LABOUR PRODUCTIVITY AND TECHNOLOGICAL INTENSITIES OF SMALL AND MEDIUM ENTERPRISES IN MANUFACTURING

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Abstract

Technological intensity is a critical determinant of enterprises labour productivity growth and competitiveness. The impacts of technological intensity can be expected in economics performance of enterprises. The goal of this paper is to examine the role of technological intensity in changes labour productivity and economics performance of small and medium enterprises in manufacturing (SMEs). The article analysis manufacturing industry according to technological intensity. The analysis focuses on the Czech Republic. The observed data were from the 5-year period (2012-2016). The source of data for the conducted analysis of the enterprises was a database containing accounting data of companies with at least one employee. It was found that labour productivity decreased due to a significant increase in labour costs compared with enterprises performance growth in all technology-intensity groups (except low-technology industry). The reason is a situation on the Czech labour market.

Key words: labour productivity, technological intensity, enterprises, manufacturing

JEL Code: D24, E01, E23

Introduction

Level of labour productivity is one of the critical factors influencing the competitiveness of enterprises in the manufacturing. An important influence that can influence labour productivity is the level of technological intensity. It can be assumed that companies with higher technological intensity also achieve higher labour productivity. The aim of the paper is to assess the role of technological intensity in changes of labour productivity and economic performance of small and medium enterprises in manufacturing.

Manufacturing is not uniform sector. Manufacturing consists of different divisions with different development of productivity and economic performance. The significant factors that affects these divisions of manufacturing are innovation, level of R&D (Raymond & St-Pierre, 2010) or business cycle (Marchetti, 2002). Cyclical impact of the economy on the divisions

performance is in some sections more some less. Important is also the cause of its origin (Vorlicek & Cermakova, 2017).

The performance of enterprise can be measured by using the five basic financial indicators: liquidity, solvency, profitability, efficiency and productivity. Productivity is in firm measured the efficiency of using factors of production. The productivity of firm we can measure by many indicators of productivity. The most frequently measured indicator is labour productivity. We have other types of productivity as capital productivity or total factor productivity. The capital productivity shows how productively capital is used to generate value added. Total factor productivity measure technological change and TFP is a very important driver of long-run economic growth (Everaert et al., 2015).

Labour productivity provides a measure of the efficiency with which labour are used in enterprise to produce goods and services, it can be measured in various ways. Labour productivity is equal to the ratio between a volume of output (value added, sales) (Huynh et al., 2015) and a measure of input use (the total number of hours worked, labour cost or total employment). Labour productivity is influence by many factors as sector (Aoyama et al., 2009), enterprises age (Cucculelli et al., 2014), innovations (Mura & Rozsa, 2013), size of firm (Chmelikova &Redlichova, 2013) or technological intensity (Hall et al.,2009).

1 Data and methodology

The aim of the paper was to assess the differences in the labour productivity and economics performance of small and medium enterprises divided according to technological intensity. The goal was also to find a change in this efficiency in 2016 compared to 2012 (change after five years) in enterprises in manufacturing of the Czech Republic. The analysis was performed in 1068 SMEs, through their financial statements drawn from the Albertina database. The same enterprises were under review in both of the years. We used the classification by Commission Recommendation 2003/361/ESES based on number of employees, turnover and balance sheet total. Attention was focused on enterprises in the manufacturing industry, which were divided according to economic activity or technological demands. The enterprises were sorted into four categories. Eurostat uses the aggregation of the manufacturing industry according to technological intensity and based on NACE Rev. 2 at 2-digit level: HT (high-technology), MHT (medium-high-technology), MLT (medium-low-technology), LT (low-technology).

It was evaluated not only the efficiency of the labour factor but also the company's performance. Efficiency of work was measured through indicators: Labour productivity (Sales

- S/labour costs - PC), Labour intensity (labour costs - PC/ total costs - TC), Capital-Labour ratio (fixed assets/labour costs). Business performance was evaluated using ROA, i.e. the ratio of EBIT and Assets a Return on Equity (ROE) – ratio EAT and Equity.

The partial objective was to analyse the contributions of industry divided by technological intensity to a change in labour productivity or a change in asset profitability in 2016 compared to 2012. This analysis was based on a data of 1068 small and medium-sized enterprises to divide the overall change in labour productivity (or asset return) into parts that could be attributed to individual groups of enterprises. The analysis should identify the groups of firms that have major contribution to the change in the labour productivity and ROA in SME.

The basis for determining the size of the benefit or loss is to come out of the variable composition index as a comparison of two arithmetic averages (Jílek & Vojta, 2000), i.e.

$$\frac{\bar{\gamma}}{\bar{\bar{\gamma}}} = \frac{\sum_i \gamma_1^i L_1^i}{\sum_i L_1^i} : \frac{\sum_i \gamma_0^i L_0^i}{\sum_i L_0^i} \tag{1}$$

Where

$\gamma_{1,}^i, \gamma_0^i =$ Labour productivity in period 1 (2016) and in the year 0 (2012) for the i category of enterprises by technological intensity, or ROA,

$L_1^i, L_0^i =$ Labour costs for the period 1 (2016) and in the year 0 (2012) for the i category of enterprises by technological intensity, or assets.

To calculate the benefit of each category of enterprise to change labour productivity for the whole set of enterprises or to change the ROA, only the group of enterprises whose impact is calculated should be placed in the first period for the other groups of enterprises to enter data from the base period. The computational relationship was used to analyse both labour productivity and ROE.

Based on the pyramidal breakdown of ROE change and the logarithmic method of decomposing indicator values, the effect of changes in the labour productivity for individual categories of enterprises on changes in return on equity can be observed. The breakdown is based on a causal deterministic model:

$$\begin{aligned} &ROE = ROA * leverage = (1 - \cos ratio) * turnover * leverage = \\ &(1 - (\frac{labour \cos ts}{\cos ts} + \frac{other \cos ts}{\cos ts}) * turnover * leverage = \\ &(1 - \left[(average wages * labour productivity) + \frac{other \cos ts}{\cos ts} \right] * turnover * leverage \end{aligned} \tag{2}$$

The influence of labour productivity then can be find by using the logarithmic method.

$$\Delta ROE/_{labour\ productivity} = \frac{\log I_{ROA}}{\log I_{ROE}} * \frac{\log I_{(1-n)}}{\log I_{ROA}} * \frac{ratio\ labour\ costs_0 - ratio\ labour\ costs_1}{n_0 - n_1} * \tag{3}$$

$$* \left(- \frac{log\ I_{LP}}{log\ I_{ratio\ labour\ costs}} \right)$$

2 Results

2.1 Labour productivity and firms performance in manufacturing

The analysed enterprises group consists from Czech small and medium-sized enterprises in manufacturing which were divided according to technological intensity (see methodology).
The monitored enterprises are in groups Medium high technology (45%), low technology (30%), medium low technology (22%). The lowest representation has SMEs in the high technology sector, which is in line with the representation of these sectors and across the national economy. The Czech manufacturing industry is characterized by the high share of Medium high technology sector, medium low technology and low share of high technology sector in comparison to the EU average.

All indicators were surveyed in 2012 and 5 years later, i.e. 2016, and then a comparison was made. The following table 1 describes development of labour productivity individual groups. We can see a decline in labour productivity due to disproportionate labour costs in all groups except low technology sector. Capital-labour ratio and the labour intensity is increased in most sectors. In terms of business performance measured by profitability, outputs of single sectors are different.

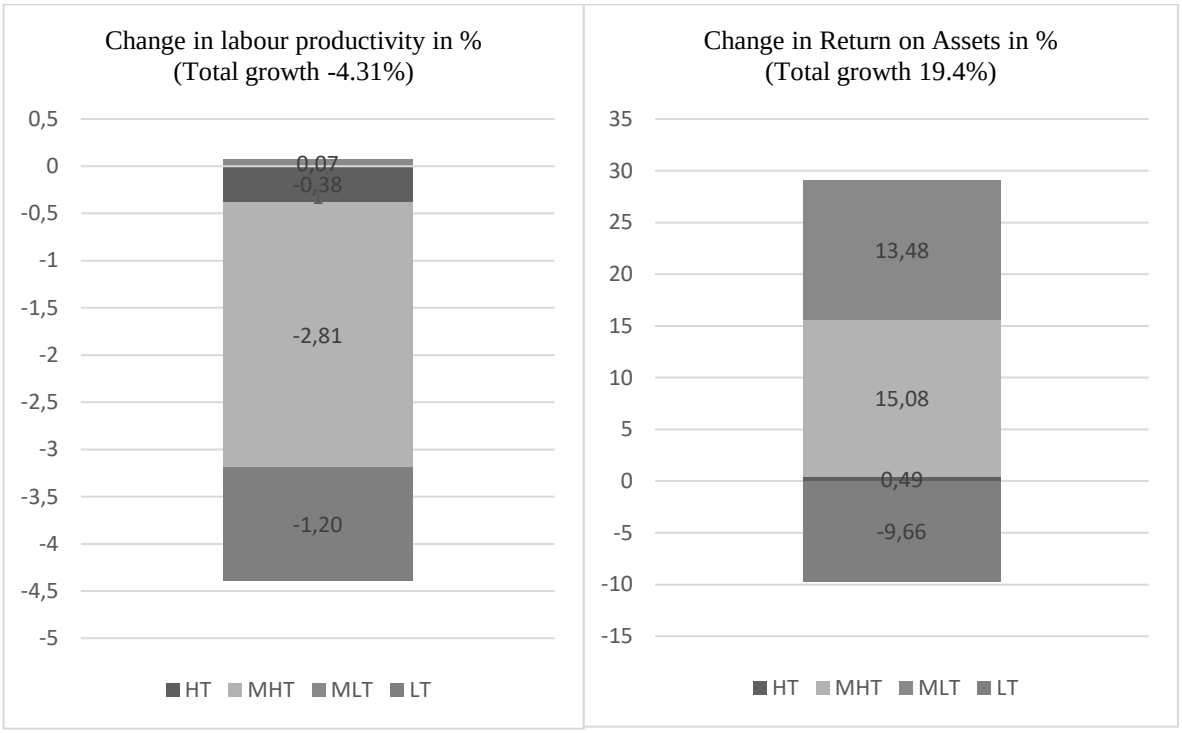
Tab. 1: Labour productivity – group of technological intensity

Indicator	Technological intensity	2012	2016	Index (2016/2012)
Labour productivity in CZK	HT	4,060	3,317	0,817
	MHT	3,893	3,549	0,912
	MLT	3,632	3,494	0,962
	LT	3,559	3,605	1,013
	Total	**3,692**	**3,533**	**0,957**
C-L Ratio in CZK	HT	0,820	0,985	1,201
	MHT	1,417	1,389	0,980
	MLT	1,312	1,432	1,091
	LT	1,486	1,526	1,027
	Total	1,259	1,333	1,059
Labour intensity	HT	0,217	0,286	1,321
	MHT	0,206	0,254	1,229
	MLT	0,248	0,269	1,084
	LT	0,235	0,245	1,041
	Total	0,227	0,263	1,162
ROA in %	HT	11,500	11,330	0,985
	MHT	1,908	5,196	2,724
	MLT	7,845	9,166	1,168
	LT	6,495	4,902	0,755
	Total	**5,842**	**6,975**	**1,194**
ROE in %	HT	14,585	14,100	0,967
	MHT	0,499	8,730	17,487
	MLT	10,479	12,392	1,183
	LT	9,199	6,137	0,667
	Total	7,776	9,885	1,271

Source: Own calculations based on firm database ALBERTINA

Figure 1 illustrates the contributions of individual groups to the overall change in labour productivity or overall change in return on assets in 2016 compared to 2012. The greatest contribution to the change in labour productivity had medium-high-technology and low-tech industries. Low-tech and medium-high-tech industries contributed the most to the growth of small and medium-sized enterprises.

Fig. 1: Contributions of enterprises according to technological intensity to change of labour productivity and profitability (index 2016/2012)



Source: Own calculations based on firm database ALBERTINA

The relationship between the change in profitability and the change in labour productivity is described in Table 2 below. The logarithmic method has been found to contribute negatively to the growth of firm profitability in group HT, MHT and MLT.

Tab. 2: Profitability and labour productivity – group of technological intensity

Technological intensity	Change of indicator ROE		Influence of labour productivity	
	Absolute in CZK	Index	Absolute in CZK	Relativní (index)
HT	-0,005	0,967	-0,075	0,594
MHT	0,082	17,487	-0,015	0,594
MLT	0,019	1,183	-0,022	0,822
LT	-0,031	0,667	0,005	1,064

Source: Own calculations based on firm database ALBERTINA

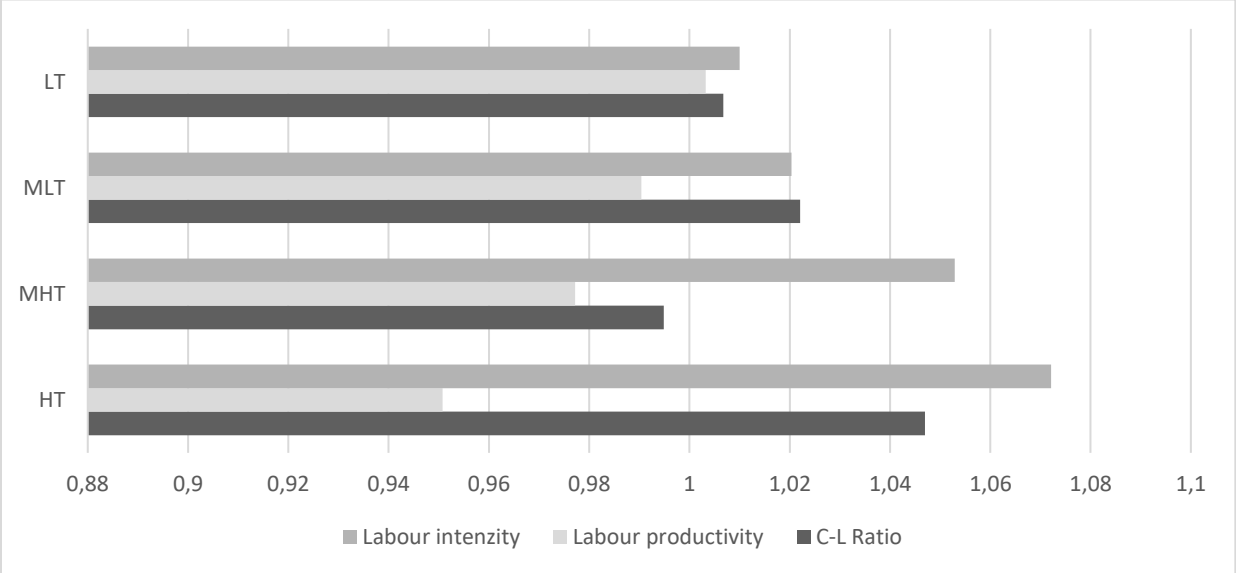
On the other hand, in the low-technology industry, the positive effect of labour productivity on the profitability of enterprises (ROE) was found.

2.2 Labour productivity and labour cost

If labour productivity is based on labour costs, it is necessary to monitor labour intensity and capital-labour ratio. Figure 2 shows the average growth rate in the monitored period for

individual categories of enterprises for indicators related to the efficiency of the labour. The big decline of labour productivity and large increase in labour cost with growth of capital-labour ratio was found in high-tech industry. On the other hand, in the low-tech industry was found low growth of capital-labour ratio and labour cost with had a positive effect on labour productivity growth.

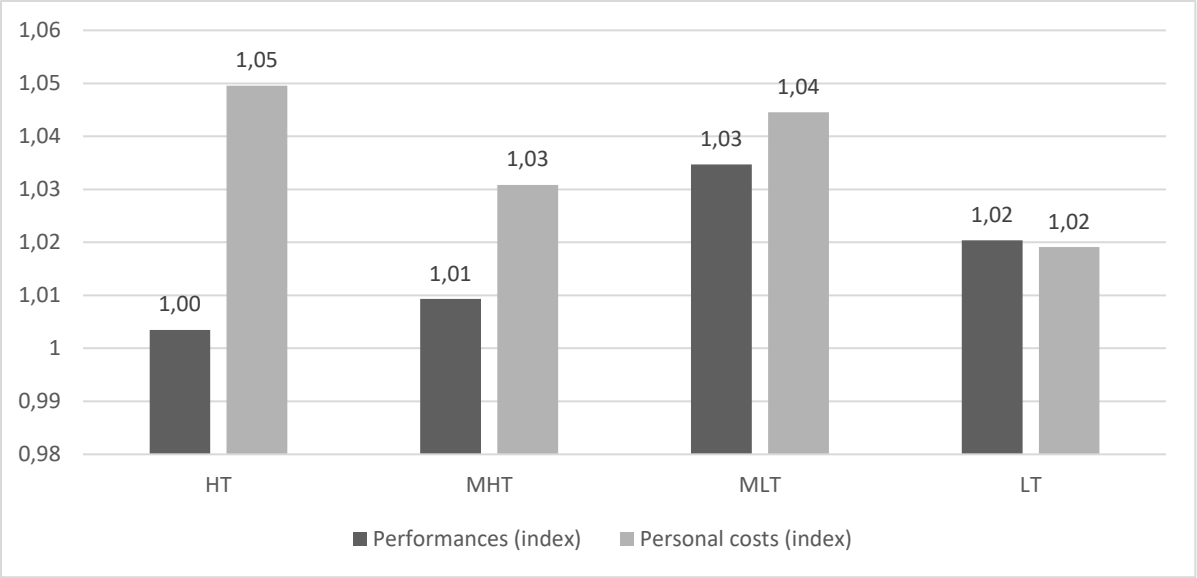
Fig. 2: Average annual growth rate of selected indicators by technological intensities in 2012-2016



Source: Own calculations based on firm database ALBERTINA

The last analysis is focused on the individual indicators from which labour productivity is based. Figure 3 analyses the average annual growth rate of firms' performance and labour costs. In order to increase labour productivity, which at the same time positively affects the performance of the company or its profitability, growth of corporate performance should be higher than the growth of labour costs.

Fig. 3: Average annual growth rate of outputs and labour costs by technological intensities in 2012-2016



Source: Own calculations based on firm database ALBERTINA

The growth rate of labour costs excesses the growth rate of enterprises performance for all groups of enterprises divided by technological intensity except low-technology group. This situation can entail a risk for enterprises to reduce their competitiveness.

Conclusion

The paper deals with the role of technological intensity in changes labour productivity and firms' performance of small and medium enterprises in manufacturing. Compared to the original assumption, it was found that low-technology industry has the positive effect on the growth of labour productivity. On the contrary, labour productivity in the high-tech industry declined, compared to the original expectation, which was mainly due to the high growth of labour cost compared to the enterprises performance growth. It was found that, apart from the low-tech industry in all sectors, labour productivity decreased due to a significant increase in labour costs over the period under review as compared to the growth in the production performance of enterprises. This situation is caused by situation in the labour market where labour productivity is very influenced by the flexibility in the labour market (Pavelka & Loester, 2013). Next disproportionate wages growth can mean a significant risk of losing competitiveness for enterprises in the future.

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