

Drivers of ROE and ROA in the Czech Food Processing Industry in the Context of Market Concentration

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Abstract

The paper investigates the effects of sectoral determinants on profitability of the Czech food processing industry over the period of years 2003-2014. Large micro-level sample (N = 10,509) for 12 years and across 9 food subsectors in the Czech Republic was utilized to create a sectoral panel dataset, which was used in the empirical analysis. As for the methods, regression models with fixed effects were employed. Sectoral profitability served as the dependent variable in regressions and it was operationalized by two variables, i.e. ROA and ROE. Both profitability indicators revealed the same influence of investigated determinants. Obtained results reported positive influence of higher market concentration on sectoral profitability, and also the increase of productivity was associated with the increase of ROA and ROE. It was confirmed that high indebtedness affects the profitability negatively. Contrary to the expectations, the effect of the import penetration on the profitability was not proved.

Keywords

Industry profitability, return on assets (ROA), return on equity (ROE), market concentration, regression analysis, the Czech food industry.

Blažková, I. and Dvouletý, O. (2017) "Drivers of ROE and ROA in the Czech Food Processing Industry in the Context of Market Concentration", *AGRIS on-line Papers in Economics and Informatics*, Vol. 9, No. 3, pp. 3 - 14. ISSN 1804-1930. DOI 10.7160/aol.2017.090301.

Introduction

The firm profitability is a critical issue for shareholders, firm management, and from the national point of view also for the policy makers, since increasing economic activity is positively related to the economic growth in the Czech Republic (Dvouletý, 2017). Shareholders are interested in the firm profitability, since it influences the value of their firm and their investments in the long run. The firm management is responsible for the increasing profits that, in the long run, contribute to maximization of the firm value. Furthermore, the profitability of particular industries is relevant to policy makers to be able to adopt appropriate economic measures with respect to industrial policy.

As emphasized by Polok et al. (2016), the contemporary global, turbulent and unpredictable environment forces the need to investigate the factors influencing the profitability to maintain the competitiveness. Recent empirical contributions investigated the factors of performance in a number

of studies (e.g. Lopez-Valeiras et al., 2016; Maier, 2016; Hirsch et al., 2014; Machek and Špička, 2014; Janda et al., 2013; Sivathaasan et al., 2013), nevertheless, the Czech food processing industry has not received adequate interest yet. Therefore, the purpose of our study is to contribute to the literature on this issue through filling in the gap in the existing research.

Generally, the food industry is one of the most important sectors in the economy due to its great significance for economic and environmental development and also for the social welfare (FoodDrink Europe, 2016), which makes the agribusiness firms' competitiveness to be important factor of continuous economic growth (Zouaghi et al., 2016). It is also a strategic sector in relation to ensuring the population's diet (Ministry of Agriculture of the Czech Republic, 2015). The food industry as the connecting link between the producer of primary agricultural commodities and the final consumer affects, to a large extent, the competitiveness of primary agricultural production in the region and can act

as a catalyst for the development of the region.

Nowadays, significant structural changes take place in the agribusiness sector – many authors emphasize the increase of market concentration and effectiveness growth (e.g. Kaditi, 2013; Sckokai a kol., 2013; González and Kujal, 2012), which is related to the changes of firms' structure and is evident especially in the food processing industry and retail sector (Hanf and Belaya, 2008; Dries et al., 2004 or Weiss and Wittkopp, 2005). Retail chains with high concentration of business activities gained considerable market power and have a decisive role in the development of food commodity verticals, as confirmed by, e.g. Lloyd et al. (2015) or the OECD (2014). Globalization processes give the agribusiness development a transnational dimension and substantially change the territorial allocation of food production. As stated by Saitone and Sexton (2017), the growing concentration of food processors and retailers, which was the subject of interest to advocates of the structure-conduct-performance (SCP) paradigm especially in the second half of the 20th century (Conner et al., 1985; Marion, 1986), is due to its impact on market power and the overall performance of the agri-food system on the front burner also today (e.g. Adjemian et al., 2016; Hirsch et al., 2014; Kaditi, 2013; Setiawan et al., 2012).

Openness of the economy and the increasing globalization mean for the Czech food processing firms not only undisputable advantages, but also much more competitive pressure than in the past. While in the past, food and raw agricultural materials mostly of the Czech origin were used for the food production, nowadays there are widely used raw materials from EU and other countries, as stated by Fuksa (2010). Also the commodity structure has changed after the entry into the EU towards the apparent growth of the share of finalized products with high value added (Svatoš and Smutka, 2012), which emphasize the key role of the food industry within the commodity verticals and networks particularly in relation to the competitiveness of the whole agri-food chain.

Nowadays, also the level of technology and implementation of innovations has become an indispensable precondition of competitiveness of the Czech food processing industry, since it significantly affects the productivity, which is nowadays of great interest to economists and managers (Lefebvre et al., 2015).

The above mentioned facts justify the timelessness and validity of the analysis focused on the key

industry drivers of profitability of the Czech food processing sectors, since understanding the relationship between the structural changes on the food market and the profitability of the Czech food industry, is a key point when determining the effective industry policy. Moreover, the results of this study are relevant not only to policy makers with respect to the economic and industrial policy (Dvouletý, 2017), but have implications also for food managers and investment analysts evaluating the external environment changes.

The aim of our study is to test empirically the effect of the key industry factors on the profitability of the Czech food processing sectors in the period of years 2003-2014. Except market concentration as the main factor of our interest, the analysis includes also the impact of the market size, import penetration, productivity and leverage on two indicators of profitability – Return on Assets (*ROA*) and Return on Equity (*ROE*). We estimate the set of econometric models with fixed effects, which allows us to interpret separately the impact of the determinants on the profitability over the time and across the particular sectors keeping other factors constant.

The structure of our paper is as follows. First, the review of scientific literature related to the issue of market concentration and performance is presented. It is followed by the description of the methodological approach, including data and variables used for the analysis. In the next section, we present and discuss the results of the regression analysis. Finally, the conclusions are made.

Literature review

The assessment of the impact of industry factors, particularly the market concentration, as well as other structural variables such as the intensity of advertising and promotion, capital requirements, import competition, size of firms, industry growth or risk level, has been the subject of a number of research studies (e.g. Sivasubramaniam and Kara, 2015; Bothwell et al., 1984; Setiawan et al., 2012; Collins and Preston, 1966; Dickson, 2005). The analyses are based on economic literature usually using the econometric approach to investigate the relationship between market structure and performance.

The assessment of market concentration is different from the firm perspective, industry perspective and also from the national economy point of view. On one hand, there are arguments that promote positive effects of higher market concentration due

to the distribution of fixed costs for a larger number of products, due to the repetition of certain activities and also due to the concentration of research, marketing, financial transactions and the use of managerial skills, which affects the competitiveness of the company (Ginevičius and Čirba, 2007). On the other hand, high market concentration usually means the existence of a monopoly or dominant firm in an industry that may be related to market power and, more likely, anticompetitive behaviour of firms in the market with negative impact on small businesses and consumers (Kaditi, 2013), since large companies have considerable bargaining power and ability to influence the economic policy and government decision-making through corruption or social threats to unemployment, influence public opinion, etc. (Adams and Brock, 1986; Dicken, 2011). As pointed out by Curry and George (1983) or Hausman and Parker (2010), a clear assessment of market concentration is a complex and controversial issue.

The main finding of the previously published studies is the positive relationship between market concentration and performance, as higher market concentration usually means higher prices (e.g. Schmalensee and Willig, 1989; Newmark, 2004; Setiawan et al, 2012; Hirsch et al., 2014). It can be assumed that performance will tend to be higher in highly concentrated markets, where a large share of the industry output is attributable only to a few companies, than to less concentrated markets or industries with competitive structure (Viscusi et al., 2005).

As highlighted by Newmark (2004), it is appropriate to put an indicator of market size in the price-concentration analysis, since prices change not only depending on various size of firms, which is reflected in market concentration indicators, but also on the number of firms in the industry. The restrictive effect of competition (measured by the number of competitors) on the profit margins of enterprises was demonstrated e.g. by Hersch et al. (1994) in the transitive economies of Hungary, Poland and the former Czech and Slovak Federal Republic (CSFR).

In connection with the structural characteristics affecting the performance of industries, it is also appropriate to examine the impacts of the growing openness of the market, for example through the import competition. Considering the link between import competition and firm profitability, there are two different effects that may result

from greater market openness – first, the rise in imports leads to sharper competition in the domestic market, and secondly, openness to foreign supply markets makes it possible to increase the availability of cheaper raw materials or intermediate products (Kasahara and Rodrigue, 2008). In general, increased competition may pose a threat to domestic businesses in the industry as well as the opportunity. Negative impacts of import penetration on the Austrian manufacturing industry was found out by Onaran (2011), while Olper et al. (2013) demonstrated across 25 European countries and 9 food industries over the 1995–2008 period that an increase in import penetration is systematically positively related to the productivity growth.

In the view of the heterogeneity model developed by Melitz and Ottaviano (2008), the increase of import competition due to the trade liberalization should induce a selection process from low to high productivity firms resulting in the productivity growth of the industry. At the same time, the similar selection may induce also by market size, as mentioned by Olper et al. (2013). This shows the interdependence of various structural characteristics and their effects on the industry performance, and motivates researchers to include the productivity indicators among the tested industry factors when addressing the effects of structural characteristics on the industry performance. According to Jorgenson et al. (2014), an increase in productivity and thus the profitability growth is often generated by product and process innovations. In view of the fact that new investments are usually connected with higher capital use leading to higher indebtedness, the disunited results on both negative and positive impacts on profitability were researched by many authors (e.g. Daher and Le Saout, 2015; Sivathaasan et al., 2013; Chaddad and Mondelli, 2013; Hirsch et al., 2014).

The debate on the relationship between industry performance and structural characteristics, which should offer an advice upon the economic and competition policy, still remains non-consensual, and therefore, the issue continues to be open.

Materials and methods

In this section we introduce our collected sample and methodological approach. We are particularly interested in the determinants of industry performance and the influence of the market concentration.

Sample

The empirical analysis has been conducted with usage of the dataset of the enterprises operating in the Czech food processing industry, i.e. the subsectors between CZ-NACE 101 and CZ-NACE 110 drawn from the database Albertina – Gold Edition (Bisnode, 2015), and covers the period from 2003 to 2014. The units of analysis were individual food subsectors, where the subsector CZ-NACE 104 (manufacture of vegetable and animal oils and fats) was excluded in order to provide relevant data. During the analysed period significant structural change took place in this subsector, which caused sharp fluctuations of this subsector profitability and market concentration – till 2008 there was only one large company in this subsector with the high market share (48.5% in 2003), whose financial results were worsening during 2003-2008. The bad financial situation of this company resulted in the bankruptcy of the company and its transformation into new enterprises, which led to temporary decrease of both subsector profitability and market concentration. Explaining the changes in the profitability of this subsector through the analysed determinants would be misleading, since the sharp fluctuations in profitability did not occur depending on the evolution of the subsectoral characteristics, but due to the bankruptcy of one largest enterprise in the subsector.

The sample of the accounting data of enterprises is made out of 10,509 observations across 12 years and 9 food subsectors in the Czech Republic; namely CZ-NACE 101 – Production, processing, preserving of meat and meat products, CZ-NACE 102 – Processing and preserving of fish and fish products, CZ-NACE 103 – Processing and preserving of fruit and vegetables, CZ-NACE 105 – Manufacture of dairy products, CZ-NACE 106 – Manufacture of grain mill products, starches and starch products, CZ-NACE 107 – Manufacture of bakery and farinaceous products, CZ-NACE 108 – Manufacture of other food products, CZ-NACE 109 – Manufacture of prepared animal feeds, CZ-NACE 110 – Manufacture of beverages. The sample includes also small enterprises with 0-19 persons employed (49% observations in the sample) that are in the Czech food processing industry represented in a large number, which increases the representativeness of the sample. These firm data were used for particular subsectors when calculating the concentration indicators, which are of the main interest of our study.

The other three data sources were utilized. First,

the data published by the Ministry of Agriculture in the regularly published publication Panorama of the Food Industry of the Czech Republic (Ministry of Agriculture of the Czech Republic, 2008, 2015) – this source was employed for the determination of the remaining indicators used in the presented analysis and also for identification of the total sales of individual subsectors when calculating the market concentration indicator CR4. Second, the data published by the Czech Statistical Office (Czech Statistical Office of the Czech Republic, 2016) – the value added was expressed at comparable prices based on the producer price indices for particular subsectors of the Czech food industry (the year 2005 = 100). Third, the numbers of enterprises in individual food subsectors in 2003-2007 were supplemented from Eurostat (European Commission, 2016) as they have been published by the Ministry of Agriculture of the Czech Republic only since 2008 (Ministry of Agriculture of the Czech Republic, 2008, 2015).

Variables

Two indicators were used to measure the profitability of subsectors – return on assets (*ROA*) and return on equity (*ROE*). *ROA* measures the company management ability to generate profits from total assets of the company regardless of the way of funding, *ROE* reflects the return to shareholders on their equity, and are calculated as follows (Megginson et al., 2008):

$$ROA_j = \frac{EBIT_j}{Total\ Assets_j} \times 100$$

$$ROE_j = \frac{EAT_j}{Equity_j} \times 100$$

where *j* denotes the subsector of the Czech food industry, i.e. CZ-NACE 101 to 110, except for CZ-NACE 104.

Since the market structure is characterised by the number of firms in an industry and the size distribution of companies, the measures of concentration and the number of firms in the subsectors are used to describe the market structure – the Concentration Ratio of four largest firms in the market (*CR4*), the Herfindahl-Hirschman Index (*HHI*), and the number of firms (*NF*).

The concentration indicators represent independent variables in models and are calculated by the following formulas (Viscusi et al., 2005):

$$CR4 = \sum_{i=1}^4 S_i$$

$$HHI = \sum_{i=1}^n (S_i)^2$$

where S_i denotes the individual market share, i.e. the percentage of the i -th firm calculated as the production of the company divided by the sum of production of all firms in the subsector, n denotes number of firms in the subsector, for which HHI is calculated. We used the sales data, i.e. sales of own products and services, because they explain more about the market share than the output. For the concentration indicators it is valid that the higher they are, the higher market power is concentrated among the largest firms therefore positive coefficients in models are expected.

Number of firms (NF) in particular subsectors is expected to have a negative sign of the parameter in models, since larger markets with a large number of firms can be considered as a more competitive environment, which implies smaller ability of the firms to influence the price on the market.

Import penetration ratio (IMP) is a measure of the importance of imports in the domestic country and shows the extent to which the demand for goods or services is being met by foreign producers rather than domestic production. The formula is as follows (Lindner, 2001):

$$IMP_{it} = \frac{M_{it}}{Y_{it} + M_{it} - X_{it}}$$

where i denotes each of the nine subsectors of the Czech food and drink industry and t denotes the year, M_{it} and X_{it} are, respectively, the total imports and exports of the subsector i in the year t , and Y_{it} is the total production of the subsector i expressed by the total sales of own products and services. Since the international trade increases the competitive pressure (Kalínská et al., 2010), the import competition should reduce overall market share of large companies in the industry, and due to the increase in imports, decrease the market shares of large domestic firms. Therefore, the negative relationship between profitability and import penetration is expected, i.e. the negative sign of estimated parameter in models.

Since the production efficiency is significantly influenced by the productivity, two proxies for productivity, namely labour productivity ($Labour_Productivity$) and personal cost per value

added ($PersCost_VA$), were included in models as independent variable to test their impact on the profitability (Hayes et al., 1988). They are calculated as follows:

$$Labour_Productivity_j = \frac{Value\ Added\ in\ comparable\ prices_j}{Number\ of\ Employees_j}$$

$$PersCost_VA_j = \frac{Labour\ Cost_j}{Value\ Added_j} \times 100$$

where j denotes the subsector of the Czech food industry, i.e. CZ-NACE 101 to 110, except for CZ-NACE 104.

As emphasised by Saitone and Sexton (2010), nowadays, the food processing firms face severe competition due to the changing market conditions (such as increased market concentration in retailing, emphasis on the dimensions of product quality and food safety, and changes in worldwide distribution and geographic location of production and processing), which forces them to increase the productivity by keeping steady labour force and increasing overall output. It can be assumed that higher productivity causes the increase of profits, as investigated e.g. by Athanasoglou et al. (2005). Given the design and interpretation of the productivity indicators, the $Labour_Productivity$ indicator is expected to have positive impact on profitability, whereas the $PersCost_VA$ indicator the negative impact.

Given the fact that indebtedness is an important variable for understanding the profitability (Simon-Elorz et al., 2015), we use the debt ratio ($Leverage$) calculated by the following formula (similarly to the previous studies, e.g. Clayton, 2009; Lopez-Valeiraz, 2016; Chandrapala and Knápková, 2013) as independent variable:

$$Leverage_j = \frac{Total\ Liabilities_j}{Total\ Assets_j} \times 100$$

where j denotes the subsector of the Czech food industry, i.e. CZ-NACE 101 to 110, except for CZ-NACE 104. Since the debts in the capital structure provide benefits to the firm as well as increase the financial distress costs, it is difficult to determine the relationship between indebtedness and profitability ratios, i.e. the sign of the parameter in models. On the one hand, the interests mean the tax reduction, but on the other hand, the interests are obligations and as such they can incur the financial distress to the firm.

Before moving to the methodological approach, we present the descriptive statistics for the variables of interest, which are reported in Table 1.

| Variable/Statistics | Mean | SD | Min | Max | N |
|----------------------------|-----------|-----------|------------|-----------|-----|
| <i>ROA</i> | 6.7396831 | 3.4552748 | -4.8387882 | 15.482057 | 108 |
| <i>ROE</i> | 9.6966256 | 8.4777807 | 34.239597 | 41.153664 | 108 |
| <i>CR4</i> | 39.270157 | 19.618538 | 12.577329 | 96.238654 | 108 |
| <i>HHI</i> | 928.15055 | 1286.4564 | 85.455134 | 6332.1207 | 108 |
| <i>NF</i> | 728.58333 | 850.02504 | 15 | 3,036 | 108 |
| <i>IMP</i> | 42.727938 | 27.324315 | 8.9975684 | 115.00251 | 108 |
| <i>Labour_Productivity</i> | 610.99249 | 294.61539 | 215.48077 | 1266.9048 | 108 |
| <i>PersCost_VA</i> | 56.076266 | 13.290135 | 25.426469 | 88.04782 | 108 |
| <i>Leverage</i> | 55.727831 | 11.611146 | 34.742969 | 91.038824 | 108 |

Source: STATA 14; authors' elaboration

Table 1: Descriptive statistics.

Empirical approach

Our sample consists of a panel of nine subsectors of the Czech food industry for the period of years 2003-2014. To study determinants of sectoral profitability and to achieve main goal of our research, we implement multivariate regression analysis of panel data, which was used for example in the study by Setiawan et al. (2012) or Dickson (2005). Regression analysis allows us to analyse the impact of the sectoral determinants (independent variables), especially market concentration, on the profitability of the subsectors (dependent variables). Profitability is represented by two different profitability indicators of the subsectors, i.e. *ROA* and *ROE*. Market concentration is represented also by two different indicators, i.e. *CR4* and *HHI*. Other determinants include number of firms in particular subsector (*NF*), import penetration (*IMP*), indebtedness (*Leverage*), and we also use two ways, how to measure productivity, i.e. labour productivity (*Labour_Productivity*) and personal cost per value added (*PerCost_VA*). According to Verbeek (2012) we need to begin with the test of stationarity of the individual variables, then we need to choose the most appropriate estimation technique and finally, our estimated models need to fulfil econometric assumptions.

In our study, we used the programme STATA 14 to estimate all presented outcomes. To test stationarity, Levin, Lin & Chu test for the panel data (Levin et al. 2002) was conducted for each of the variables, which proved that all of the variables are stationary. As for the estimation technique, we could choose pooled OLS, random effects or fixed effects approach. Based on the results of Hausman test, we have decided to use fixed effects estimator. Our econometric models were therefore estimated with the fixed effects and with robust standard errors, which are consistent against the consequences

of autocorrelation and heteroscedasticity. To evaluate level of collinearity and to detect potential threat of multicollinearity, we used correlation matrices and Variance Inflation Factors (VIF) test. This high level of collinearity was observed between *Labour_Productivity* and *PersCost_VA*, and between *CR4* and *HHI*. As a remedy, these variables had to be put into the regression models separately. In the presented models, collinearity among the independent variables was found to be below the generally accepted threshold. All estimated models were found to be statistically significant and the Goddess of fit (R^2) informs us that the share of explained variance of the dependent variables in our estimated models is quite good and comparable with the previously published studies (Verbeek, 2012). Since all assumptions were fulfilled, we might proceed towards interpretation of obtained results.

Results and discussion

The final models are presented in Table 2. Statistical significance of independent variables is reported conventionally. The results show, that the market concentration, productivity and indebtedness have significant effect on both *ROA* and *ROE* in all estimated models.

The market concentration variables (*CR4* and *HHI*) have statistically significant positive effect on *ROA* and *ROE*, which indicates that during the period of observation, i.e. 2003-2014, the increase in market concentration in the Czech food processing market (documented by Blažková, 2016) was associated with higher profitability of food subsectors. This result corresponds with the majority of previous studies, e.g. Dickson (2005), Setiawan et al. (2012) or Hirsch et al. (2014), and also with our assumptions related

to the ongoing changes in the commodity verticals, i.e. increasing retail concentration as the subsequent vertical stage (*CR5* indicator was 14.45% in the Czech food processing industry in comparison with 45.50% in the Czech retail sector in 2013). It can be assumed that higher market concentration on the food processing market may generate better bargaining position of food processors towards retailers.

As stated by Newmark (2004) or Hersch et al. (1994), the structure of the industry can be assessed not only by the size distribution of firms on the market, i.e. by the market concentration indicators, but also by the number of firms on the market. Contrary to our expectations, the positive sign of the coefficient for *NF* variable was observed in all models. Regarding the fact that the coefficients were not statistically significant, we cannot make any conclusions about the impact of the number of firms on profitability of the Czech food processing industry. There are several large firms in the Czech food processing industry reporting high profits, but on the other hand, very small firms are represented in large numbers that can be successful and profitable from the regional point of view or due to the discovering and occupying of the market

niches. Therefore, the number of firms in the sector is not considered as an important determinant of profitability in the Czech food processing industry.

As seen from Table 2, the import penetration ratio (*IMP*) is not statistically significant driver of profitability in the Czech food processing industry. Moreover, the sign of its coefficient is differing in particular estimated models. Thus, it has to be concluded that the impact of import penetration on profitability was not confirmed, and although the import competition was increasing on the Czech food market during 2003-2014, the impact on the firm profitability was not observed. When considering the linkage between import penetration and the profitability, two different effects could be at work behind the openness of the market – first, imports lead to sharper competition in the domestic market, and second, the openness to foreign supply markets enables the availability of cheaper intermediates (Kasahara and Rodrigue, 2008). Hence, the increased import penetration may represent a threat for firms in the industry as well as the opportunity.

To investigate the effects of productivity on the *ROA* and *ROE* indicators, two variables

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
|--------------------------------|-----------------------|-----------------------|--------------------------|--------------------------|------------------------|---------------------|------------------------|------------------------|
| <i>Independent/Dependent</i> | <i>ROA</i> | <i>ROA</i> | <i>ROA</i> | <i>ROA</i> | <i>ROE</i> | <i>ROE</i> | <i>ROE</i> | <i>ROE</i> |
| <i>CR4</i> | 0.0737*** -0.0195 | 0.0874*** -0.0222 | | | 0.137*** -0.0334 | 0.161*** -0.041 | | |
| <i>HHI</i> | | | 0.000745*** -0.000207 | 0.000814*** -0.000242 | | | 0.00132** -0.000407 | 0.00142** -0.000454 |
| <i>NF</i> | 0.000794 -0.00177 | 0.00136 -0.00165 | 0.000477 -0.00143 | 0.000842 -0.0012 | 0.00216 -0.003 | 0.00312 -0.00268 | 0.00149 -0.00235 | 0.00203 -0.00182 |
| <i>IMP</i> | -0.00264 -0.0262 | 0.0142 -0.0352 | 0.0196 -0.0292 | 0.0395 -0.0398 | -0.0179 -0.043 | 0.0105 -0.0636 | 0.0223 -0.0466 | 0.0547 -0.0694 |
| <i>Labor_Productivity</i> | 0.00513** -0.00154 | | 0.00639** -0.00253 | | 0.00946*** -0.00256 | | 0.0117** -0.00466 | |
| <i>PersCost_VA</i> | | -0.0802*** -0.0201 | | -0.0871** -0.035 | | -0.139** -0.0449 | | -0.149* -0.0676 |
| <i>Leverage</i> | -0.160*** -0.0282 | -0.147*** -0.0343 | -0.149*** -0.0332 | -0.134** -0.0424 | -0.176*** -0.0506 | -0.154** -0.0511 | -0.156** -0.0584 | -0.131* -0.0668 |
| Observations | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 |
| <i>R</i> ² | 0.455 | 0.425 | 0.408 | 0.344 | 0.354 | 0.318 | 0.299 | 0.226 |
| Adjusted <i>R</i> ² | 0.359 | 0.324 | 0.304 | 0.229 | 0.24 | 0.198 | 0.176 | 0.09 |
| <i>AIC</i> | 393 | 398.7 | 401.9 | 412.9 | 538.3 | 544.2 | 547.1 | 557.8 |
| <i>BIC</i> | 414.5 | 420.2 | 423.3 | 434.4 | 559.8 | 565.7 | 568.6 | 579.3 |

Note: Standard errors are in parentheses, *** stat. significance at 1% level, ** stat. significance at 5% level, * stat. significance at 10% level.
Source: STATA 14; authors' elaboration

Table 2: Model table.

were employed in models – labour productivity (*Labour_Productivity*) and personal cost per value added (*PersCost_VA*). All coefficients were found to be statistically significant, and according to our expectations, the increased labour productivity led to higher profitability of the Czech food processing industry in 2003-2014, and the impact of the increase of personal cost per value added was negative, which shows that the investments in the technology and innovations generate positive effects through the increased level of productivity.

As mentioned above, increased innovation activity and investments in new technologies are usually connected with the increased capital needs, which may be manifested in the higher indebtedness causing the risk of the firm due to the possible troubles with paying of interests and risks of getting into the bad financial situation. On the other hand, the risk theory suggests that firms with higher risk should on average achieve higher profits (Roeser, 2012). In our analysis, the effect of higher indebtedness (*Leverage*) was not favourable and caused statistically significant decrease of profitability in all estimated models. It would be better to use combined sources to fund the firm activities in the Czech food processing industry and to decrease debts to a lower lever that would not affect the financial autonomy of firms and would increase the assets' ability to generate higher profits.

Conclusion

The aim of this paper was to investigate the determinants influencing the profitability of the Czech food processing industry, which is nowadays the key issue to maintain the competitiveness on the global and constantly changing markets, and which responds to the lack of related studies in the Czech food environment. Our main focus, when assessing the impact of industry factors on the differentiation of sector performance, was on the effects of key structural characteristics such as market concentration, increase of import competition and related changes in productivity of the subsectors.

Data for the analysis drawn from more databases were formed into the panel dataset, which covers 12-year period across 9 subsectors of the Czech food processing industry. The econometric models with fixed effects were estimated to empirically study the relationship between profitability and structural indicators, productivity and related indebtedness of the food subsectors.

It was statistically confirmed that increase in market concentration in the Czech food processing industry led to the increase in sectoral profitability, which is in line with the results of previous published studies (e.g. Kaditi, 2013; Setiawan et al., 2012a; Dickson, 2005). It confirms better market position of concentrated food processors relative to the retail in the Czech Republic regardless whether it is the consequence of efficiency or market power. Also the sectoral productivity is an important determinant of profitability, as proved by the conducted analysis, therefore policies and firm strategies should be focused on innovations of processes or products, since the innovation capabilities contributes to the sectoral profitability through lower production cost or superior products. The negative relationship was found between the profitability and the indebtedness that corresponds with Goddard et al. (2005), Chaddad and Mondelli (2013), Hirsch et al. (2014) or Chandrapala and Knápková (2013). On the other hand, this result contradicts the theory of risk (Roeser, 2012). This result shows the suitability to reduce the debts of the Czech food processing firms to generate higher profits. Although the import competition is still increasing after the entry of the Czech Republic into the EU, the impact on the sectoral profitability was not observed and statistically proved.

The study should provide a basis for the public policy makers, food managers and for further analytical research focused on all levels of the food commodity chain in the Czech Republic, since to investigate the performance in the whole chain, including possible effects of industry specific attributes on the firms' profitability, would be important and challenging aim for the further research. From a methodological perspective, future research should test, whether the industry related determinants are the same, when using different measures of profitability.

Acknowledgements

This work was supported by Internal Grant Agency of Faculty of Regional Development and International Studies, Mendel University in Brno, under no.: 2017/009 and by Internal Grant Agency of Faculty of Business Administration, University of Economics in Prague, under no.: IP300040.

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