COMPETITIVENESS OF LATVIAN DAIRY SECTOR: PRODUCTIVITY AND EXPORT

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Abstract
The objective of the research paper is to explore the competitiveness of Latvian dairy sector from the aspect of productivity and export indicators, as well as to examine some of the possibilities to improve the sector competitiveness. The authors explore the productivity and export indicators of Latvian dairy sector, and the link between productivity and export (within the EU context), as well as analyze the impact of farm investment support within RDP 2007 – 2013. Value added per labour unit has been chosen as the productivity indicator; suitable qualitative and quantitative research methods have been applied to the studies. Based on the introduced indices of relative position of dairy industry productivity and exports, dairy processing in Latvia has strong inter-branch position in the domestic food industry. However, the inter-country comparison shows that Latvian dairy processing is behind the EU average level, when its productivity and export volume are considered. It has been found that productivity and export of dairy processing are positively related; rather strong positive correlation also exists between productivity in dairy farming and dairy processing. Therefore, the development of Latvian dairy sector, which mainly depends on the development of exports, can be more successfully achieved by the increase in its productivity; and relatively the largest productivity gap to close is in the dairy farming in Latvia. The direct investment support effect on NVA/AWU of dairy farms is found to be significant and positive, indicating that farm modernisation support of RDP 2007 – 2013 has facilitated the improvement of overall dairy farm productivity in Latvia.
Key words: dairy sector, productivity, export, Latvia.

Introduction

Raw milk production in Latvia exceeds the domestic consumption needs by almost 40% (CSB of Latvia, 2015) implying that the country's dairy sector is export-oriented to a large extent. In literature, there is an evidence of the link between productivity and export – companies have to be productive to enter export markets (self-selection effect), and vice versa - exporting improves the productivity of companies by gaining experience and learning (learning-by-exporting effect) (Yang & Chen, 2012). There has been an evaluation carried out to analyze the existing relations between exports of goods and services and labour productivity in the economy for Latvia and other European Union (EU) countries. The estimation results confirm that the higher the labour productivity is, the higher the exports will be. Moreover, a higher exporting activity is found to be linked to a higher volume of economic activity, and as Latvia's economy is an import-dependent economy, also a higher import growth rate (Auziņa-Emsiņa & Ozoliņa, 2013). Similarly, it has been found out that exporting enterprises in Latvia are noticeably more productive than non-exporting enterprises, and the most productive are regular exporters (Beņkovskis & Bēms, 2014). This paper, inter alia, contributes to the studies evaluating productivity and the relationship between productivity and export success by focusing on the dairy sector, which is one of the most important agri-food sectors in Latvia and the development of which is to be mainly associated with its competitiveness on export markets.

The objective of this paper is to explore the competitiveness of Latvian dairy sector from the aspect of productivity and export indicators, as well as to examine some of the possibilities to improve the sector competitiveness. To reach the objective, the following tasks have been set: 1) to explore the productivity and export indicators of Latvian dairy sector, and the link between productivity and export (within the EU context); and 2) to analyze the impact of farm investment support within the Rural Development Programme 2007 – 2013 (RDP 2007 – 2013) to increase the productivity of Latvian dairy farming.

Materials and Methods

Although competitiveness of dairy sector can be evaluated from various perspectives (Viira *et al.*, 2015), this article focuses on productivity and export indicators. Considering the aim of the study and data availability, value added per labour unit has been chosen as the productivity indicator to be analyzed in this paper. Inter alia, indices of relative position of productivity and export of dairy processing have been calculated by the authors, based on the similar approach as used for Balassa index of revealed comparative advantage (RCA) (Balassa, 1965). The index of relative position of dairy industry productivity in Latvia (IRCP) is introduced as follows:

$$IRCP = \frac{\frac{P_{LVD}}{P_{LVF}}}{\frac{P_{EUD}}{P_{EUF}}}, \qquad (1)$$

where P_{LVD} - productivity in manufacture of dairy products in Latvia; P_{LVF} - productivity in manufacture of food products in Latvia; P_{EUD} - productivity in manufacture of dairy products in EU-28 (except Denmark, Luxembourg and Malta); P_{EUF} - productivity in manufacture of food products in EU-28 (except Denmark, Luxembourg and Malta).

Similarly, index of relative position of dairy industry exports in Latvia (IRCE) is defined:

$$IRCE = \frac{\frac{E_{LVD}}{E_{LVF}}}{\frac{E_{EUD}}{E_{EUF}}}, \quad (2)$$

where E_{LVD} - export of processed dairy products in Latvia; E_{LVF} - export of processed food products in Latvia; E_{EUD} - export of processed dairy products in EU-28 (except Denmark, Luxembourg and Malta); E_{EUF} - export of processed food products in EU-28 (except Denmark, Luxembourg and Malta).

The relations regarding productivity and export have been evaluated using analysis of variance (ANOVA) and correlation coefficients. For the calculation of the indicators used in the study, data from Eurostat databases, including Comext, were retrieved for Latvia and other EU countries for the period 2008 – 2013. Correspondence tables between PRODCOM and Combined Nomenclature (CN) (Eurostat, 2016b) have been used to extract and calculate exports of processed food products. Considering the large export of raw milk from Latvia, CN code 04012099 (packed milk >2kg, fat >3%, but <=6%) has not been counted as export of processed food products.

In order to evaluate the impact of the investment support (i.e., Farm modernisation measure of Latvian RDP 2007 – 2013) on dairy farms, 'naïve' difference-in-differences (DiD) estimator has been used in combination with propensity score matching (PSM). Until recently, the use of 'naïve' estimates was common and widely accepted in the evaluations of policy interventions, which included 'before – after' or 'with – without' approaches (DiD is the combination of these two approaches) along with the comparison with national averages. However, by the use of these methods, the real effects may become understated or overstated, and there can be a potential substantial bias when using the outcomes of non-participants as proxy for the possible outcomes of participants. Therefore, PSM-DiD method is also applied in the study.

PSM-DiD is a rigorous non-experimental method. Data for PSM are usually pooled in a panel from programme participants and non-participants. The non-participating or 'untreated' units constitute the 'control' group, while participants are included in 'treatment' group. Information from the control group is used to assess what would be the outcome of interest for participants in the absence of the programme. The difference in outcomes for both groups is evaluated by comparing relatively similar units in the groups. The method was developed by Rosenbaum and Rubin (1983). For the implementation of the PSM-DiD method, Imbens (2004) suggests four steps: 1) selection of observational covariates and estimation of propensity scores; 2) stratification of propensity scores and testing of balancing properties in each block; 3) calculation of the Average Treatment on Treated (ATT) by matching; 4) sensitivity test for robustness of estimated ATT effects.

If the balancing properties of covariates are not satisfied in all strata, the test has to be repeated with different number of strata. If the balancing properties are not satisfied again, estimation of propensity scores has to be repeated with a modified list of covariates by adding higher order (squared) covariates. After getting all covariates balanced in every stratum, causal effects can be estimated by the nearest neighbour matching (NNM), radius matching (RM), kernel matching (KM) or stratified matching (SM).

NNM computes the ATT by finding the unit in the control group whose propensity score is the nearest (the value of difference is minimal) for every unit in the treatment group. In RM, the units in both groups are matched when the propensity scores in control group fall in the predefined radius of the units in the treatment group. In KM, all units in the treatment group are matched with the weighted average of all units in the control group. The weights are determined by distance of propensity scores, bandwidth parameter and a kernel function. In SM, for each block the average differences in the outcomes of the treatment group and the matched control group are calculated. The ATT is estimated by the mean difference weighted by the number of treated cases in each block.

The data on participating and non-participating dairy farms of Farm modernisation measure of Latvian RDP 2007 – 2013 were sourced from FADN database, which is not publicly available. Unpublished data of Rural Support Service (RSS) for the identification of supported farms have also been used.

Results and Discussion

Productivity and export competitiveness

Productivity is found to be the ultimate driver of long-run economic growth (EU Membership and…, 2005). Value added per employed person is among the most widely used measures of productivity (OECD, 2001). Along other factors, the reason for its popularity can be related to the fact that labour productivity is regarded to be a revealing indicator of several economic indicators as it offers a dynamic measure of economic growth, competitiveness, and living standards within an economy (OECD, 2008). Moreover, labour productivity is considered the main factor that explains the dynamics of market shares and thus competitiveness in the Eastern European countries (Beņkovskis & Bēms, 2014).

The obtained results reveal that the productivity of Latvian dairy processors expressed as value added (i.e, value added at factor costs from industry structural statistics) per employee is higher than the average value added per employee in Latvian food industry. In 2013, the productivity of Latvian dairy processing exceeded the same indicator of food industry by about 30%. Likewise, the productivity of dairy processing is higher also in the EU on average, surpassing the value added per employee in food industry only a slightly less than in Latvia – by 28%. Therefore, the calculated index of relative position of dairy industry productivity in Latvia in 2013 was 1.02, indicating that the relative position of dairy processing in Latvia in the context of Latvian food industry is roughly the same as in the EU on average, with a slight comparative advantage.

Processed dairy products (without raw milk) accounted for about 18% of the total exports of processed food products in Latvia in 2013. The same share in the EU on average was smaller – exports of dairy processing made about 15% of the total exports of processed food in 2013. The ratio between these two shares gives the index of relative position of dairy industry exports for Latvia standing at 1.20 in 2013. This implies that in processed food exports Latvia has more specialization in dairy products than it can be observed in the EU on average.

Figure 1 summarizes the calculated indices of relative position of dairy industry productivity and exports for Latvia and other EU countries in 2013, which are obtained for each EU country applying the same formula as for Latvia. It can be seen that Latvia is positioned in the upper right quadrant, with the values of indices exceeding '1' (axes crossing at the EU average – '1') and representing countries having both a high relative inter-branch productivity and a high relative inter-branch exports of dairy products. Based on the chosen indicators, dairy processing in Latvia has a strong position in the domestic food industry. From its neighbouring countries, only the relative inter-branch position of dairy processing in Estonia is found to be better than in Latvia. At the same time, it has to be mentioned that the analyzed inter-branch position in each country depends on the status of other food industry sectors in a country, and countries with a modest position of dairy processing within its domestic food industry can have a very good competitiveness against dairy sectors in other countries (for example, the Netherlands). Nevertheless, the authors believe that a strong position within domestic food industry generally is a good platform for Latvian dairy processing to develop its competitiveness potential.

When the inter-country comparison of dairy industry is made, the opposite position of Latvian dairy processing can be observed (see Figure 2). Based on the absolute value added per employee and the share of Latvian dairy exports in the total EU exports of processed dairy products, Latvia is positioned in the lower left quadrant, with values below the EU average (axes crossing at the EU average) and representing countries with low productivity and smaller/small export volume of processed dairy products. Latvia shares this quadrant also with Estonia and Lithuania;

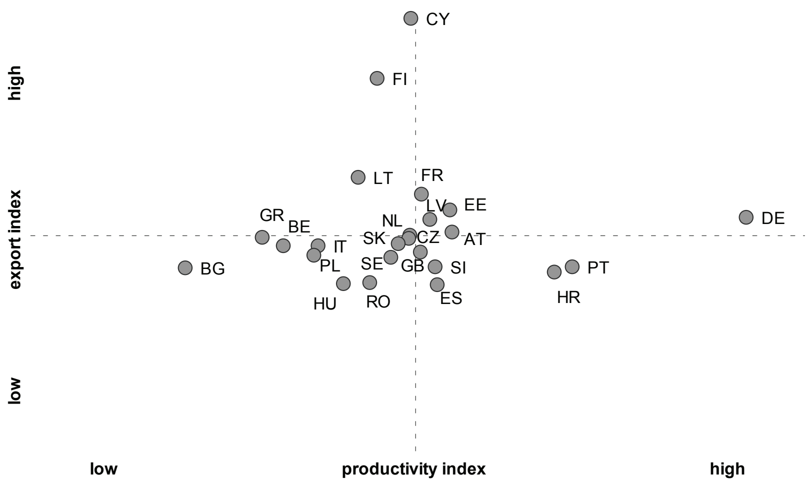

Figure 1. Productivity and export indices of dairy processing in Latvia and other EU countries in 2013*.

*Z-scores used; no productivity data available for IE.
Source: calculations and construction by authors, based on Eurostat data (2016a; 2015a).

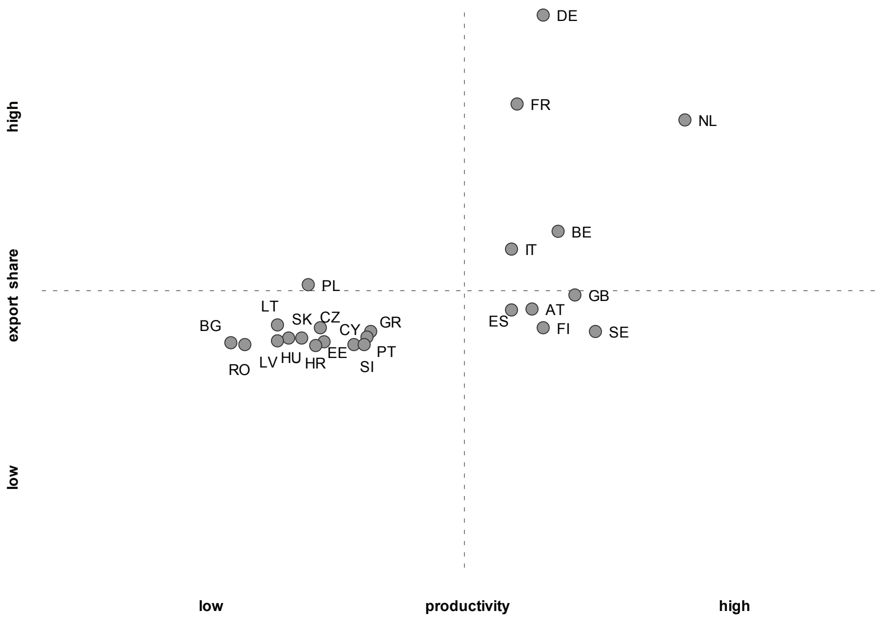

Figure 2. Productivity and export share (EU-28=100%) of dairy processing in Latvia and other EU countries in 2013*.

*Z-scores used; no productivity data available for IE.
Source: calculations and construction by authors, based on Eurostat data (2016a; 2015a).

from so called new EU member states (joining EU from 2004), only Poland is positioned in a different quadrant – upper left, with export volume slightly above the EU average. It can be argued that low value added per employee in these countries is influenced by cheaper labour force and this indicator merely represents the resulting strategies, at the same time, the authors believe that developed and viable dairy industry can not only compete on export markets, but also ensure normal living standards for its employees.

It is also quite obvious that the largest exporters of dairy products are the largest EU countries, at the same time, Belgium and the Netherlands and especially Ireland, with the number of inhabitants being 11.3, 19.9 and 4.6 million accordingly (Eurostat, 2015b), are also positioned in the upper quadrant, and these countries also have a high productivity indicator (Ireland - based on the results of 2012). Figure 2 gives a notion on the relationship between productivity and export, which in more detail is examined further.

When speaking about the competitiveness of the whole dairy supply chain (limiting the concept to its main segments), not only the competitiveness of dairy processing, but also dairy farming has to be considered. Figure 3 shows that, based on the value added per employee in dairy processing and value added (calculated as output less the value of intermediate consumption from FADN) per annual work unit (AWU) in dairy farming, Latvia is positioned in the lower left quadrant, with values below the EU average (axes crossing at the EU average) and representing countries with low productivity of the whole dairy supply chain.

Although generally the value added per employee in dairy farming is lower than in dairy processing – the difference being 2.7 times in the EU on average in 2013, the gap between the two productivity indicators in Latvia is larger. In 2013, the value added per employee in manufacture of dairy products was 3.7 times the level of value added per annual work unit in dairy farming in Latvia. The gap between productivity in dairy processing and dairy farming was less also in Estonia (1.7 times) and Lithuania (2.1 times). The large difference in Latvia indicates that dairy processing is comparatively more competitive than dairy farming in Latvia and therefore the increase in the productivity in dairy farming is very topical as from the productivity aspect it is relatively the weakest link of the dairy supply chain. Although the production subsidies improve the situation of Latvian dairy farms, net value added per annual work unit (NVA/AWU) in dairy farming in Latvia, which is a farm standard economic result in FADN, still lags the productivity of dairy processing more than in the EU on average.

Link between productivity and export

Having formed data array covering all EU countries in the period 2008-2013 (subject to data availability), the authors further tried to establish the link between productivity (i.e., value added per employee) and export value in manufacture of dairy products. The

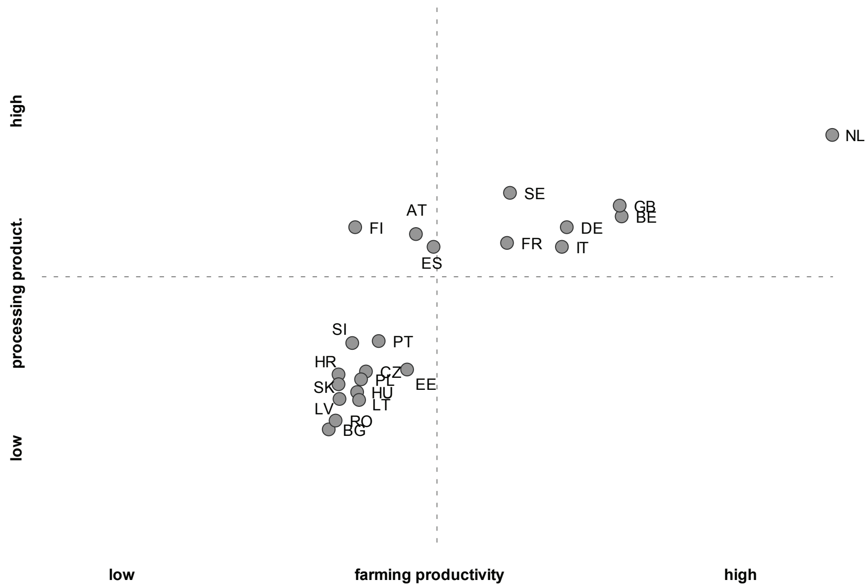

Figure 3. Productivity of dairy processing and dairy farming in Latvia and other EU countries in 2013*.

*Z-scores used; no dairy processing productivity data available for IE; no dairy farming data available for CY and GR.
Source: calculations and construction by authors, based on Eurostat (2016a; 2015a), DG Agri (2016) and LSIAE (2015) data.

obtained results by analysis of variance (ANOVA) reveal that there is a difference between the mean productivity of country group having export below the EU average and the country group having export at the EU level and above (see Table 1), pointing to the existing positive link between the productivity and export in dairy processing. Although there are many factors that influence productivity, the authors believe that exports are the preconditions for ensuring the economy of scale effect for such countries as Latvia, whose domestic market is rather small; at the same time, export markets also provide more opportunities for attracting higher product value from the market.

As regards the productivity link within the dairy supply chain, where raw milk constitutes about a half of all purchased materials and services by dairy processing enterprises, rather strong positive correlation (R=0.819, p=7.42E-33) has been found between the value added per employee in dairy processing and value added per annual work unit in dairy farming for the EU countries in the period 2008 – 2013. This generally means that a higher productivity in dairy farming is associated with a higher productivity in the dairy processing. The authors believe that both more efficient dairy processors can pay a better price for milk and thus facilitate the increase in the value added in dairy farming; besides, more efficient dairy farming sector reduces different processors' cost related to milk collection and quality etc. thus contributing to higher value added in dairy processing.

Based on the finding, the development of Latvian dairy sector, which mainly depends on the development of export, can be more successfully achieved by the increase in the productivity of Latvian dairy sector; and relatively the largest productivity gap to close is in the dairy farming in Latvia.

Table 1

Results of ANOVA tests for the relation between productivity and export in dairy sector

Variables	Group	Number of cases	Mean	p value
Dependent: Productivity of dairy processing (value added/employee, thsd EUR) **Grouping:** Export value of processed dairy products (as share of the EU average) (Group 1- below EU average; Group 2 – EU average and above)	1 2	107 41	36.9 69.2	0.000^{***}

***significant at the 1% level.
Source: calculation by authors, based on Eurostat (2016a; 2016c), DG Agri (2016) data.

Table 2

Average changes in NVA/AWU of supported (T=1) and non-supported (T=0) dairy farms obtained by the 'naïve' DiD method

Number of Units	NVA/AWU 2007, EUR	NVA/AWU 2014, EUR	ATT (difference), EUR
T=1 (94)	13,437	16,381	2,944
T=0 (51)	9,267	11,586	2,318
Difference	4,170	4,795	625

Source: calculation by authors, based on unpublished LSIAE (FADN) and RSS data.

Investment support for productivity

Measures of Latvian RDP have been the main support instruments for the facilitation of competitiveness of Latvian dairy sector. In the programming period 2007 – 2013, the investment support for the modernisation of farms and adding value to agricultural products was provided, with the total public funding of EUR 369.5 million granted to farmers and EUR 72.1 million obtained by processors (RSS, 2016). According to the evaluation of the authors from unpublished RSS data, investment support received by dairy farms totalled to about 37% of farm modernisation support, while dairy processors obtained about 31% of the total support for adding value to agricultural products. There is a quite impressive modernisation programme also in RDP 2014 – 2020, which provides EUR 490.0 million for the investments in physical assets, out of which majority (almost 70%) is again targeted at the improvement of the competitiveness of agricultural farms in Latvia (MoA, 2015).

Increase in the productivity of supported farms was the main objective of the Farm modernisation measure of Latvian RDP 2007 – 2013. The contribution of the programme to the restructuring of dairy sector was another important issue, and a growth in productivity is one of the crucial factors behind the improvements in a rather fragmented dairy farming in Latvia. In this paper, the authors tried to evaluate the direct impact of the Farm modernisation measure on supported dairy farms. The economic data in FADN database, which were used for the study, include all relevant information on the programme participants and non-participants regarding their structure and performance from 2007 to 2014. As the information should cover periods before and after the implementation of the programme, initially 145 dairy farms were selected out of the total number of 943 farms. The possible overlapping was checked, leaving treated units that participated only in the selected measure: there were 94 dairy farms in the treatment group, leaving 51 dairy farms for possible controls.

Firstly, the differences in the farm standard economic result - NVA/AWU - after and before the implementation of the programme were obtained using the 'naïve' DiD method by the authors. The values of changes in the analyzed economic variable and the calculated treatment effects are shown in Table 2. According to the results of 'naïve' DiD method, the ATT effect (difference) on NVA/AWU both on programme participants and non-participants is positive, being slightly higher for the supported dairy farms.

Further, the authors proceeded by the second evaluation method - propensity score matching (PSM-DiD method). In total 31 variables related to farm structure, considered critical for comparability of economic performance, were initially selected for the use in matching process (i.e., finding matches between treated and control farms). After the repeated Logit regressions with adding of higher order covariates and failed satisfaction of balancing properties in one or more blocks, only 13 variables were retained. These variables include agricultural land; NVA/AWU; gross margins in crop farming; gross margins in livestock farming; gross value added; intermediate consumption; depreciation; buildings; equipment

Table 3

Average treatment effects on NVA/AWU obtained by the PSM-DiD method

Method	Nearest neighbor	Radius matching (0.01)	Radius matching (0.1)	Kernel matching	Stratified matching
Treated	94	55	94	94	94
Controls	22	38	42	42	42
ATT (EUR)	-766	1,785	2,631	214	-1,252
t	-0.20	0.70	1.29	0.05	-0.37

Source: calculation by authors, based on unpublished LSIAE (FADN) and RSS data.

and machinery; fixed assets in crop farming; external costs; labour costs; costs of lease.

After obtaining the propensity scores for all dairy farms, only units satisfying common support condition were selected. Generally, common support restriction is based on 'minima and maxima' comparison, which assumes deletion of all observations whose propensity score is smaller than the minimum and larger than the maximum in the opposite group. With the given specification the balancing property is satisfied. The results of evaluation of average treatment effects with various matching methods and respective test statistics are shown in Table 3.

The average treatment value with the highest test statistics (radius matching, R=0.1) was considered the best estimate for the analyzed economic variable. In addition, sensitivity analysis was carried out using the Rosenbaum bounding approach. The results show that the estimated effects of the intervention measure on NVA/AWU are rather sensitive. The sensitivity test shows that a hidden bias, which increases the odds ratio from 1 to 1.05, would make the obtained results statistically insignificant. The relatively high sensitivity could be caused by a relatively small number of observations in the control group. It is recommended to have up to 4 times more observations for potential controls, which is not the case in the study. However, the results of sensitivity tests are providing only additional information with respect to the stability of calculated effects; it does not question the overall validity of the obtained results.

The PSM-DiD method provides a statistically rigorous estimation of the contribution of the analyzed support measure to the growth of NVA/AWU for participating dairy farms at EUR 2,631. The obtained direct programme investment support effect amounts to 16% of the total NVA/AWU of supported farms at the end of the programming period. The value of changes in the economic variable obtained by PSM-DiD method is higher than the value yielded by 'naïve' DiD estimator. This indicates a possible underestimation of programme effects if 'naïve' method is used.

Conclusions

1. Based on the introduced indices of relative position of dairy industry productivity and relative position of dairy industry exports, dairy processing in Latvia has a strong inter-branch position in the domestic food industry. It is characterized by the ratio of dairy processing productivity (value added per employee) against the total food industry productivity slightly above the average EU ratio, and the share of exports of processed dairy products from the total processed food exports also above the level, which can be observed in the EU on average.
2. According to the inter-country comparison, Latvian dairy processing with low value added per employee and smaller/small share in the total EU exports of processed dairy products, is behind the EU average level.
3. Labour productivity is also low in dairy farming in Latvia, moreover, the gap between the productivity of dairy processing and dairy farming in Latvia is greater than in the EU on average and also in the neighbouring countries, indicating that dairy processing is comparatively more competitive than dairy farming in Latvia and from the productivity aspect it is relatively the weakest link of the main stages in the dairy supply chain.
4. It has been found that productivity and export in dairy processing are positively related. Significant differences in the mean values of productivity for the EU countries have been obtained, when comparing two groups of countries – with export value below and above the EU average level. Rather strong positive correlation (R=0.819, p=7.42E-33) has been found also between the value added per employee in dairy processing and dairy farming for the EU countries in the period 2008 – 2013, indicating that a higher productivity in dairy farming is associated with a higher productivity in dairy processing. Based on the finding, the development of Latvian dairy sector, which mainly depends on the development of exports, can be more successfully achieved by the increase in the productivity of Latvian dairy sector.
5. When estimating the impact of the Farm modernisation support measure of RDP 2007 – 2013 on dairy farms in Latvia, propensity score matching has to be considered as a more suitable method in establishing a sound counterfactual, as the use of 'naïve' estimators can lead to the underestimation of the support impact. The changes in NVA/AWU estimated by propensity score matching, which can be viewed as a direct investment support effect on the beneficiaries, are significant and positive, indicating that farm modernisation support has facilitated the improvement of overall dairy farm productivity in Latvia.

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