DEVELOPMENT OF VALUE PRODUCTIVITY IN SELECTED INDUSTRY BRANCHES

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Abstract

This paper focuses on the level and evolution of productivity in selected industry branches in the Czech Republic. The paper discusses the total productivity as well as partial productivities, mainly labour productivity. The used data sample covers the time period 2006-2011 which contains the development during the last global economic crisis. The development is compared before the crisis, during and after the crisis, respectively the reaction of businesses to the crisis. The metallurgical industry and automotive industry represent two selected industry branches which have been chosen because of their significant cyclical character. Although these two industry branches are significantly cyclical industries they are different in the proportion of the consumed inputs. This contribution identifies and analyzes the value productivity which reflects the level and changes in the technical and economic efficiency of production factors. The value productivity is an important factor in achieving the corporate performance. The value productivity is used in the contemporary concept which works not only with the efficiency of inputs consumption but also with the efficiency of employed capital (inputs binding). The advantage of this approach can be detected that counted and analysed indicators are not described as static but we are able to dynamize the analysis.

Key words: value productivity, labour productivity, metallurgical industry, automotive industry, Czech Republic

JEL Code: D24, J24, M2

Introduction

The value productivity is a key factor in achieving the corporate performance and competitiveness. The position of the Czech Republic in competitiveness rankings is not optimal but the weaknesses are more connected with inputs than outputs (Nečadová and Scholleová, 2011). Employees are very often discussed as important input whose increasing productivity could be a solution for a company as well as national or regional economic development (Pavelka, 2007). The issue of employees is connected with the task how to

measure impacts of employees' education as a long term tool for increasing productivity (Scholleová, 2012). According Čámská (2012) employees were a hidden source for coping with the crisis. During the crisis the volatility generally increased but big enterprises from classical branches as metallurgy or manufacturing would not have been affected the most (Scholleová, 2011). The last critical issue is connected with financial statements and possibilities of reporting which can influence results gained by this paper (more details in Strouhal, 2010).

1 Productivity

Productivity can be generally defined as the efficiency of using production factors in manufacturing process, or widely in a production process, whose results are tangible as well as intangible outputs (Klečka, 2011). The productivity can be discussed on the level of the country (macroeconomic level) or on the level of enterprises, detail in Hayes (1988). This paper aggregates enterprises' productivities on the level of industry branch in the country or regions and it could be called as mezzo economic productivity.

Two basic types of productivities can be distinguish (Craig and Harris, 1973) – total productivity (equation 1) and partial productivity (equation 2).

$$\text{total productivity} = \frac{\text{total output}}{\text{total input}} \tag{1}$$

$$\text{partial productivity} = \frac{\text{total output}}{\text{partial input}} \tag{2}$$

2 Used ratios

The equations 1 and 2 are too general and they cannot be used for fulfilling the paper's aim. This chapter shows how the productivity ratios are modified for the further use. The choice for the indicators used in the analysis has been a compromise between the paper's aim to reflect the value productivity in the contemporary sense and limited data availability which will be specified later.

2.1 The total productivity ratio

The total productivity takes into account all types of outputs as well as inputs. The contemporary concept of productivity expresses the value of inputs as the costs of

consumption (and depreciation plus amortization) and costs of binding (components of assets, converted to flow-related capital costs).

$$\text{Total productivity} = \frac{\text{Total revenues}}{\text{Costs of consumption and binding of inputs}} \qquad (3)$$

$$\text{Costs of consumption and binding of inputs} = \text{Total costs (accounting)} - \text{interests} + \frac{WACC}{1-t} \times \text{Total assets} \qquad (4)$$

Production and production factors are reflected in the broadest sense - not only for operational part, but also financial and extraordinary activities in enterprises. The total productivity ratio in the contemporary concept is an alternative to the economic profit or EVA.

This contribution uses the constant rate of the inputs binding costs for all reporting period and for both analysed industry branches. This constant rate is equal to WACC for the year 2011 for the manufacturing industry in the Czech Republic. The constant value of WACC is 11.86% (taken from Finanční analýza podnikové sféry za rok 2011, 2012) and the level of taxation is equal to 19%.

2.2 The partial productivity ratios of inputs consumption

The partial productivity ratios are focused only on the selected production inputs and the experimental part is based on following ratios.

$$\text{Productivity of consumption (depreciation) of an input} = \frac{\text{Total revenues}}{\text{Costs of consumption of an input}} \qquad (5)$$

The costs of consumption are expressed as the difference between total costs and interests of debts.

$$\text{Productivity of consumption of material and energy} = \frac{\text{Operating revenues}}{\text{Costs of material and energy}} \qquad (6)$$

The equation 6 uses narrower revenues because using only the main part of revenues increases the explanatory power. Operating revenues are used also in the indicators 7, 8 or 13. In the case of labour productivity we even use only the value added because this numerator is used in the theory and practise for decades.

$$\text{Productivity of consumption (depreciation) of fixed tangible and intangible assets} = \\ = \frac{\text{Operating revenues}}{\text{Depreciation of fixed tangible and intangible assets}} \quad (7)$$

$$\text{Productivity of consumption and binding of fixed tangible and intangible assets} = \\ = \frac{\text{Operating revenues}}{\text{Depreciation} + \text{Costs of fixed tangible and intangible assets binding}} \quad (8)$$

The above mentioned costs of binding are expressed as $WACC*(1-t)^{-1}$ multiplied by the value of fixed tangible and intangible assets.

$$\text{Labour productivity} = \frac{\text{Value Added}}{\text{Number of employees}} \quad (9)$$

2.3 The partial productivity ratios of inputs binding

The binding productivity ratios follow the contemporary concept of the value productivity. The costs of binding used in the denominator of formulas are expressed together at the end of the sub-chapter.

$$\text{Productivity of inputs binding} = \frac{\text{Total revenues}}{\text{Costs of inputs binding}} \quad (10)$$

$$\text{Productivity of fixed tangible and intangible assets binding} = \\ = \frac{\text{Total revenues}}{\text{Costs of fixed tangible and intangible assets binding}} \quad (11)$$

$$\text{Productivity of current assets binding} = \frac{\text{Total revenues}}{\text{Costs of current assets binding}} \quad (12)$$

$$\text{Productivity of inventories binding} = \frac{\text{Operating revenues}}{\text{Costs of inventories binding}} \quad (13)$$

The cost of binding are expressed as $WACC*(1-t)^{-1}$ multiplied by the value of examined assets (equation 10 – total assets etc.)

2.4 Time indices of productivity

The static ratios of value productivity have usually equivalent explanatory power or even just same as some ratios of financial analysis (even in practice more used). In contrast, the

dynamic indicators of value productivity have the potential to capture the size and impact of changes in productivity. There is a need of data about inputs and outputs in prices and physical volumes. The apparatus for the value productivity in the contemporary sense on the micro economical level is in detail described by Klečka (2008).

Such specified data for an analysis of the value productivity in the automotive and metallurgical industry were not available. At least effect of price changes and the impact of changes in physical volumes were removed partly by using only the ratios of productivity and index comparison. The changes of prices are compensated because of the similar trend of price development of outputs and inputs. Furthermore, the effect of price changes is reduced by the fixation of costs of binding. The development of productivity is expressed as standard time base indices whose content is obvious from further presented figures.

3 Development of productivity of selected companies operating in the metallurgical and automotive industry in the Czech Republic

The metallurgical industry and automotive industry represent two selected industry branches which have been selected because of their significant cyclical character. Although these two sectors are significantly cyclical they differ in a share of consumed inputs. This analysis is a subpart of a broader analysis and comparison of productivity of enterprises operating in the automotive industry in different regions and other selected industries in the Czech Republic. This paper is focused on the Czech metallurgical enterprises and selected businesses operating in the automotive industry in the Liberec Region and in the Central Bohemia Region. Among automotive businesses there are not included direct automobile manufacturers because they are significantly different types of businesses.

3.1 Data sample

The used data source is represented by the corporate database Albertina. It allows to analyse the data of 85 Czech metallurgical companies and 40 companies operating in the automotive industry from two above mentioned regions – the Liberec Region (11 units) and the Central Bohemia Region (29 units). The 85 analyzed metallurgical enterprises had the aggregate value of assets 139 515 329 000 CZK together and they employed 34 847 workers in 2011. The 40 analyzed automotive enterprises had the aggregate value of assets 33 715 753 000 CZK (8 059 182 000 CZK for businesses in the Liberec Region and 25 656 571 000 CZK for businesses in the Central Bohemia Region) together and they employed 12 526 workers

(3 357 people worked in the Liberec Region and 9 169 in the Central Bohemia Region) in 2011[1].

3.2 Results

This part is dedicated to results which will be displayed in several figures and commented as well. The figures generally show differences between industry branches and declines and subsequent different fast "recoveries" of several productivities in the context of the crisis around 2009.

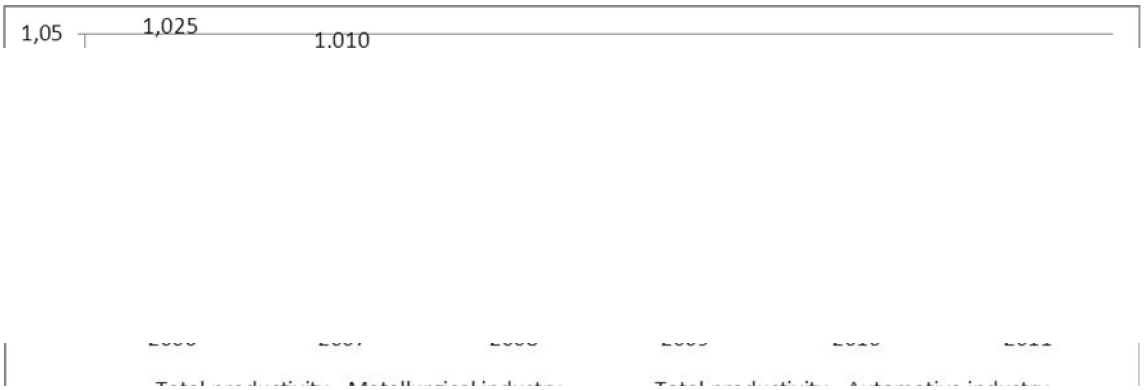
From the figure 1 it is clear that the total productivity of metallurgical enterprises was 1.025 in 2006 (It is the value of output in CZK for 1 CZK of value of consumption and binding of inputs.) and the total productivity fell in the years 2007, 2008 and 2009. Until the year 2007 the total productivity was over one which means that the performance was effective and not only accounting profit but also economic profit were created. In contrast the total productivity of automotive enterprises was lower in the period 2006-2008. It was slightly below 1 and economic profit was not made but the decline was moderate. Even after 2008 there was only a slight decrease in the total productivity in the case of enterprises operating in the automotive industry. At that time, the total productivity of metallurgical enterprises compared to the automotive industry was lower which remained until the end of the analysed period (until 2011). The total productivity of both industries has begun increasing after 2009. In the case of metallurgical enterprises it had not returned in the year 2011 yet to the level of the year 2008 when the decrease started. On the other hand the total productivity of automotive enterprises was above the level of the year 2006 in 2011.

The above mentioned changes in productivity were probably caused by the lower demand for the production which reduced the quantities of produced and sold output (measured by total revenues), values of input (measured by costs of consumption and binding of inputs) and their difference. Their difference is represented by the modified economic profit[2] which is displayed in the figure 2. More significant decrease of total revenues is evident in the case of enterprises operating in the metallurgical industry.

[1] It should be noted here that the numbers and proportion of businesses have been affected by the data availability in the corporate database and therefore the data do not indicate the actual numbers of enterprises in the analysed industry branches or regions. On the other hand it does not distort the analysis because of observed productivity characteristics which are expressed in relative terms.

[2] The modification is based on a broader sense of chosen inputs and outputs (not only operating, but any) and the valuation and partial fixation over time. The used modified economic profit is an alternative to the standard economic profit used in microeconomics, respectively to Economic Value Added (EVA) used in practice.

Fig. 1: Total productivity (The value of output in CZK / the value of consumption and binding of inputs in CZK)

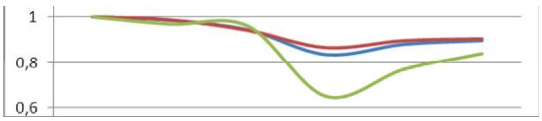


Source: Author

Fig. 2: Revenues, costs of consumption and binding of inputs and modified economic profit (in thousands CZK)

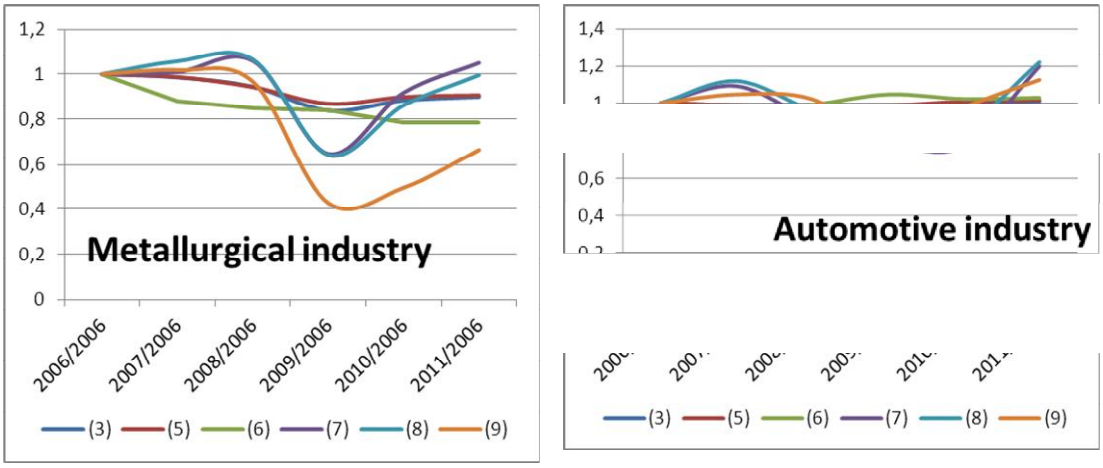
Source: Author

Fig. 3: Total productivity changes (base indices, the year 2006 = 100)



Source: Author

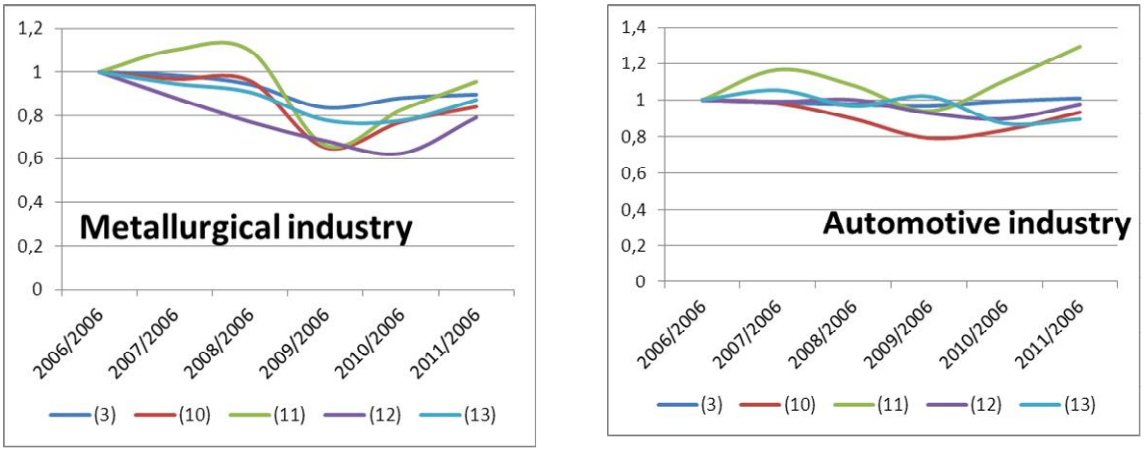
Fig. 4: Changes of total productivity and input consumption (the year 2006 = 100)



Source: Author

Changes in productivity and differences among these variations are shown in figures 3, 4 and 5. The changes in productivity are expressed by base indices (the year 2006 = 100). In these figures we can see and compare various declines and subsequent different fast "recoveries" of several productivities in the context of the crisis around 2009.

Fig. 5: Changes of total productivity and binding productivity (the year 2006 = 100)



Source: Author

3.3 Discussion

According to shapes of curves it is able to distinguish which production factors are more flexible and which more fixed. The curves with big (deep and long) decline are characteristic for lower flexibility. The shape is similar as for revenues (values of total output displayed in the figure 1). The lower flexibility is a case of labour productivity or productivity of binding

of inputs and it can be more significantly detected in the metallurgical industry in the analysed sample. On the other hand the curves which are flatter prove higher flexibility of that production factor. It is a case of costs of material or energy.

Other data would be necessary for discovering specific causes of differences in dynamics of partial productivities between the analysed industrial branches. The increase of labour productivity in the automotive industry can be caused by firing of employees or also by improving effectiveness of their work.

When the results are evaluated we have to take into account that measured characteristics are relative. The influence of each production factor does not depend only on the shape of its curve mentioned above but also on the consumed amount. The consumed amount can be expressed by the costs and their share on the total costs. The share of costs of inputs consumption was 89.5% and the share of costs of binding of inputs was 10.5% in the whole sample for the whole analysed period. It significantly influences the changes of these partial productivities on the absolute enrichment or impoverishment (total profits or lost).

Conclusion

Above commented results on the differences in the efficiency and flexibility of business performance may be completed by other possible benefits. Among them we can appoint specific knowledge from inter-comparisons or from a comparison among individual companies themselves. Or even more detailed comparison between different parts of the same company can be done but it requires additional (specific) input data. This is not included in the text due to its limited page range but it provides methodological guidelines of such analyzes for any interested persons.

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