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How does public investment support change the capital structure and productivity of small enterprises? An empirical study of the food industry

RESEARCH ARTICLE

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Abstract

The impact evaluations of public investments are essential for policymakers to evaluate the effectiveness of public resource allocation. European public investment subsidies target small companies to enhance their competitiveness and viability in the market. This article uses the average treatment effect and the difference-in-difference approach to evaluate the impacts of investment support from the Rural Development Programme and the Operational Programme Enterprise and Innovation on structural and economic indicators of small enterprises. This representative case study of 550 supported small companies from the Czech food and beverage industry during 2007-2015 clearly shows that investment subsidies increase the fixed assets, the credit-to-debt ratio and the labour productivity of supported companies versus nonparticipants. However, the discussion with recent studies indicates that this is not always positive for participants since high growth versus nonparticipants could result in crowding-out effects and increasing long-term and short-term debt that negatively impact technical efficiency.

Keywords: average treatment effects, capital structure, labour productivity, public investment support, policy impact evaluation, small enterprises, food industry

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1. Introduction

Many public policy measures have focused on supporting small enterprises. It is not easy to universally agree with the support of all small business entities. Nonetheless, it is necessary to distinguish start-ups, high-growth firms and established small companies. Some experts suggest that policymakers should stop subsidising typical start-ups and focus on the subset of businesses with higher growth potential since the typical start-up is not innovative, creates few jobs, and generates little wealth (Lerner, 2010; Shane, 2009). Other studies are more enthused about much better-targeted start-up support towards high-potential new ventures with support tailored to the particular requirements of such firms (Arshed *et al.*, 2014; Mason and Brown, 2013). Nevertheless, studies usually do not argue using empirical evidence. Since a key factor for the ineffectiveness of entrepreneurship policy is how it is formulated, the next part of the paper focuses on the policy framework for small enterprises in the European Union (EU).

Small enterprises are defined by the EU recommendation 2003/361 as enterprises which employ fewer than 50 people and whose annual turnover and (or) annual balance sheet total does not exceed €10 million (European Commission, 2003). The European Commission supports small enterprises through the Enterprise Europe Network that facilitates accessing market information, overcoming legal obstacles and identifying potential business partners across Europe. Moreover, small enterprises can use developmental programmes to obtain support for innovation activities and equipment upgrades. For example, the Operational Programme Enterprise and Innovations for Competitiveness helps small and medium-sized local companies gain ground in world markets and create sufficient jobs over the long term. The Rural Development Programme helps rural areas of the EU meet the wide range of economic, environmental and social challenges. It is highly important to measure the effectiveness of public investment support for policymakers to obtain knowledge regarding the effects since taxpayers are a key stakeholder in every public support policy.

The reason why the article investigates food and beverage industries is that they are essential for nutrition. They include many small companies. European and national funds have supported many of them. The Czech Republic has been a member of the EU for some time. The important characteristics of the Czech food industry are significant heterogeneity among firms and sectors (Čechura and Hockmann, 2017; Rudinskaya, 2017) and the relatively low competitiveness of some branches against the main trading partners (such as meat processing and fruit and vegetable processing) (Pohlová *et al.*, 2016; Smutka *et al.*, 2016). The later parts of the article discuss specific measures of support for small enterprises in the Czech Republic.

Impact evaluation follows extensive theory (Khandker *et al.*, 2010; White, 2009). Effective impact evaluation should be able to precisely assess the mechanisms by which beneficiaries respond to the intervention. Quantitative impact evaluation usually uses the counterfactual approach that considers causality and enables better isolation of the program's effects from other factors (such as branch, size or capital structure) and potential selection bias. Recent studies on impact evaluation in the agri-food business provide an overview of various methods and empirical findings relevant for small enterprises.

The impact evaluation methods consist of qualitative or quantitative methods and ex-ante or ex-post approaches. Qualitative analysis cannot be generalised, and it is useful for the deep understanding of impact mechanisms through which the programme helps beneficiaries. Qualitative methods should follow quantitative analysis, which is a cornerstone of ex-post impact evaluation. Variants of impact evaluation include randomised evaluations (Duflo *et al.*, 2008), the propensity score matching (PSM) approach (Caliendo and Kopeinig, 2008), difference-in-difference (DID) methods (Abadie, 2005; Bertrand *et al.*, 2004; Petrick and Zier, 2011), the use of instrumental variables (Angrist *et al.*, 1996; Froelich and Huber 2017), regression discontinuity (Cerqua and Pellegrini, 2014; Decramer and Vanormelingen, 2016; Lee and Lemieux, 2010) and pipeline comparisons (Ravallion, 2005). The European Commission presented a broader set of quantitative and qualitative evaluation methods (Table 1) (European Commission, 2014).

Table 1. Overview of evaluation approaches (European Commission, 2014).¹

Method	Input	Output	Examples of methods
Qualitative methods	Mainly text (spoken or written) and theory	The substance of text analysed, effects, impacts (ordinal)	Intervention logic, interviews, MAPP, Delphi method
Theory-based evaluation	Programme theory or any other social/economic theory	Estimate on the effectiveness of the intervention logic	Realist evaluation theory-based evaluation
Econometric methods	Economic theory and data at the unit level	Estimates of (net) effects (cardinal), hypothesis tests	PSM, regression analysis, DID
Experimental methods	Designed experiment observations	Estimates of (net) effects (cardinal) hypothesis tests	RCT: phase-in design, pilot project design, encouragement design
Computational Economic models	Economic theory and parameters	Estimates of impacts (cardinal)	Regional and national input-output, general and partial equilibrium models, farm models, CBA, CEA
Environmental approaches	Scientific theory, the indicators on the unit level, coefficient or parameter	Effects, impacts, text on the environment	LCA, integrated modelling approaches, SEA
Combinations of approaches	All of the above	All of the above	GRIT, the theory of driving forces, pressures, states, impacts, responses

¹ CBA = cost-benefit analysis; CEA = cost-effectiveness analysis; LCA = life-cycle analyses; GRIT = generation of regional input-output tables; MAPP = method for impact assessment of programmes and projects; RCT = randomised controlled trial; SEA = strategic environmental assessment; PSM = propensity score matching.

Concerning past empirical studies, there is no consensus regarding the best methods and indicators. The choice of indicators depends on data availability and the purpose of evaluation. Most studies do not analyse the firm size, despite policies that usually set preferential criteria for small firms. Recent relevant studies showed that policies boost private investment in small firm growth more than in the full sample. The importance of the support for financial investments is much higher for small than for large firms since smaller firms receive a higher subsidy relative to their size (Decramer and Vanormelingen, 2016). The policy strongly impacts growth of output, value added and employment. The non-subsidised small firms invest substantially less than subsidised ones, and small firms invest more efficiently in their production process than larger firms. More recent studies also confirmed stronger impacts of investment subsidies on investment activity (Bronzini and Iachini, 2014), innovation activity (Bronzini and Piselli, 2016) and firm growth measured by output and input indicators (Decramer and Vanormelingen, 2016) of small firms over large ones. The positive effects of the incentives on turnover and productivity growth concern firms that have accumulated international experience (Bannò *et al.*, 2014). Nevertheless, marginal effects of additional incentives on employment decrease with the amount of financial aid for small-sized firms (Bia and Mattei, 2012).

In some cases, programme support may be mistargeted. Deadweight loss occurs if a programme participant would undertake a similar investment without programme support (Michalek, 2012). Small firms have a lower deadweight loss in the investment support programme (Ratinger *et al.*, 2013). Another study found that subsidised firms do not produce more innovations and receive subsidies for projects that would have been undertaken even without the subsidy. We find some positive, marginally significant signals of effectiveness only for small and medium firms (Blasio *et al.*, 2015). In addition to the deadweight loss, the crowding-out effect supports the critical views of public investment support. Recent studies provided empirical evidence of the inter-firm crowding-out of investment support (Bronzini and Blasio, 2006), where supported firms increased their investments to the detriment of unsubsidised firms. Ciaian *et al.* (2015) found that the crowding-out effect of the Rural Development Programme is close to 100%, which implies that firms use public support to substitute for private investments.

Based on the counterfactual analysis, authors recommend targeting the investment support to smaller firms with low capital equipment (Bartova and Hornakova, 2016). Impact evaluation studies on dairy processing (Naglova *et al.*, 2016) and meat processing (Spicka *et al.*, 2017) were carried out in the Czech food industry. They investigated profitability, labour productivity and changes in capital structure. Unfortunately, they were not representative of the group of small companies since there is a lack of publicly available data on small enterprises.

The article assesses how public investment support changes the capital structure and productivity of small enterprises. We assume that public investment support has a positive impact on productivity and capital structure through the higher use of bank loans compared to unsupported small companies. The article is unique for three reasons. First, the ex-post analysis provides a comprehensive evaluation based on all supported companies in the food and beverages industries thanks to the data provided by the Ministry of Agriculture and the Ministry of Industry and Trade. Such representative results have not been previously published. Second, 95% of the food and beverage industry players in the Czech Republic are small enterprises which makes them very important group. Third, small companies are important beneficiaries of public investment support. From 2007 to 2013, small companies received 35% of the total investment subsidies given to the Czech food and beverage industry. Thus, it is highly important to provide policymakers and analysts proper knowledge about the effects of public investment support for such an important part of the industry.

2. Methods

The main challenge across different types of quantitative evaluation methods is to find a good comparison point, such as a beneficiary's outcome in the absence of the intervention. Guo and Fraser (2015) distinguish two types of counterfactual designs. The first group of methods uses logistic regression to predict propensity scores (Heckman *et al.*, 1998; Rosenbaum and Rubin, 1983). Alternatively, matching estimators do not calculate propensity scores. They require fewer decisions, are easy to implement, and do not involve the nonparametric estimation of unknown functions. Groups of matching estimators include the simple matching estimator, the bias-corrected matching estimator, the variance estimator that assumes a constant treatment effect and homoscedasticity, and the variance estimator that allows for heteroscedasticity (Abadie and Imbens, 2006).

Matching uses the *teffects nnmatch* algorithm running in the Stata software (StataCorp LLC, College Station, TX, USA) (Abadie and Imbens, 2011, 2006). The algorithm estimates the average treatment effect on the treated (ATET) from observational data using nearest-neighbour matching (NNM). NNM estimators impute the missing potential outcome for each subject by using an average of the outcomes of similar subjects that received the other treatment. The similarity between subjects resides in weighted function of the covariates for each observation. The treatment effect consists in taking the average of the difference between the observed and imputed potential outcomes for each subject. An exact match using Nomenclature statistique des activités économiques dans la Communauté européenne (NACE) codes was applied to isolate the branch-specific effects of the programme.

In this binary-treatment potential-outcome model, y_1 is the potential outcome obtained by an individual if given treatment level 1 (supported companies), and y_0 is the potential outcome obtained by each individual if given treatment-level 0 (unsupported companies). The average treatment effect on treated is:

$$\delta_1 = E(y_1 - y_0 | t = 1) \quad (1)$$

NNM uses a vector of covariates $\mathbf{x}_i = \{x_1, x_2, \dots, x_p\}$ to find the most similar individuals who receive the other treatment level. The principal component analysis identified 6 covariates that represent 81.1% of the variability of the original 33 variables (sales, operating profit, debt ratio, credit debt ratio, financial leverage and equity).

We consider the vector of covariates \mathbf{x}_i and the frequency weight w_i for observation i . The distance between \mathbf{x}_i and \mathbf{x}_j can be parametrised by the vector norm

$$\|\mathbf{x}_i - \mathbf{x}_j\|_S = \{(\mathbf{x}_i - \mathbf{x}_j)' \mathbf{S}^{-1} (\mathbf{x}_i - \mathbf{x}_j)\}^{1/2}, \quad (2)$$

where \mathbf{S} is a given symmetric, positive-definite matrix. Using this distance definition, the nearest-neighbour indices for observation i are

$$\Omega_m^{\mathbf{x}}(i) = \{j_1, j_2, \dots, j_{m_i} \mid t_{j_k} = 1 - t_i, \|\mathbf{x}_i - \mathbf{x}_{j_k}\|_S < \|\mathbf{x}_i - \mathbf{x}_l\|_S, t_l = 1 - t_i, l \neq j_k\} \quad (3)$$

Here, m_i is the smallest number such that the number of elements in each set $m_i = |\Omega_m^{\mathbf{x}}(i)| = \sum_{j \in \Omega_m^{\mathbf{x}}(i)} w_j$ is at least m , the desired number of matches (1:1).

The Mahalanobis distance (Guo and Fraser, 2015) was used as this paper's distance calculation method.

The NNM method predicts the potential outcome for the i -th observation as a function of the observed y_i

$$\hat{y}_{ti} = \begin{cases} y_i, & \text{if } t_i = t \\ \frac{\sum_{j \in \Omega_m^{\mathbf{x}}(i)} w_j y_j}{\sum_{j \in \Omega_m^{\mathbf{x}}(i)} w_j}, & \text{otherwise} \end{cases} \quad \text{for } t \in \{0, 1\} \quad (4)$$

Then, ATET is:

$$\hat{\delta}_1 = \frac{\sum_{i=1}^n t_i w_i (\hat{y}_{1i} - \hat{y}_{0i})}{\sum_{i=1}^n t_i w_i} = \frac{\sum_{i=1}^n \{t_i - (1-t_i)K_m(i)\} y_i}{\sum_{i=1}^n t_i w_i} \quad (5)$$

where

$$K_m(i) = \sum_{j=1}^n I\{i \in \Omega(j)\} \frac{w_j}{\sum_{k \in \Omega(j)} w_k}$$

The article employs the DID approach to calculate the net effect of investment support (Bertrand *et al.*, 2004; Kirchweiger *et al.*, 2015). The DID compares the treatment and comparison groups regarding outcome changes over time relative to the outcomes observed for a preintervention baseline. Given a two-period setting where $t=0$ before the programme and $t=1$ after programme implementation, we let Y_t^T and Y_t^C be the respective outcomes for a programme beneficiary (T) and untreated units (C) in time t . Then, the DID method will estimate the average programme impact as follows (Khandker *et al.*, 2010):

$$DID = E(Y_1^T - Y_0^T | T_1 = 1) - E(Y_1^C - Y_0^C | T_1 = 0) \quad (6)$$

Where $T_1=1$ denotes the treatment or the presence of the programme at $t=1$, whereas $T_1=0$ denotes untreated areas.

Following the literature review and impact indicators of development and operational programmes (MoA, 2008; MoIT, 2007), we identified key economic variables that could be affected by investment support. The aim of this article is to ex-post evaluate the effects of investment support on the fixed (tangible) assets, the credit-to-debt ratio, the labour productivity and the fixed assets turnover of Czech small enterprises producing food and beverages between 2007 and 2015.

As a consequence of higher investment activity, supported companies should increase fixed assets more dynamically than nonparticipants (Decramer and Vanormelingen, 2016; Kirchweiger and Kantelhardt, 2015; Medonos *et al.*, 2012). The fact that most investment subsidies aim at improving the value of capital for supported companies supports this hypothesis. Simultaneously, fixed assets should be used more efficiently, as measured by Fixed Assets Turnover (Sales/Fixed Assets).

The capital structure of supported companies should change as companies use bank loans for financial modernisation. If we assume that supported companies have higher investment activity than non-supported companies, there should be significant differences in the credit-to-debt ratios (Bank Loans/Total Assets in %) for participants and nonparticipants. Nevertheless, measuring this effect could be problematic since small enterprises do not take as many bank loans as large companies.

Labour productivity is an important indicator focused on by the European Commission (European Commission, 2016) since it is the key economic indicator of a company's productivity (Rezbova and Skubna, 2013). Investment support should increase labour productivity due to the investment in more modern and efficient technology. Moreover, investment support should also focus on creating new jobs (Bernini and Pellegrini, 2011), especially in small enterprises, unlike medium-sized and large-sized enterprises where upgrading technology often substitutes for human labour. There is some evidence that small firms receiving lower incentive levels are much more sensitive to incentive changes than firms receiving higher incentive levels (Bia and Mattei, 2012). However, the output should increase more than labour costs to retain economic efficiency and profits (Decramer and Vanormelingen, 2016). The hypothesis is that there is a positive dynamic effect of investment support on labour productivity. Otherwise, the strategic goals of development and operating programmes will not be accomplished. The author calculates labour productivity as gross value added (Sales minus Expenditures on Material, Energy and Services) per unit of Labour Costs. The Labour Costs of unpaid labour inputs means the average labour costs in the branch, year and region (Czech Statistical Office).

3. Data

This research uses the individual data from 550 small enterprises (beneficiaries) that received investment support from the Ministry of Agriculture and the Ministry of Industry and Trade of the Czech Republic in the previous programming period (from 2007 to 2015 when authorities completed the last applications). There were 803 projects completed in the food (NACE 10) and beverage (NACE 11) industries. It contains the full population of supported small enterprises and projects. The selection of key indicators depends on the purpose of the grant programmes. There were two main development programmes for small food and beverage industries in the Czech Republic during the previous programming period. First, the Rural Development Programme provided investment subsidies for small and medium enterprises within sub-measure I.1.3.1 Adding value to agricultural and food products. The measure was granted for tangible and intangible investments concerning the processing, marketing and/or development of new products, processes and technologies linked to products covered by the Annex I of the EC Treaty (except for fishery products) and with respect to the EC standards applicable to the investment concerned (MoA, 2008). The investments should improve the overall performance of small and medium enterprises and increase the competitiveness of the agri-food industry. The key economic indicator for impact evaluation was labour productivity (gross value added per worker). Finally, Ministry of Industry and Trade has supported small and medium companies making products not covered by the Annex I of the EC Treaty by the under the Operational Programme Enterprise and Innovation (MoIT, 2007). Value added was a key performance indicator.

Whereas indicators for all supported enterprises were available, the most difficult stage of the research was to gather data from unsupported small companies since they are usually uncooperative. The Bisnode Albertina database was a suitable basis for the random sampling of small companies within the same branches of the food and beverages industries that had the same turnover interval and did not receive investment support until 2015. They were surveyed to obtain at least the same number of responses as in the group of supported enterprises. We obtained 795 completed questionnaires from which we matched 550 untreated enterprises (control group) based on indicators resulting from the Principal Component Analysis (sales, operating profit, debt ratio, credit debt ratio, financial leverage and equity). However, the limitation of the analysis is that it does not follow the recommendation by the European Evaluation Helpdesk for Rural Development (European Commission, 2016) about the selection of a sample from the control group that is at least 2-3 times larger than the sample of beneficiaries. The exact match using the NACE variable caused this limitation. Figure 1

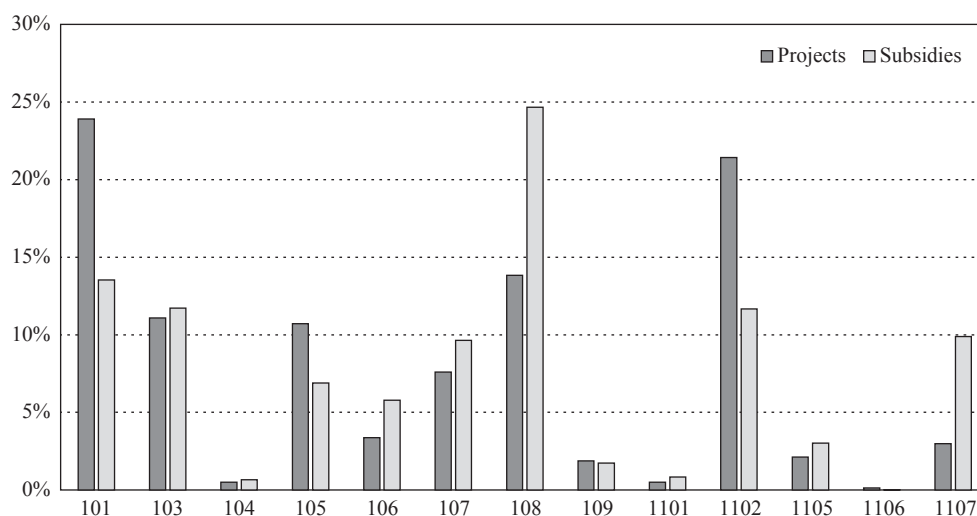


Figure 1. Project and subsidies of small enterprises by NACE code (2007-2015).

provides the structure of completed projects (N=803). The branch structures of supported and unsupported companies exactly correspond.

Except for the manufacture of other food products (10.8), the most supported small enterprises come from the meat processing industry (10.1), the fruit and vegetable processing and preservation industry (10.3), the dairy industry (10.5), bakeries (10.7), the manufacture of wine from grape (11.02) and the manufacture of soft drinks (11.07). There is an obvious imbalance between the structures of projects and subsidies. In the investigated period, the average investment subsidy per project was 2,872,789 CZK (CZK=Czech koruna) with a standard deviation 5,293,029 CZK, a minimum of 22,000 CZK and a maximum of 76,751,000 CZK (1 EUR=26 CZK). The biggest projects were in branch 11.07 that encompasses the manufacture of soft drinks and the production of mineral waters and other bottled waters (9.5 million CZK). Alternatively, the smallest projects were in 11.02 that encompasses the manufacture of wine from grapes due to the very small size of winemakers (1.5 million CZK). Thus, high heterogeneity concerning project size is obvious.

Since the period 2007-2015 is quite long, a mid-term evaluation is needed. Thus, the author divided the period into two sub-periods where

- 2007 was the starting point (i.e. the year before support);
- 2011 was the year of mid-term evaluation; and
- 2015 was the year when supported companies completed all projects.

4. Results and discussion

Before the impact evaluation, it would be helpful to look at the total investment subsidy as a percentage of the total assets before (2007) and after (2015) support since low shares could have limited impacts concerning the investment project.

There are obvious differences between the food industry and the beverage industry. Projects in the food industry were smaller relative to the participants' total assets. In the period 2007-2015, enterprises in the beverage industry experienced a higher average growth of total assets (13.13%) than in the food industry (5.75%). The most dynamic increase of total assets was in the manufacturing of grain mill products, starches and starch products (10.6), the distilling, rectifying and blending of spirits (11.01) and the manufacturing of beer (11.05), as shown in the Table 2. Small enterprises specialising in the distilling, rectifying and blending of spirits and manufacturing beer received the highest investment subsidies relative to their asset value before support. The reason is that the technology (equipment) is very expensive. Alternatively, the dairy industry

Table 2. The branch-specific growth of total assets and share of investment subsidy in total assets.

NACE	The growth of total assets (%, 2015/2007)	Share in 2007 (%)	Share in 2015 (%)
10.1	4.40	48.17	13.12
10.3	13.74	84.32	8.86
10.4*	–	–	–
10.5	1.97	13.32	5.84
10.6	32.25	167.47	5.02
10.7	2.64	52.62	17.99
10.8	3.71	141.35	31.35
10.9	1.19	2.65	2.10
11.01	31.48	1,319.27	16.47
11.02	3.68	16.08	6.65
11.05	26.59	202.32	14.46
11.06*	–	–	–
11.07	4.85	151.14	28.29
Total	6.95	105.95	15.71

* = less than three observations.

(10.5) and feed processors (10.9) grew slightly, and their projects were relatively small compared to their asset values before support. Small milk processors invested mostly in building mini dairy plants since they mostly were cattle breeders and decided to add higher value to their basic products (goat, sheep or cow milk). The projects of small feed processors were heterogeneous, including the purchasing of oil presses, granulation lines, laboratory equipment, mixers, and others.

Table 3 provides the important finding that small enterprises have relatively high shares of investment subsidies concerning total assets. In total, the mean share before the subsidy was 105.95% (2007). It means that supported enterprises received more investment subsidies in 2008-15 compared to the value of their assets. There were also some extremely big investment projects since the maximum share was 3,950.62% (which was a project that reconstructed a distillery and brewery). The share of investment subsidy in total assets was significantly smaller in 2015 (15.7%) as the supported companies dynamically grew.

The relatively high importance of investment projects regarding company's size (Decramer and Vanormelingen, 2016) provides an assumption about the significant impacts of investment subsidies on the structural and economic indicators of small enterprises. The impact of investment subsidies on the development of fixed assets and an external source of funding (credit-to-debt ratio) are the most important. The reason why Table 4 presents fixed assets and the credit-to-debt ratio together is that bank loans are important financial sources for purchasing fixed assets.

Table 3. The share of investment subsidy in total assets by industry branches (2007, 2015, %).¹

Aggregation	Mean	SD	Min	1 st Q	Median	3 rd Q	Max
Total 07	105.95	386.05	0.16	6.71	18.16	48.01	3,950.62
Total 15	15.71	22.51	0.13	3.75	8.37	16.40	145.37
NACE 10_07	74.93	185.60	0.16	6.59	20.01	44.76	1,337.58
NACE 10_15	16.19	23.70	0.13	3.90	8.46	16.90	145.37
NACE 11_07	265.51	858.83	0.55	6.72	12.63	86.08	3,950.62
NACE 11_15	13.20	15.16	0.47	2.44	7.30	16.21	53.86

¹ Total N=550; NACE 10 N=404; NACE 11 N=146.

Participants often invested in upgrading technical equipment and buildings related to investments, including buying or building new facilities. The investment support aims at improvements in the processing and marketing of agricultural products. It includes investments aimed at improving efficiency, opening new market opportunities for agricultural products, introducing modern technologies and innovation, emphasising quality, and improving environmental protection, occupational safety, hygiene and animal welfare.

Table 4 shows the effects of investment support on fixed assets and the credit-to-debt ratio. Participants dynamically increased the value of fixed assets, whereas the control group of nonparticipants invested to cover the depreciation of their fixed assets. It means that participants followed the growth strategy and expansion, unlike nonparticipants. We can explain it in two ways.

First, nonparticipants deliberately follow sustainable business strategies since they do not have the potential or intention to grow. Moreover, some family firms have significant off-firm income diversification (Weltin *et al.*, 2017). Business income together with off-firm income is sufficient for their family. The sample of nonparticipants does not contain companies which do not intend to invest at all. Companies either make investments to accomplish long-term growth objectives or just upgrade old equipment. Second, some nonparticipants' applications were not successful, and they did not resubmit. The question is whether subsidised firms invest more than they usually would? Decramer and Vanormelingen (2016) additionally confirmed the investment by analysing the cumulative net investment growth of the subsidy amount.

Empirical findings from the Czech food industry showed that the application success rate was lower in the group of small companies than in the medium and large ones since bigger companies usually use own specialists or professional consulting services, whereas small entrepreneurs must rely on himself/herself (Spicka *et al.*, 2017). A substantial difference in growth between participants and nonparticipants may be a signal of the crowding-out effect of investment programmes on nonparticipants (Ciaian *et al.*, 2015; Hud and Hussinger, 2015).

The growth of the credit-to-debt ratio corresponds to participant growth. The DID of the credit-to-debt ratio increased in the group of participants, whereas it dropped in the sample of nonparticipants. It indicates that participants used bank loans for co-financing investment projects (Decramer and Vanormelingen, 2016). Instead, nonparticipants decreased their credit burden. They did not invest in expansion but just in the renovation of existing assets. The results show that investment support mobilised additional resources to finance the sector investment in small food and beverage companies. However, recent studies revealed no significant increase in the bank indebtedness on large firms due to investment support because of a higher

Table 4. Average treatment effect on the treated (ATET) and difference-in-difference (DID) – fixed assets and the credit-to-debt ratio ($\times 1000$ CZK).

Fixed assets ($\times 1000$ CZK)	Participation	Controls	ATET	SE	<i>t</i>	<i>P</i>
2011	28,505.39	13,763.46	14,741.93	1,347.68	-10.939	<0.0001
2015	38,150.10	15,898.66	22,251.44	1,778.01	-12.515	<0.0001
DID2007-11	13,713.32	468.33	13,244.99	1,018.45	13.005	<0.0001
DID2007-15	23,358.03	2,603.53	20,754.50	1,488.18	13.946	<0.0001
DID2011-15	9,644.71	2,135.20	7,509.51	799.56	9.392	<0.0001
Credit debt ratio (%)	Participation	Controls	ATET	SE	<i>t</i>	<i>P</i>
2011	16.567	12.132	4.435	0.892	4.974	<0.0001
2015	17.388	9.117	8.271	0.848	9.753	<0.0001
DID2007-11	5.239	1.861	3.378	0.795	4.249	<0.0001
DID2007-15	6.060	-1.153	7.214	0.861	8.381	<0.0001
DID2011-15	0.821	-3.014	3.836	0.725	5.288	<0.0001

deadweight loss for large companies over small business units (Ratinger *et al.*, 2013). However, recent empirical research showed a negative impact for long-term and short-term debt on the technical efficiency of the Czech food processing industry (Rudinskaya, 2017), which could be a warning signal for participants.

The results support the Final report of Ex-post evaluation of the Rural Development Program of the Czech Republic for the period 2007-2013 (EKOTOXA and IREAS centrum, 2016). The counterfactual analysis (PSM) and regression analysis confirmed the impact of investment support on the mobilisation of external capital (an increase of credit indebtedness) in supported enterprises. It supports the view that there has been additionality (investment beyond the normal investment) and therefore it can be concluded that the deadweight loss of the measure is rather low. It was in principle confirmed by the answer to the questionnaire survey (EKOTOXA and IREAS, 2016). Even though only 13% of the respondents would not realise the project at all, most of the others would have realised it at a lower level (54%) or over a longer period (64%).

The second part of the analysis (Table 5) concerns the effects of investment subsidies on the capital intensity and labour productivity. Participants should use fixed assets more efficiently, as measured by fixed assets turnover. Labour productivity should increase more in the participants' group due to the automation of modern technologies.

Table 5 illustrates that participants had significantly higher fixed assets turnover than the control group in 2011 and 2015. This ratio specifically measures how able a company is to generate sales from fixed-asset investments. Generally, a higher fixed-asset turnover ratio indicates that a company has more effectively utilised investment in fixed assets to generate revenue. There is no a benchmark in recent literature. One possible reason for this difference is that participants do not fully exploit new production capacities. Participants invested in fixed assets, but investments are usually in the start-up phase for several years after completion. Alternatively, nonparticipants did not significantly extend their production capacities. The indicator decreased in both groups of companies, but the difference-in-difference indicator does not prove any significant effect for investment subsidies on fixed assets turnover.

Labour productivity is key impact indicator in the Rural Development Programme and Operational Programme. Since most of the investments go to machinery and equipment, entrepreneurs are more concerned about labour productivity than about the other possible effects of modernisation through investment. Policy makers assume that investment subsidies help increase labour productivity, but there is often a trade-off between employment and labour productivity since labour productivity has been increased by the substitution of capital-intensive methods for labour-intensive methods in production processes, leading to a potential loss

Table 5. Average treatment effect on the treated (ATET) and difference-in-difference (DID) – fixed assets turnover and labour productivity.

Fixed assets turnover	Participation	Controls	ATET	SE	t	P
2011	2.058	2.426	-0.369	0.125	-2.946	0.0034
2015	1.721	2.210	-0.489	0.114	-4.294	<0.0001
DID2007-11	-0.530	-0.466	-0.064	0.104	-0.617	0.5373
DID2007-15	-0.867	-0.682	-0.185	0.142	-1.306	0.1920
DID2011-15	-0.337	-0.216	-0.121	0.101	-1.193	0.2333
Labour productivity	Participation	Controls	ATET	SE	t	P
2011	1.703	1.452	0.251	0.095	2.645	0.0084
2015	1.894	1.597	0.297	0.079	3.776	0.0002
DID2007-11	0.020	-0.241	0.261	0.147	1.773	0.0767
DID2007-15	0.211	-0.096	0.307	0.138	2.227	0.0263
DID2011-15	0.190	0.145	0.046	0.083	0.551	0.5817

of jobs (Choudhry and Van Ark, 2010). Results in Table 5 show significantly higher labour productivity of participants than in the control group. The DID indicator shows very interesting fact that there was only a long-term significant effect of investment subsidies on labour productivity between 2007 and 2015. Alternatively, there were no significant short-term effects, since DID2007-11 and DID2011-15 were not significant at the 0.05 significance level. A positive impact of public investment support on productivity is a signal of effective policy in the long term. Harrison *et al.* (2014) studied the impact of process and product innovations introduced by firms on employment growth. They found that productivity gains tend to be higher in innovating firms. Simultaneously, they noticed that an increase in the employment in innovative firms is higher despite their larger labour productivity gains. It shows that, on average, the effects stemming from the growth of output dominate the displacement effects of innovation. Firms pass on the productivity gains to lower prices and thus can increase demand and employment (Lachenmaier and Rottmann, 2011).

In contrast to this article, the recent study (Spicka, 2018) did not reveal any significant, positive effects on the intensity of the use of fixed assets and labour productivity when considering medium-sized and large food processors in the Czech Republic. It supports the assumption of high deadweight loss effect in productivity in the group of medium-sized and large companies because they can create sufficient funds for recovery and finance development through commercial credits. Alternatively, the deadweight loss effect can be relatively low in the group of small companies.

Although the survey (EKOTOXA and IREAS, 2016) indicate a higher share of product innovations among recipients, this cannot be attributed to the impact of these aids, as very little investment support targeted on product finalisation and product development. Evidence of significant upgrading of operations and processes among beneficiaries and thus better compliance with mandatory and voluntary standards can be considered as valid. In conclusion, the beneficiaries received a significant modernisation of the production which was insufficiently utilised in the market, especially due to the small application of marketing techniques. Low level of marketing innovation in the Czech food processing industry relative to Germany and Austria is a negative signal resulting from the latest Eurostat Community Innovation Survey (Eurostat, 2017).

5. Conclusions

The article focused on the impact evaluation of investment support on selected important structural and economic indicators using statistical and econometric methods. The case study of small enterprises in the Czech food and beverage industry during 2007-2015 noted some interesting findings that are important for policymakers and other stakeholders. Focus on small enterprises is unique since most recent studies have considered medium-sized and large-sized companies since data on small enterprises is unavailable.

According to the policy guidelines, investment support should enhance viability and competitiveness and promote resource efficiency for supported enterprises. The food and beverage industries are suitable branches for the case study since European and national funds have heavily supported them for a long time. The article compares supported companies with similar non-treated companies from the same branches of the food and beverage industry. Such an approach avoids the selection bias caused by branch specificities. Findings are generalised on the investment support programmes for small food and beverage producers supported by the Rural Development Programme and Operational Programme in the period 2007-2015.

Descriptive statistics revealed the relatively high importance of investment projects in the small enterprises in the food and beverage industry, which provides a good argument for the significant impacts of investment subsidies on size, capital structure and labour productivity. Some treated enterprises invested even more than the value of their assets before the subsidy. The analysis found big differences in relative project size between branches.

If we generalise our findings, supported companies (participants) have higher investment activity than nonparticipants. Investment support dynamically increases the amount of fixed assets and the size of

participants. Alternatively, nonparticipants invest enough to cover the depreciation of fixed assets and do not develop themselves. However, the turnover of fixed assets did not significantly improve after the completion and launch of the investment. It could mean that participants are not able to fully exploit new production capacities in the years after the project launch.

Investment support changes the capital structure of participants towards the increased use of bank loans and a growing credit-to-debt ratio. Investment support mobilises additional resources to finance the sector investment priorities. The DID indicator estimated low deadweight losses in the group of small enterprises. Alternatively, recent studies showed relatively high deadweight losses for large companies in the agri-food sector. The results are particularly important for the next programming period of 2021+ that will be more focused on financial instruments, which will play an important role in the achievement of Cohesion Policy objectives. Such instruments may take the form of equity or quasi-equity investments, loans or guarantees, or other risk-sharing instruments. Where appropriate, they may be combined with grants.

Concerning the impact of investment support on labour productivity, empirical research showed only long-term positive effects on labour productivity, which meets the strategic goals of both investigated grant programmes. The effects of investment support strongly depend on the type of investment project. Recent studies found that productivity tends to be higher in innovating firms where the effects stemming from the growth of output dominate the displacement effects of innovation. Discussion found that the deadweight loss effect can be relatively low in the group of small companies compared to medium-sized and large companies because larger companies would undertake a similar investment without programme support using more bank loans.

Finally, we can evaluate the results can also from the nonparticipant's point of view. Facts that unsupported companies do not expand and increase labour productivity compared to the participants establish the hypothesis that investment support could have a crowding-out effect for companies that have not received investment support in the long-term period. Recent studies proved the crowding-out effect, which implies that firms use public support to substitute for private investments. It is especially important for small enterprises that are more vulnerable than large companies. In the next programming period 2021+, policymakers should better define the priorities of public investment support to target investment projects that cannot be effectively financed by external or internal private sources. Moreover, policymakers in the Czech Republic should put more emphasis on marketing innovations which help small food processors to be more competitive on the market.

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