongly to GDP changes in a cyclical manner, there may be a significant fall in employment in the sector, which will add additional costs to the state to secure the redistribution function of public finances. In fact, the state's support for the unemployed is real. If wages and rewards occur, it will automatically reduce the disposable income of citizens, leading to a reduction in demand and a fall in investment. This will cause a short-term decline in GDP in the real economy, and the recession may deepen. So, the state has to go into an expansionary policy that is typical of the economic recession and is also associated with an increase in government spending. At the current stage of economic growth in most EU countries, there is an increase in employment in the processing industry. Even here, however, there are certain limits that can be reflected in the overheating of the economy. This can happen due to the lack of one of the production factors. A good example is Slovakia, which records a shortage of qualified labor force for the automotive industry this year. The solution is the arrival of non-EU workers who are willing to work for lower wages, as well. This phenomenon is negative for the domestic economy. Despite domestic GDP growth, there is no fall in domestic unemployment. Also negative is the outflow of funds (wages) of foreign employees to non-European countries, where they realize the bulk of their consumption.

Indicators of the manufacturing industry have generally shown a strong cyclical relationship in most EU countries. This largest industrial area has a significant impact on the development of the economic cycle of the countries. The manufacturing industry, particularly the automotive industry, represents the undeniable potential of the country's economic growth. This should indicate the state's orientation to several key sectors. As a result, the state can expect lower negative effects on GDP at a time of recession than a strong cyclical focus. This risk distribution does not, of course, lead to the full exploitation of the country's economic potential. In the recession, however, the spread of economic risk can contribute to a more moderate decline in employment, disposable income, living standards, and a more moderate increase in government spending.

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Contact information

Ing. Marcel Behun, PhD.
Technical University of Košice
Faculty of Mining
Ecology, Process Control and Geotechnologies
Letná 9, 040 01 Košice, Slovakia
E-mail: marcel.behun@tuke.sk

doc. Ing. Beata Gavurova, PhD., MBA
Technical University of Košice
Faculty of Economics
Department of Banking and Investment
Němcovej 32, 040 01 Košice, Slovakia
E-mail: beata.gavurova@tuke.sk - corresponding author

Ing. Andrea Tkacova, PhD.
Technical University of Košice
Faculty of Economics
Department of Finance
Němcovej 32, 040 01 Košice, Slovakia
E-mail: andrea.tkacova@tuke.sk

Ing. Anna Kotaskova
Paneuropean University Bratislava
Faculty of Economics and Business
Tematinská 10, 840 00 Bratislava, Slovakia
E-mail: anna.kotaskova@gmail.com