Dynamic Effects of Public Investment Support in the Food and Beverage Industries

Jindřich Špička

Faculty of Business Administration, University of Economics, Prague, Czech Republic

Abstract

Impact evaluation of public investment is essential for policy makers to evaluate the effectiveness of public resource allocation and for company management from various industries to determine whether to participate in grant programmes. This article aims to use statistical and econometrical methods (such as propensity score matching, average treatment effect on treated, difference-in-difference approach and pooled regression with time lags) to evaluate the impacts of investment support from the Rural Development Programme, national sources and the Operational Programme Enterprise and Innovation on selected key economic indicators. This representative case study of 412 companies from the Czech food and beverage industry during the period from 2007-2015 noted some interesting findings, many of which go against previous findings. The food and beverage industry is an important beneficiary of public investment subsidies. Investment support increases investment activity and the size of supported companies. This investment support could lead to a crowding-out effect, which has been revealed in recent studies. Simultaneously, investment support changes the capital structure of participants towards higher use of bank loans and positively affects long-term profitability. However, there were not any significant, positive effects on the intensity of the use of fixed assets and labour productivity, which has been a key impact indicator for programme evaluations. However, research revealed positive dynamic effects of investment support on improving resource efficiency.

Keywords

Treatment effects, impact evaluation, lagged effects, food and beverage industry.

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Introduction

Many companies in various industries use investment subsidies from national and international public sources. In the European Union, there are structural funds and development programmes to increase the competitiveness of companies. Each country adds its own national sources to co-finance investment projects or provides full national investment support for enterprises that are not eligible for support from European funds.

There are many stakeholders interested in how such programmes work, including beneficiaries, governmental payment agency, ministry, banks, and the European Commission. Impact evaluation is particularly interesting for public money providers (such as the ministry and European Commission). Public investment support principles are closely linked to concepts of economy, efficiency and effectiveness. Each programme document contains a set of objectives that must be accomplished (effectiveness). Once the goals are attained, it is fundamental to see how they can be met with the least amount of effort (efficiency). Unlike efficiency, which examines the volume of resources and their utilization, economy looks more in terms of their costs. Impact evaluation of public investment support is in the spotlight of researchers and analysts working for the public sector.

Most published studies have been empirical studies regarding the impact evaluation of public investment support. Impact evaluation spans qualitative and quantitative methods, as well as ex ante and ex post methods. (Khandker et al., 2010) provided a good overview of econometric quantitative methods. Variants of impact evaluation include randomized evaluations (Duflo et al., 2008), the propensity score matching (PSM) approach (Caliendo and Kopeinig, 2008), double-difference (DID) methods (Abadie, 2005; Bertrand et al., 2004; Heckman et al., 1998), the use...
of instrumental variables (Angrist et al., 1996), regression discontinuity (Cerqua and Pellegrini, 2014; Decramer and Vanormelingen, 2016; Hahn et al., 2001; Lee and Lemieux, 2010; van der Klauw, 2002) and pipeline comparisons (Ravallion, 2005). 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. However, some authors do not prefer matching before impact evaluation (Petrick and Zier, 2011). The (European Commission - Directorate-General for Agriculture and Rural Development, 2014) presented a broader set of quantitative and qualitative evaluation methods (Table 1).

A comprehensive discussion about the advantages and disadvantages of methods is beyond the scope of this article. This article is about the application of selected statistical and econometric methods to the food processing industry. Thus, an overview of econometric methods is presented in the introduction. The theoretical part of this article compares investigated indicators, methods, regions and results from relevant, recently-published articles. Table 2 summarizes key information, and results are discussed later. It is evident that there is not a consensus about methods and indicators. The choice of indicators depends on data availability and the purpose of evaluation. There have been only a few published studies focused on the food industry, although it is an important beneficiary of European and national funds. In the Czech Republic, companies in the food and beverage industry received 8 billion CZK (i.e., more than 300 million EUR) from 2008-2015. Therefore, it is highly important to evaluate the effects of investment subsidies on key economic indicators.

The selection of key indicators depends on the purpose of the grant programmes. There were three main development programmes for food and beverage industries in the Czech Republic during the previous programming period. First, the Rural Development Programme (RDP) provided investment subsidies for small and medium enterprises within the following two sub-measures: I.1.3.1 Adding value to agricultural and food products, and I.1.3.2 Cooperation for development of new products, processes and technologies (or innovations) in food industry. The measures were granted for tangible and intangible investments concerning processing, marketing and/or development of new products, processes and technologies linked to products, covered by Annex I of the EC Treaty (except for fishery products), and respecting the EC standards applicable to the investment concerned (MoA, 2008). The investments should improve the overall performance of the small and medium enterprises and increase competitiveness.

| Method                | Input                                         | Output                                          | Examples of methods                        |
|-----------------------|-----------------------------------------------|------------------------------------------------|-------------------------------------------|
| Qualitative methods   | Mainly text (spoken or written) and/or theory  | 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 effectiveness of the intervention logic | Realist Evaluation Theory-based evaluation |
| Econometric methods   | Economic theory and data at 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, figures on unit level, coefficient or parameter | Effects, impacts, text on environment          | LCA, integrated modelling approaches, SEA |
| Combinations of approaches | All of the above                              | All of the above                               | GRIT, theory of driving forces, pressures, states, impacts, responses |

Note: 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 = Randomized controlled trial, SEA = Strategic Environmental Assessment.

Source: (European Commission - Directorate-General for Agriculture and Rural Development, 2014)

Table 1: Overview of evaluation approaches.
| Methods | Source | Region (Time) | Industry | Key Indicators |
|---------|--------|---------------|----------|----------------|
| General method of moments (GMM) by (Arellano and Bond, 1998) | Harris and Trainor (2005) | Northern Ireland (1983–1997) | Manufacturing | Total factor productivity (TFP) |
| Propensity score matching (PSM) DID estimator (DID) | Bernini and Pellegrini (2011) | Southern Italy (1996–2004) | Manufacturing | Output Employees Fixed assets Gross Margin/Output Profitability (ROI, ROE) Fin. charges/output Output/employees Fin. charges/debt Value added |
| No matching “Naïve” regression model using pooled data (panel data regression) Static and dynamic (lagged) version of DID | Petrick and Zier (2011) | Eastern Germany (1999-2006) | Agriculture, forestry, fishery | Number of employees Regional population density Average yearly wages per employee |
| Generalized propensity score (GPS) | Bia and Mattei (2012) | Northern Italy (2000–2003) | Manufacturing | Employment |
| Average treatment on treated (ATT) and DID Modified conditional DID estimator (PSM-DID) | Michalek (2012) | Slovakia (2002-2005) Germany (2000-2006) | Agriculture | Profit / corrected / extended profit per farm, per family labour, per fully employed person Addition to economic assets Milk production per farm Labour productivity Transfers from farm to household for living, for building of private assets, total Farm total employment |
| Average treatment effect on treated (ATT) and DID Nearest neighbour matching | Rattinger et al. (2013) | Czech Republic (2007-2010) | Agriculture | Total sample: Gross value added (GVA) Productivity (GVA/Labour cost)Profit Bank indebtedness Investment in fixed assets |
| The PSM estimator of net effects (Smith and Todd, 2005) Average treatment effect on treated (ATT) Conditional difference in differences (CDID) method | Bartova and Hornakova (2016) | Slovakia (2007-2013) | Agriculture | Total factor productivity (TFP) Gross value added (GVA) Profit Assets Utilized Agricultural Area (UAA) GVA/UAA, GVA/AWU Profit/UAA, Profit/AWU, Assets/UAA, Assets/AWU |
| Direct covariate matching (Ho et al., 2007) Propensity score matching (Rosenbaum and Rubin, 1985) Greedy pair matching without replacement (no matches outside calipers) Average treatment effect on treated (ATT) and DID (Heckman et al., 1998) | Kirchweger et al. (2015) | Austria (2003-2010) | Agriculture | Total livestock units (LU) Stocking density (LU/ha) Total output Farm income Share of net worth on total assets (%) |
| Regression discontinuity design (RDD) by (Lee and Lemieux, 2010) | Decramer and Vanormelingen (2016) | Belgium (2001-2012) | Multiple sectors (12) | Fixed assets Sales Value added Employment |
| No matching Fixed-effect model (panel data regression) | Naglova et al. (2016); Spicka et al. (2017) | Czech Republic (2008–2013) | Dairy industry Meat processing industry | Labour productivity Profitability (ROA) Capital structure (Credit Debt Ratio) Production consumption Sales |

Source: own processing

Table 2: Different econometric approaches that impact evaluation of public investment support.
of the agri-food industry. The key economic indicator for impact evaluation was labour productivity (gross value added per worker). In the RDP, sub-measure I.1.3.2 Cooperation for development of new products, processes and technologies (or innovations) in the food industry was also available to large companies. Second, the national support programme of the Ministry of Agriculture No. 13 was complementary to RDP, and it was available to large companies but was not aimed at cooperation projects supported by the RDP (I.1.3.2). Finally, companies making products not covered by Annex I to the EC Treaty were supported by the Ministry of Industry and Trade under the Operational Programme Enterprise and Innovation (MoIT, 2007). Value added was a key performance indicator.

Following the literature review and impact indicators of development and operational programmes, we identified key economic variables that could be affected by investment support. The aim of this article is to ex-post evaluate effects of investment support on the fixed assets, capital structure, labour productivity, profitability and direct cost efficiency of Czech companies producing food and beverages from 2007-2015. Although the impact evaluation that is presented is a case study of the Czech Republic, the methodical framework could be used by other evaluators in different industries and countries.

Labour productivity is an important indicator focused on by the European Commission (European Commission - Directorate-General for Agriculture and Rural Development, 2016), since it is the key economic indicator of a company’s productivity (Rezbova and Skubna, 2013). Investment support should increase labour productivity because of the investment in more modern and efficient technology. Moreover, investment support should also focus on creating new jobs and improving the quality of life. However, output should increase more than labour costs (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. Lagged effects are possible since investments are gradually introduced after completion.

As a consequence of higher investment activity, supported companies should increase fixed assets more dynamically than nonparticipants (Medonos et al., 2012). This hypothesis could be supported by the fact that most investment subsidies should be aimed at improving the value of capital for supported companies. Simultaneously, fixed assets should be used more efficiently, as measured by Fixed Assets Turnover¹.

The capital structure of supported companies should change as companies use bank loans for financial modernization. If we assume that supported companies have higher investment activity than non-supported companies, there should be significant differences in the credit debt ratio² for participants and nonparticipants (Ratinger et al., 2013). Nevertheless, measuring this dynamic effect could be problematic since taking a bank loan precedes receiving support.

Profitability is an essential indicator of a company’s financial performance. There should be a positive effect of investment support on a company’s profitability since profitability has been a strategic interest of shareholders (Naglova et al., 2016). Long-term profitability³ is a better measure than current profitability, since long-term profitability takes account of retained earnings and is one of the selection criteria for the Czech RDP (MoA, 2008).

Finally, direct cost efficiency⁴ measures a company’s operating efficiency. Investment support aims increasing output and decreasing average costs (e.g. energy-saving technologies, lower material losses). There should be positive effects for investment support on direct cost efficiency (European Commission - Directorate-General for Agriculture and Rural Development, 2016).

Materials and methods

This research is based on the individual data from companies that received investment support from the Ministry of Agriculture and Ministry of Industry and Trade of the Czech Republic in the previous programming period (from 2007 to 2015 when the last applications were completed). The database of supported companies was connected to the financial statement database MagnusWeb, which contains individual data on assets, liabilities, revenues and costs for the companies listed in the Czech Business Register.

¹ Fixed Assets Turnover \( (x) = \frac{\text{Sales}}{\text{Fixed Assets}} \)

² Credit Debt Ratio (\%) = \( \frac{\text{Bank Loans}}{\text{Total Assets}} \times 100 \)

³ Long-term Profitability (%) = \( \frac{\text{Retained Profit} + \text{Current Profit}}{\text{Total Assets}} \times 100 \)

⁴ Direct Cost Efficiency = \( \frac{\text{Cost of Material, Energy and Services}}{\text{Sales}} \)
Ex post impact evaluation of public investment support often follows a DID framework. Compared with PSM, DID assumes that unobserved heterogeneity in participation is present but such factors are time invariant. The literature recommends combining the PSM and DID to resolve the problem of selection bias by matching units (Khandker et al., 2010). It is necessary to process the PSM followed by the DID estimate. This approach is called conditional DID and it has been used for impact evaluation (Bartova and Hornakova, 2016; Bergemann et al., 2009; Gilligan and Hoddinott, 2007; Kirchweger and Kantelhardt, 2015; Pufahl and Weiss, 2009).

Propensity score matching is the most common matching technique used in the evaluation of grant programmes. PSM constructs a statistical comparison group that is based on a model of the probability of treatment participation by using observed characteristics. Participants are then matched on the basis of this probability, called a propensity score, to nonparticipants (Khandker et al., 2010). There are two assumptions for PSM validity as follows: i) conditional independence (namely, that unobserved factors do not affect participation), and ii) sizable, common support or overlap in propensity scores across the participant and nonparticipant samples. In this article, the PSM process follows four main steps (European Commission - Directorate-General for Agriculture and Rural Development, 2014; Khandker et al., 2010).

1. Build a dataset that includes participants and nonparticipants from the time periods prior to and following investment support. This dataset is characterized in a separate chapter. Ideally, the sample should respect the population structure. The sample size was calculated through the same method as (Krejcie and Morgan, 1970).

\[ s = \frac{X^2 N P (1-P)}{d^2 (N-1)} + X^2 P (1 - P), \]  

(1)

where \( s \) denotes the required sample size, \( X^2 \) indicates the Chi-squared table value for 1 degree of freedom at the desired confidence level (3.841), \( P \) represents the population proportion (assumed to be 0.5 since this would provide the maximum sample size) and \( d \) denotes the statistical significance expressed as a proportion (0.05).

There were 6 560 Czech companies producing food and beverages (NACE 10 and 11) at the beginning of the programming period in 2007. Equation (1) resulted in a required sample size of 363 companies. We gathered 620 randomly selected companies, which is higher than expected. A Chi-squared test was performed to guarantee that the actual set of companies does not significantly differ from the structure of NACE 10 and 11 (4-digit codes).

2. Select performance and structural variables (covariates) to find similar groups of participants and nonparticipants. Generally, covariates entering the logit function are expected to determine both programme participation and outcomes. The selection of covariates was processed through principal component analysis (PCA).

The PCA identified 13 variables, representing 80.69% of the variability of the original 63 variables. However, in the logit regression, we did not directly use the factors, but we used the indicators that had a high correlation with the factors, since they were most suitable for analysis. Annex table A1 shows the set of selected indicators and the factors’ focus. It is obvious that factors cover the most important structural and economic features of companies.

3. Calculate propensity scores for each individual unit based on the likely determinants of a company’s participation in the modernization programme. The logit model estimates participation probabilities for companies that received an investment subsidy (“participants”, \( T = 1 \)) and those without any investment support in the reference period (“nonparticipants”, \( T = 0 \)). In this case, causality is not as interesting as the correlation of covariates with \( T \). There are three significant determinants of a company’s participation, including the amount of bank loans, liquidity (Acid Test Ratio) and capital structure (Debt Ratio), which were used as covariates for propensity score matching. Other variables did not significantly determine participation in the modernization programme. The distribution of estimated propensity scores is illustrated in Figure 1, where a good overlap is evident. Annex table A2 provides the results of logit analysis.
4. Matching algorithms are used to match participants to nonparticipants. Approaches used for matching include nearest-neighbour matching, caliper and radius matching, stratification and interval matching, and kernel and local linear matching. Nearest-neighbour matching was selected since it has been the most commonly used matching framework in empirical studies of the agri-food sector. The nearest-neighbour was matched to the estimated propensity score $p(X)$ as an aggregate measurement. Probability $p(X)$ was estimated on the fitted values with a parametric logit model, using the observed treatment assignment (yes/no) as the explained and $X$ as the explanatory variables. When performing an impact evaluation on a group of companies with different branches, it was necessary to acknowledge that participants and nonparticipants have similar branch structures classified by NACE (4-digit) codes since the food and beverage industry has very high heterogeneity.

Two distinct matching procedures can be applied – optimal data matching (ODM) and greedy data matching (GDM). The linear greedy data matching algorithm was applied in the article, such as in previous studies of the agri-food sector by other authors (Bozik, 2011; Kirchweger et al., 2015). There are several ways to measure distance. The best distance measure depends on the number of covariate variables, the variability within the covariate variables, and other factors. Based on empirical studies that compared various distance metrics (Gu and Rosenbaum, 1993; Rosenbaum, 1989; Rosenbaum and Rubin, 1985), authors decided to use the Mahalanobis Distance within Propensity Score Calipers (no matches outside calipers) as this paper’s distance calculation method since it is best when there are fewer covariates (3) to match.

The performance of distance metrics involving calipers is somewhat dependent on the caliper radius used. The level of caliper radius depends on how much tight or loose matching is preferred. The caliper radius is calculated using sample variances of the treatment and control groups. Because of the limited available data, “loose matching” with $1\sigma$ was applied. The Mahalanobis distance within propensity score calipers (no matches outside calipers) can be formulated as

$$d(i,j) = \left\{(u_i - u_j)^T C^{-1} (u_i - u_j) \right\}^{\frac{1}{2}}$$

where $i$ refers to the $i^{th}$ treatment subject, $j$ refers to the $j^{th}$ control subject, $d(i,j)$ is the estimated distance between subjects $i$ and $j$, $x$ is the vector of observed covariates used to estimate the propensity score, and $q(x)$ is the propensity score based on the covariates $x$. Vector $u = (y, q(x))$ is the vector of observed covariates $y$ and the propensity score, $C$ is the sample covariance matrix of the matching variables (including the propensity score) from the full set of control subjects, and $c$ is the caliper radius. $FM_{i,l}$ are the values of the $l^{th}$ forced match variable for subjects $i$ and $j$, respectively. If no forced match variables are specified, then $FM_{i,l} = FM_{j,l}$ for all $l$. However, we used one forced match variable 4-digit NACE code to have the same branch structure in groups of participants and nonparticipants. The number of matches per treatment was 1 (i.e., 1:1 matching), as there were not enough nonparticipants for 1:N matching.

Finally, we selected the matching order to be sorted by distance. This option caused the programme to sort the matrix of all pair-wise treatment-control distances. It then assigned matches in ascending order starting with the smallest distance until all treatments have been matched with the specified number of controls. Annex table A3 shows the results of matching.

The final sample includes 206 participants and 206 nonparticipants from the same branch
of the food and beverages industry. Some participants (23.99%) and nonparticipants (40.97%) were not matched because of the specified forced match variable’s 4-digit NACE and caliper radius.

5. Calculate average treatment effects.

The European Commission (European Commission - Directorate-General for Agriculture and Rural Development, 2016) recommends using the average treatment effects on treated (ATT) for evaluating the effects of investment support. ATT is defined as

$$\tau_{ATT} = E[\tau | D = 1] - E[\tau | D = 0]$$

where $\tau = Y(1) - Y(0)$. $Y(D)$ is a result variable where $D$ equals 1 if the unit received investment support (participant) and 0 otherwise (nonparticipant). The theoretical principle of ATT can be described through the Roy-Rubin-model (Caliendo and Kopeinig, 2008). A positive (negative) ATT indicates a better (worse) development of outcome variables for treated companies when compared to control companies.

We calculated the difference-in-difference effects (DID) of indicators from 2007–2015. We estimated DID cumulatively in each year between participants and nonparticipants. The starting point was 2007 at the beginning of the programming period. Then, differences between 2007 and subsequent years were tested.

To measure the dynamic effects of investment subsidies, robust linear dynamic panel-data estimation was applied based on OLS (Allison, 2009; Wooldridge, 2016). The evaluation of the model included a Wald test of simple and composite linear hypotheses about the parameters of the fit model (Greene, 2012). Since the panel data have both a time-series and cross-sectional dimension, we used robust estimation assuming there are heteroscedastic and autocorrelated errors. The fixed-effects were estimated as a panel regression between the economic indicator ($y_i$) and investment subsidies ($x_i$).

$$y_{it} = \alpha + x_{it} \beta + v_i + \epsilon_{it} \quad i = 1, ..., N; \quad t = 1, ..., T,$$

where $y_{it}$ is an observation of a dependent variable (labour productivity\(^5\), fixed assets, fixed assets turnover\(^6\), credit debt ratio\(^7\), long-term profitability\(^8\), direct cost efficiency\(^9\)) for i-th unit in time t. $\alpha$ is a scalar common to all entities. $x_{it}$ is it-th row of NT × K matrix X, which contains the observed values of K. It denotes whether the company was supported (0 if company was not supported, 1 if company received support). Therefore, the model with binary regressors estimates the average impact of the investment subsidy on the selected economic indicator. $v_i$ is the unit-specific error term. It differs between units, but for any particular unit its value is constant. $\epsilon_{it}$ is the “usual” error term with the typical properties (mean 0, uncorrelated with itself, uncorrelated with $x_i$, uncorrelated with $v_i$, and homoskedastic), although with more research we could decompose $\epsilon_{it} = u_t + \omega_{it}$, assume that $\omega_{it}$ is a conventional error term, and better describe $u_t$.

We tested one-year and two-year\(^10\) lags of independent variables, since we aimed to reveal some effects of an investment subsidy one year after project was finished and launched. The dynamic panel-data estimation was applied in the sample of 412 companies (206 participants and 206 nonparticipants) to respect matching results and the counterfactual approach. Linear panel-data estimation and diagnostic tests were processed by the STATA software package.

**Results and discussion**

Heterogeneity among firms and sectors is an important feature of the Czech food processing industry (Rudinskaya, 2017). Drawing investment subsidies from the RDP is the domain of small and medium enterprises. In the sample of 206 participants, 215 projects were supported from the RDP, 124 projects from national subsidy programme and 137 projects from the Operation Programme of the Ministry of Industry and Trade from 2008-2015. Table 3 shows that this sample amply represents the total number of supported projects.

Before we start to describe the results of evaluation, it would be interesting to look at the significance of investment support on the supported companies. Figure 2 presents the share of investment support

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\(^5\) Labour Productivity = Value Added / Total Personnel Expenses

\(^6\) Fixed Assets Turnover ($x$) = Sales / Fixed Assets

\(^7\) Credit Debt Ratio (%) = (Bank Loans / Total Assets) * 100

\(^8\) Long-term Profitability (%) = (Retained Profit + Current Profit) / Total Assets * 100

\(^9\) Direct Cost Efficiency = Cost of Material, Energy and Services / Sales

\(^10\) Two-year lag was processed when we supposed delayed effect as a consequence of running up the investment (fixed assets turnover, long-term profitability, labour productivity, direct cost efficiency).
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We found that 80% of projects had less than a 5% share of investment subsidies in the total assets. However, the project might be relatively large if we consider that approximately 10% is the depreciation rate under the assumption of a 10-year average economic life of the projects.

| Size  | RDP          | National subsidy from Ministry of Agriculture | Ministry of Industry and Trade |
|-------|--------------|----------------------------------------------|--------------------------------|
| Small | 86 (265 913 942) | 0                                             | 41 (114 543 000)              |
| Medium| 113 (493 782 253) | 0                                             | 96 (554 470 600)              |
| Large | 16 (109 794 481)  | 124 (393 116 401)                             | 0                             |
| Total sample | 215 (869 490 676) | 124 (393 116 401)                             | 137 (744 765 600)            |

% of population | 18.84 (21.72) | 40.52 (30.35) | 32.08 (27.13) |

Table 3: Distribution of participants in the sample (2008-2015).

Average treatment effect, DID and lagged effects
Change in the fixed assets was evaluated as first (Table 4).

It is evident that ATT was increasing as average fixed assets of participants increased from 72.65 m CZK to 113.25 m CZK from 2007-15. Simultaneously, average fixed assets of nonparticipants were relatively stagnant. ATT became statistically significant in 2012 at a 0.05 significance level. This finding is in compliance with other authors (Decramer and Vanormelingen, 2016; Kirchweger and Kantelhardt, 2015). While participants invested in upgrading and expanding production capacities (Spicka et al., 2016), the non-participants invested enough to cover the depreciation of fixed assets.

The DID showed clearly positive cumulative effects of investment support on fixed assets when compared to the base year 2007. However, linear panel-data estimation showed significant effects without any lags, but there were not any significant lagged effects. This can be explained by the fact that companies book new fixed assets just after they complete projects. Investment subsidies increased the value of fixed assets by an average of 10.51 million CZK (p-value = 0.034). Overall, it can be concluded that investment support positively affects investment in fixed assets. Alternatively, nonparticipants could be crowded out because they did not expand. A recent study showed that the crowding-out effect of the RDP is close to 100%, implying that firms use public support to substitute for private investments (Ciaian et al., 2015).

Fixed assets turnover measures whether there were any positive effects of investment subsidy on fixed assets efficiency (Table 5) to improve competitiveness and profitability.

Lower participants’ turnover of fixed assets since 2010 could be caused by an increase in their profit margins after support when companies started to produce food and beverages with a higher value added. There were not any significant difference-in-difference (DID) effects when compared to 2007. However, linear panel-data regression revealed a significant effect without any lags. Coefficients show that investment support decreased fixed asset turnover by an average of 5.322. This is quite logical since investors increased fixed assets, but investment increased without a corresponding increase in sales. After one year of operation, a negative (but not significant) effect on fixed assets turnover continued. When considering a two-year lag, there is a positive but not significant effect of investment support on fixed assets turnover. Thus, an increase in fixed assets turnover is delayed when compared to an increase in fixed assets. However, the positive effect was not significant. It is an important finding for policy makers and management that investment support both increases the value of fixed assets and improves efficiency, but not before two years after launching the finished project on average. Unfortunately, other
### Table 4: ATT, DID and OLS of fixed assets (´000 CZK).

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2007 | 72 653       | 59 137  | 13 516 | 17 964 | 0.7524 | 0.4522  |
| 2008 | 78 699       | 59 503  | 19 196 | 18 258 | 1.0514 | 0.2937  |
| 2009 | 84 898       | 59 080  | 25 818 | 19 900 | 1.2974 | 0.1952  |
| 2010 | 90 869       | 58 314  | 32 555 | 20 009 | 1.6270 | 0.1045  |
| 2011 | 95 041       | 58 110  | 36 931 | 20 239 | 1.8248 | 0.0688  |
| 2012 | 100 174      | 58 899  | 41 274 | 20 796 | 2.1014 | 0.0362  |
| 2013 | 105 236      | 59 405  | 43 831 | 20 858 | 2.2253 | 0.0266  |
| 2014 | 107 174      | 59 731  | 46 443 | 21 071 | 2.4925 | 0.0131  |

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2008-07 | 6 046       | 366     | 5 680 | 1 861 | 3.0524 | 0.0024  |
| 2009-07 | 12 245      | -57     | 12 302 | 4 550 | 2.7036 | 0.0071  |
| 2010-07 | 21 216      | -823    | 19 039 | 5 588 | 3.4073 | 0.0002  |
| 2011-07 | 22 387      | -1 027  | 23 419 | 6 196 | 3.7790 | 0.0002  |
| 2012-07 | 27 520      | -2 738  | 27 758 | 7 304 | 3.8005 | 0.0002  |
| 2013-07 | 30 582      | 268     | 30 315 | 8 208 | 3.6934 | 0.0003  |
| 2014-07 | 33 533      | 959     | 32 574 | 9 651 | 3.3754 | 0.0008  |
| 2015-07 | 40 597      | 860     | 39 737 | 11 538 | 3.4442 | 0.0006  |

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2008 | 17.584       | 18.066  | -0.482 | 5.172 | -0.0933 | 0.9257  |
| 2009 | 13.295       | 16.553  | -3.258 | 3.947 | -0.8255 | 0.4096  |
| 2010 | 7.803        | 15.213  | -7.410 | 2.766 | -2.6786 | 0.0077  |
| 2011 | 8.967        | 14.997  | -6.030 | 3.064 | -1.9679 | 0.0498  |
| 2012 | 8.932        | 14.593  | -5.661 | 2.939 | -1.9260 | 0.0548  |
| 2013 | 8.562        | 14.363  | -5.800 | 3.067 | -1.8915 | 0.0593  |
| 2014 | 7.604        | 13.146  | -5.542 | 2.358 | -2.3505 | 0.0192  |
| 2015 | 9.184        | 13.454  | -4.270 | 3.181 | -1.3424 | 0.1802  |

### Table 5: ATT, DID and OLS of fixed assets turnover (x) (to be continued).
authors have not yet used fixed assets turnover. However, we found that fixed assets turnover is an important indicator for the impact evaluation of investment support.

Credit debt ratio measures whether there are any differences in the use of bank loans for investment activity between participants and nonparticipants (table 6).

Participants had higher credit debt ratios from 2007–2015. Differences between participants and the control group were statistically significant at the 0.05 significance level since 2009. This indicates that participants used more bank loans for co-financing investment projects. However, there were not any difference-in-difference effects. Companies in the control group slightly decreased their credit debt ratio, while indicators in the participant group fluctuated. A higher credit debt ratio for participants corresponds to findings of other authors (Ratinger et al., 2013) but DID effects go against them. However, linear panel-data analysis established a significant impact for investment support on changing credit debt ratios. This finding indicates that supported companies used bank loans for co-financing fixed asset increases. However, recent empirical research showed a negative impact for long- and short-term debt on the technical efficiency of the Czech food processing industry (Rudinskaya, 2017). Investment support increased credit debt ratio by 2.554 p.p. in the year of support.

Concerning dynamic effects, there were not any significant effects for investment support on long-term profitability at the 0.05 significance level. However, there were significant positive effects at the 0.1 significance level in the year of support (b = 1.690, p-value = 0.084) and two years after support (b = 1.540, p-value = 0.053). The p-value of effects two years after support is very close to 0.05. Other authors did not use long-term profitability but instead used current profitability.
### Table 6: ATT, DID and OLS of credit debt ratio (%).

| Year | Participants | Control | ATT | SE  | t   | p-value |
|------|--------------|---------|-----|-----|-----|---------|
| 2007 | 14.580       | 12.531  | 2.049| 1.615| 1.2686| 0.2053  |
| 2008 | 15.577       | 13.194  | 2.385| 1.621| 1.4704| 0.1422  |
| 2009 | 14.570       | 11.341  | 3.228| 1.490| 2.1673| 0.0308  |
| 2010 | 13.867       | 10.599  | 3.268| 1.430| 2.2858| 0.0228  |
| 2011 | 14.686       | 10.830  | 3.856| 1.420| 2.7149| 0.0069  |
| 2012 | 14.900       | 10.313  | 4.587| 1.490| 2.7062| 0.0071  |
| 2013 | 13.847       | 10.212  | 4.758| 1.420| 2.7062| 0.0071  |
| 2014 | 14.686       | 10.830  | 3.856| 1.420| 2.7149| 0.0069  |
| 2015 | 14.900       | 10.313  | 4.587| 1.490| 2.7062| 0.0071  |

| DID | Participants | Control | ATT | SE  | t   | p-value |
|-----|--------------|---------|-----|-----|-----|---------|
| 2008-07 | 0.997 | 0.663 | 0.334| 0.928| 0.3597| 0.7193  |
| 2009-07 | -0.010 | -1.190 | 1.179| 1.090| 1.0824| 0.2797  |
| 2010-07 | -0.713 | -1.932 | 1.219| 1.180| 1.0335| 0.3020  |
| 2011-07 | 0.106 | -1.701 | 1.807| 1.305| 1.3847| 0.1669  |
| 2012-07 | 0.320 | -2.218 | 2.538| 1.369| 1.8537| 0.0645  |
| 2013-07 | -0.733 | -2.319 | 1.586| 1.357| 1.1687| 0.2432  |
| 2014-07 | -0.551 | -2.655 | 2.104| 1.483| 1.4191| 0.1566  |
| 2015-07 | 0.237 | -2.472 | 2.709| 1.479| 1.8317| 0.0677  |

| OLS | Coef. | Robust SE | t     | p-value | 95% Conf. Interval |
|-----|-------|-----------|-------|---------|-------------------|
| Const. | 12.447 | 0.073 | 169.960 | 0.000 | 12.303 | 12.591 |
| Lag0 | 2.554 | 0.583 | 4.380 | 0.000 | 1.409 | 3.700 |
| Const. | 12.542 | 0.058 | 217.850 | 0.000 | 12.428 | 12.655 |
| Lag1 | 1.131 | 0.509 | 2.220 | 0.027 | 0.131 | 2.131 |

### Table 7: ATT, DID and OLS of long-term profitability (%).

| Year | Participants | Control | ATT | SE  | t   | p-value |
|------|--------------|---------|-----|-----|-----|---------|
| 2007 | 18.799       | 15.272  | 3.528| 3.545| 0.9950| 0.3203  |
| 2008 | 19.884       | 14.341  | 5.544| 3.854| 1.4383| 0.1511  |
| 2009 | 22.643       | 13.203  | 9.440| 4.530| 2.0837| 0.0378  |
| 2010 | 23.141       | 13.963  | 9.178| 4.550| 2.0172| 0.0443  |
| 2011 | 22.702       | 14.075  | 8.628| 5.079| 1.6985| 0.0902  |
| 2012 | 22.492       | 10.606  | 11.886| 5.699| 2.0856| 0.0376  |
| 2013 | 23.125       | 11.142  | 11.983| 6.179| 1.9393| 0.0532  |
| 2014 | 25.637       | 10.008  | 15.629| 7.454| 2.0967| 0.0366  |
| 2015 | 26.610       | 11.933  | 14.677| 7.242| 2.0267| 0.0433  |

| DID | Participants | Control | ATT | SE  | t   | p-value |
|-----|--------------|---------|-----|-----|-----|---------|
| 2008-07 | 1.085 | -0.931 | 2.016| 1.452| 1.3878| 0.1659  |
| 2009-07 | 3.843 | -2.068 | 5.912| 2.317| 2.5512| 0.0111  |
| 2010-07 | 4.342 | -1.308 | 5.650| 2.687| 2.1023| 0.0361  |
| 2011-07 | 3.903 | -1.197 | 5.100| 3.706| 1.3759| 0.1696  |
| 2012-07 | 3.693 | -4.665 | 8.358| 4.507| 1.8545| 0.0644  |
| 2013-07 | 4.326 | -4.129 | 8.455| 5.180| 1.6324| 0.1034  |
| 2014-07 | 6.838 | -5.264 | 12.101| 6.653| 1.8189| 0.0697  |
| 2015-07 | 7.811 | -3.339 | 11.150| 6.523| 1.7091| 0.0882  |

Source: own calculation

Table 6: ATT, DID and OLS of credit debt ratio (%).

Table 7: ATT, DID and OLS of long-term profitability (%) (to be continued).
Table 7: ATT, DID and OLS of long-term profitability (%) (continuation).

| Wald test | F | p-value | corr(ui, Xb) | sigma_u | sigma_e | rho |
|-----------|---|---------|-------------|---------|---------|-----|
| Lag0      | 2.990 | 0.085 | 0.075 | 49.328 | 28.228 | 0.755 |
| Lag1      | 1.180 | 0.279 | 0.074 | 52.354 | 26.925 | 0.791 |
| Lag2      | 3.780 | 0.053 | 0.074 | 55.699 | 24.979 | 0.833 |

Source: own calculation

in the form of ROA, ROE or ROI. They revealed significant positive effects of investment support on profitability (Bernini and Pellegrini, 2011; Spicka et al., 2017).

Table 8 describes the development of labour productivity as measured by value added to labour cost.

From 2007–15, there were not any significant differences for average labour costs between participants and the control group in absolute values or in difference-in-difference approach. Thus, there is no effect of investment subsidies on labour productivity, which is a strategic goal of development programmes aimed at innovation and the modernization of manufacturing facilities. When considering time lag, there were not any significant lagged effects of investment support on labour productivity. This is a particularly important finding for policy makers. Despite the finding that innovator’s size and employment grow faster than the companies with a low innovation, which is in line with previous findings (Freel, 2000), there was not any significant change in labour productivity for the treated companies. Our finding is in contrast with previous findings from the agricultural sector (Ratinger et al., 2013), but it supports findings from the meat processing industry (Spicka et al., 2017). Decramer and Vanormelingen (2016) found that the effect of the subsidies on the growth of the receiving firms was rather limited. Only for the very small firms was there a positive effect on investment, employment, sales, value added and productivity. For larger firms, they did not find any effect. In our sample, there were not any very small firms. Therefore, our results confirm previous findings.

On the one hand, modernization and innovation should improve labour productivity due to the implementation of more efficient technologies (Harrison et al., 2014). In the Czech Republic, empirical research indicated labour-saving for the capital- and material-intensive behaviours of the food processing companies (Rudinskaya, 2017). It is particularly important since there has been a lack of blue-collar workers in Central European countries (Svejnar, 1995). However, there is pressure on keeping employment in the countryside, which is a strategic focus of the Rural Development Programme. No significant effects of investment support on labour productivity in the Czech Food industry could be caused by poor selection criteria of project applications from 2007–2013. Evaluation put little stress on the efficiency and productivity of investment projects. In the new programming period since 2014, a new evaluation system has been implemented that is based on cost-effectiveness analysis and financial planning.

Direct cost efficiency is another key indicator for impact assessment. It describes the relationship between sales of products and intermediate consumption (cost of material, energy, services). Table 9 provides information regarding ATT, DID and lagged effects. A lower indicator denotes improved direct cost efficiency.

Participating companies had improved average direct cost efficiency more than nonparticipants from 2007–2015. However, there was a significant difference for only a few years. This indicates that participants were more efficient concerning relationships between direct cost and sales than nonparticipants. A pooled regression revealed positive effects for investment support on direct cost efficiency in the year of subsidy and one year after launching the investment project. Nevertheless, the effects are significant only at $\alpha = 0.1$. 

| OLS | Coef. | Robust SE | t | p-value | 95% Conf. Interval |
|-----|-------|-----------|---|---------|-------------------|
| Const. | 17.542 | 0.123 | 142.860 | 0.000 | 17.301 17.783 |
| Lag0 | 1.690 | 0.977 | 1.730 | 0.084 | -0.231 3.611 |
| Const. | 17.734 | 0.101 | 174.860 | 0.000 | 17.535 17.934 |
| Lag1 | 0.972 | 0.896 | 1.080 | 0.279 | -0.231 3.611 |
| Const. | 17.774 | 0.090 | 197.750 | 0.000 | 17.535 17.934 |
| Lag2 | 1.540 | 0.793 | 1.940 | 0.053 | -0.231 3.611 |

[102]
### Table 8: ATT, DID and OLS of labour productivity (x).

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2007 | 1.732        | 1.583   | 0.149 | 0.170 | 0.8767 | 0.3811  |
| 2008 | 1.568        | 1.401   | 0.166 | 0.123 | 1.3549 | 0.1762  |
| 2009 | 1.678        | 1.542   | 0.137 | 0.128 | 1.0683 | 0.2860  |
| 2010 | 1.461        | 1.563   | -0.103 | 0.213 | -0.4829 | 0.6295  |
| 2011 | 1.576        | 1.561   | 0.015 | 0.122 | 0.1216 | 0.9033  |
| 2012 | 1.469        | 1.463   | 0.006 | 0.093 | 0.0609 | 0.9515  |
| 2013 | 1.598        | 1.532   | 0.066 | 0.096 | 0.6793 | 0.4973  |
| 2014 | 1.676        | 1.600   | 0.076 | 0.093 | 0.8168 | 0.4145  |
| 2015 | 1.567        | 1.615   | -0.048 | 0.160 | -0.2999 | 0.7644  |

**DID**

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2008-07 | -0.164 | -0.181 | 0.017 | 0.138 | 0.1230 | 0.9022  |
| 2009-07 | -0.053 | -0.041 | -0.012 | 0.169 | -0.0738 | 0.9412  |
| 2010-07 | -0.271 | -0.019 | -0.252 | 0.215 | -1.1707 | 0.2424  |
| 2011-07 | -0.156 | -0.022 | -0.135 | 0.172 | -0.7827 | 0.4342  |
| 2012-07 | -0.263 | -0.120 | -0.144 | 0.158 | -0.9098 | 0.3635  |
| 2013-07 | -0.134 | -0.050 | -0.084 | 0.161 | -0.5215 | 0.6023  |
| 2014-07 | -0.056 | 0.017 | -0.073 | 0.160 | -0.4560 | 0.6487  |
| 2015-07 | -0.164 | -0.033 | -0.197 | 0.210 | -0.9382 | 0.3487  |

**OLS**

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2007 | Const. | 1.560 | 0.006 | 243.650 | 0.000 | 1.547 | 1.572 |
| 2008 | Lag0 | 0.049 | 0.051 | 0.960 | 0.338 | -0.051 | 0.149 |
| 2009 | Const. | 1.558 | 0.006 | 272.140 | 0.000 | 1.546 | 1.569 |
| 2010 | Lag1 | -0.028 | 0.051 | -0.550 | 0.579 | -0.127 | 0.071 |
| 2011 | Const. | 1.560 | 0.007 | 239.530 | 0.000 | 1.547 | 1.573 |
| 2012 | Lag2 | 0.040 | 0.057 | 0.700 | 0.485 | -0.073 | 0.153 |

**Wald test**

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2007 | Lag0 | 0.920 | 0.338 | 0.065 | 1.023 | 1.023 | 0.500 |
| 2008 | Lag1 | 0.310 | 0.579 | -0.083 | 1.034 | 0.946 | 0.544 |
| 2009 | Lag2 | 0.490 | 0.485 | 0.067 | 1.057 | 0.951 | 0.552 |

Source: own calculation

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### Table 9: ATT, DID and OLS of direct cost efficiency (x) (to be continued).

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2007 | 1.622        | 7.264   | -5.642 | 2.550 | -2.2123 | 0.0273  |
| 2008 | 1.702        | 49.315  | -47.613 | 35.717 | -1.3331 | 0.1833  |
| 2009 | 1.058        | 14.317  | -13.258 | 9.777 | -1.3561 | 0.1758  |
| 2010 | 1.098        | 7.929   | -1.693 | 0.841 | -2.0141 | 0.0446  |
| 2011 | 0.880        | 2.804   | -1.204 | 0.486 | -2.4751 | 0.0137  |
| 2012 | 0.909        | 3.094   | -2.095 | 0.837 | -2.5036 | 0.0127  |
| 2013 | 0.901        | 2.664   | -1.764 | 0.958 | -1.8421 | 0.0662  |
| 2014 | 0.869        | 4.989   | -4.120 | 1.736 | -2.3732 | 0.0181  |
| 2015 | 1.016        | 5.598   | -4.582 | 2.443 | -1.8757 | 0.0614  |

**DID**

| Year | Participants | Control | ATT | SE  | t    | p-value |
|------|--------------|---------|-----|-----|------|---------|
| 2008-07 | 0.080 | 42.051 | -41.971 | 34.365 | -1.2213 | 0.2227  |
| 2009-07 | -0.563 | 7.052 | -7.616 | 9.176 | -0.8300 | 0.4070  |
| 2010-07 | -0.524 | -4.472 | 3.949 | 2.348 | 1.6820 | 0.0933  |
| 2011-07 | -0.742 | -5.180 | 4.438 | 2.326 | 1.9083 | 0.0570  |
| 2012-07 | -0.713 | -4.260 | 3.547 | 2.374 | 1.4942 | 0.1359  |
| 2013-07 | -0.721 | -4.600 | 3.878 | 2.006 | 1.9333 | 0.0539  |
| 2014-07 | -0.753 | -2.275 | 1.522 | 2.088 | 0.7289 | 0.4665  |
| 2015-07 | -0.606 | -1.667 | 1.061 | 2.150 | 0.4934 | 0.6220  |

Source: own calculation

Table 9: ATT, DID and OLS of direct cost efficiency (x) (to be continued).
These results correspond with previous findings from the agricultural sector (Medonos et al., 2012; Ratinger et al., 2013; Spicka et al., 2017). Uncovering positive effects for investment support on direct cost efficiency confirms the purpose of investment support as an important measurement for improving material and energy efficiency of participants.

**Conclusion**

The article focused on impact evaluation of investment support on selected important economic indicators using statistical and econometric methods. The case study of the Czech food industry from 2007-2015 noted some interesting findings that are important for policy makers and other stakeholders (managers, investors).

According to the policy guidelines, investment support should enhance viability and competitiveness and promote resource efficiency for supported enterprises. The food industry is a suitable branch for the case study because it has been heavily supported by European and national funds for a long time. The article partially confirmed previous studies but revealed new dynamic effects of investment support from three complementary grant programmes (the Rural Development Programme, a national subsidy programme and the Operational Programme Enterprise and Innovation). Supported companies were compared with similar non-treated companies from the same branches of the food and beverage industry.

If we generalize our findings, supported companies (participants) have higher investment activity than nonparticipants. Investment support increases the amount of fixed assets and 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 completion and launching the investment. This means that participants are not able to generate additional sales from new fixed assets to improve productivity. Finally, there could be another negative effect. It was revealed that nonparticipants that do not develop their business and investment support could have a crowding out effect for companies that have not received investment support, which corresponds to recent studies.

Second, investment support changes the capital structure of participants towards increased usage of bank loans and a growing credit debt ratio. This is 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 profitability and productivity, empirical research showed only positive effects on long-term profitability at the 0.1 significance level for the year of support and two years after support. A positive effect for investment support on long-term profitability is good news for management of supported companies and policy makers. Long-term profitability has been one of the key selection criteria in the Czech RDP. However, no effect of investment support on labour productivity is a very unfavourable finding since increasing labour productivity is key goal of all investigated development programmes.
In the previous programming period from 2007-2013, the Ministry of Agriculture did not require proper ex-ante evaluation of project applications. Neither financial plans nor cost benefit analyses were included in project applications. Project selection was based on a verbal description of project, features of the applicant and the rate of investment subsidy (from 40 % to 50 %).

In the current programming period, selection criteria have been improved to include cost-efficiency analysis and financial planning.

Finally, this research revealed positive dynamic effects for investment support on direct cost efficiency, which supports ongoing efforts to improve resource efficiency. The current RDP puts more emphasis on material and energy efficiency and related environmental effects.

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Corresponding authors:

doc. Ing. Jindřich Śpička, Ph.D.

Department of Strategy, Faculty of Business Administration, University of Economics Prague

W. Churchill Sq. 4, 130 67 Prague 2, Czech Republic

Phone: +420 224 09 8351, E-mail: jindrich.spicka@vse.cz

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Appendix

| Factors                          | Indicators                                                                 | Unit       | Cumulative Percent |
|---------------------------------|---------------------------------------------------------------------------|------------|--------------------|
| F1: Company’s size              | Total Assets                                                              | ‘000 CZK  | 35.54              |
| F2: Financial stability         | Debt Coverage = Cash Flow / Debt                                         | times      | 43.61              |
| F3: Trading goods               | Cost of Goods Sold                                                        | ‘000 CZK  | 49.16              |
| F4: Intensity                   | Asset Turnover = Sales of Goods and Products / Total Assets               | times      | 53.82              |
| F5: Liquidity                   | Acid Test Ratio = (Current Assets – Inventory) / Current Liabilities      | times      | 57.66              |
| F6: Retained earnings           | Retained earnings                                                         | ‘000 CZK  | 61.29              |
| F7: Use of bank loans           | Bank loans                                                                | ‘000 CZK  | 64.73              |
| F8: Financial leverage          | Debt Equity Ratio = (Debt / Equity) x 100                                 | %          | 67.95              |
| F9: Sales of long-term assets   | Revenues from disposals of fixed assets and materials                     | ‘000 CZK  | 71.04              |
| F10: Capital structure          | Debt Ratio = (Debt / Total Assets) x 100                                   | %          | 73.99              |
| F11: Working capital management | Working Capital Ratio (WCR) = Net Working Capital / Sales of Goods and Products x 100 | %          | 76.62              |
| F12: Financial earnings         | Profit / loss from financial operations (transactions)                   | ‘000 CZK  | 78.73              |
| F13: Production margin          | Relative Gross Profit Margin = ((Sales of Products – Cost of Products Sold) / Sales of Products) x 100 | %          | 80.69              |

Source: own calculation

Table A1: Results of the PCA.

| Variable                  | Coef.  | Std. Err. | z      | p-value | Odds Ratio | [95% Conf. Interval] |
|---------------------------|--------|-----------|--------|---------|------------|----------------------|
| Const.                    | 0.566  | 0.219     | 2.586  | 0.010   | 1.761      | 0.137 - 0.994        |
| Bank loans                | 0.000  | 0.000     | 2.955  | 0.003   | 1.000      | 0 - 0                |
| Debt Ratio                | -0.008 | 0.003     | -2.828 | 0.005   | 0.992      | -0.014 - 0.003       |
| Liquidity                 | -0.095 | 0.045     | -2.138 | 0.033   | 0.909      | -0.183 - 0.008       |
| Log Likelihood            | -411.86| 0.045     | -1.385 | 0.171   | 0.264      | 0.06 - 0.844         |
| Model R²                  | 0.0305 |           |        |         |            | N = 620              |

Source: own calculation

Table A2: Results of logit regression – selection of significant variables (N = 620).
### Group Comparison Report for Variable = Logit(ps)

| Group Type       | Treated | N   | Mean       | SD  | Mean Difference | Standardized Difference (%) |
|------------------|---------|-----|------------|-----|-----------------|----------------------------|
| Before Matching  | 1       | 271 | -0.1076    | 0.49|                 |                            |
|                  | 0       | 349 | 0.1167     | 0.78| -0.2243         | -34.39%                    |
| After Matching   | 1       | 206 | -0.0406    | 0.36|                 |                            |
|                  | 0       | 206 | 0.0352     | 0.3 | -0.0758         | -22.93%                    |

### Group Comparison Report for Variable = Bank loans

| Group Type       | Treated | N   | Mean       | SD  | Mean Difference | Standardized Difference (%) |
|------------------|---------|-----|------------|-----|-----------------|----------------------------|
| Before Matching  | 1       | 271 | 49774.41   | 129402.5 |                 |                            |
|                  | 0       | 349 | 19823.43   | 88391.27 | 29950.98        | 27.03%                     |
| After Matching   | 1       | 206 | 32889.38   | 79004.24 |                 |                            |
|                  | 0       | 206 | 15123.61   | 44212.91 | 17765.77        | 27.75%                     |

### Group Comparison Report for Variable = Liquidity (Acid Test Ratio)

| Group Type       | Treated | N   | Mean       | SD  | Mean Difference | Standardized Difference (%) |
|------------------|---------|-----|------------|-----|-----------------|----------------------------|
| Before Matching  | 1       | 271 | 1.6603     | 1.74|                 |                            |
|                  | 0       | 349 | 2.2452     | 6.78| -0.5849         | -11.81%                    |
| After Matching   | 1       | 206 | 1.6393     | 1.79|                 |                            |
|                  | 0       | 206 | 1.5791     | 1.74| 0.0603          | 3.41%                      |

### Group Comparison Report for Variable = Debt Ratio (%)

| Group Type       | Treated | N   | Mean       | SD  | Mean Difference | Standardized Difference (%) |
|------------------|---------|-----|------------|-----|-----------------|----------------------------|
| Before Matching  | 1       | 271 | 59.6552    | 27.32|                 |                            |
|                  | 0       | 349 | 67.3433    | 53.41| -7.6881         | -18.12%                    |
| After Matching   | 1       | 206 | 60.7391    | 27.92|                 |                            |
|                  | 0       | 206 | 62.9961    | 35.71| -2.257          | -7.04%                     |

Source: own calculation

Table A3: Results of PSM.