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Economic Evaluation of the Austrian Rural Development Programme: Is EU-funding an Appropriate Means to Increase Competitiveness of the Agricultural Sector within the Food Supply Chain?

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1 Introduction

The EU provides a number of subsidies for the European agricultural sector to promote rural development. In particular, the public funding intends to increase the competitiveness of the agricultural sector within the food supply chain. This paper will only focus on subsidies granted for economic purposes.[1]

In Austria, the Federal Ministry for Sustainability and Tourism takes over the responsibility to distribute the funds and guarantees effective use of EU funds. The Ministry is obligated to review the success of the national RDP every two years (2017, 2019 and at the end of the RDP). To evaluate the success of the RDP public funding, the Ministry designated several independent evaluators for all kinds of areas (economic, social, environmental targets).

We took over the responsibility to evaluate the economic part of the RDP. In particular, the evaluation scheme focuses on target P3 of the RDP: "Promoting food chain organisation, including processing and marketing of agricultural products, animal welfare and risk management in agriculture". The relevant focus area (3A) addresses the competitiveness of producers: "Improving competitiveness of primary producers by better integrating them into the agri-food chain through quality schemes, adding value to agricultural products, promotion in local markets and short supply circuits, producer groups and inter-branch organisations" (European Commission, 2014). Indicative public support for this focus area alone amounts to about 540 million Euros (in total, the public spending within the Austrian RDP 2014-20 amounts to almost 8 billion Euro). The parts of focus area 3A relevant for evaluation amount to more than 300 million Euros.

To approximate the effectiveness of the public spending, a sample out of all subsidised companies has been evaluated by means of several data sources. In addition to secondary data provided by the companies themselves, we conducted a number of in-depth personal interviews collecting business data, personal estimation of effects, satisfaction with application and transaction procedures, organisational issues, etc. In all, the intention is to approximate the net effects of public funding in view of economic development in rural areas.

[1] Besides that, a number of subsidies within the Rural Development Program 2014-20 (RDP) of the European Commission are dedicated to other programs with social or ecological purpose (European Commission, n.d.).

Meanwhile we are working on the 2nd intermediary report and in total, about 70 companies will be extensively evaluated for the report. At the end of the evaluation process, beyond 2020, a reliable estimation of net effects of the RDP should be possible in terms of economic development by including a comparative sample of companies that didn't take part in the RDP. The intention of this contribution is to present intermediary results. And even more important: An open discussion about our methodological approach within the scientific community should be initiated.

2 The European Rural Development Policy

The European Commission describes the rural development policy as follows: "The EU's rural development policy helps the rural areas of the EU to meet the wide range of economic, environmental and social challenges of the 21st century. Frequently called 'the second pillar' of the Common Agricultural Policy (CAP), it complements the system of direct payments to farmers and measures to manage agricultural markets (the so-called 'first pillar')" (European Commission, n.d.). The direct payments amount to 100 billion Euros from 2014 to 2020 (about 8 billion Euros for Austria).
Confirming the Regulation (EU) No 1305/2013 a "rural development policy should be established to accompany and complement direct payments and market measures of the CAP and thereby to contribute to that policy's objectives …" (§ 2) (EU, 2013). The main purpose of our study lies in the evaluation of economic support for agricultural holdings and companies which is laid down in § 15 of the Regulation: "In order to improve the economic and environmental performance of agricultural holdings and rural enterprises, to improve the efficiency of the agricultural products marketing and processing sector, including the setting up of small scale processing and marketing facilities in the context of short supply chains and local markets, to provide infrastructure needed for the development of agriculture and forestry and to support non-remunerative investments necessary to achieve environmental aims, support should be provided for physical investments contributing to these aims" (EU, 2013). Due to the large amounts of the subsidies it is of primary importance to implement efficient evaluation schemes within the EU member countries (Andersson et al., 2017). In this context, relevant publications and analytical results are presenting a broad variety of results. E.g., there is a "strong correlation […] between the amount of gross agricultural production and the volume of subsidies granted" (Vozarova and Kotulic, 2016). Other studies reveal that – on a farm level – subsidies had positive effects on technical efficiency but were negatively correlated on productivity (Kumbhakar and Lien, 2010). Several studies focus on specific agricultural sectors (Dolman et al., 2012; Kleinhanß et al., 2007) or regions (Vozarova and Kotulic, 2016). Within our contribution we do both: We analyse the effects of subsidies on Austrian manufacturing companies (processing sector), co-operations of farmers, individual farmers, and networks within the agricultural sector. Therefore, the main research question is: *Is it possible to validly measure the effects EU subsidies granted for investments intending to support positive economic effects in view of competitiveness, efficient production, and profitability the Austrian agricultural sector and within the food supply chain?* In this respect, some authors mention that most empirical research studies lie their focus on the effects of subsidies on performance indicators (Blanes and Busom, 2004). We know from literature, that subsidies usually motivate companies to increase their competitiveness by, e.g., investing more in research and development activities (Huergo and Moreno, 2017). If this is true for our empirical field, too, participation in the RDP should result in a fundamental positive development of companies.

3 Methodology

3.1 Economic target and result indicators

To quantify the effects of the subsidies, the EU specifications concerning input, output, result and impact indicators are relevant (Andersson et al., 2017). In particular, the following priority, focus area and target/result indicators are relevant:

- Related Priority 3: Promoting food chain organisation, including processing and marketing of agricultural products, animal welfare and risk management in agriculture
- Focus area 3A: Improving competitiveness of primary producers by better integrating them into the agri-food chain through quality schemes, adding value to agricultural products, promotion in local markets and short supply circuits, producer groups and organisations and inter-branch organisations
- Target indicator: Percentage of agricultural holdings receiving support for participating in quality schemes, local markets and short supply circuits, and producer groups/organisations

In order to approximate the effects of investments, a number of result indicators were developed like it is usually done in literature (Ehrmann, 2010; Quiroga et al., 2017). We collected data concerning economic variables like sales, profits, return on investment, added value, capital structure, staff related indicators (employment) – before and after the investments. The data were collected by personal, in-depth interviews as well as by analysing company reports and related information. In all, we got reliable data reflecting the financial and economic situation of the investigated companies/organisations before and after the investments they made. By that, it should be possible to approximate the effects of public funding within the agricultural and food sector (at least at the end of the RDP after 2020; we will come back to this point at the end in chapter 5: Discussion, limitations, and outlook).

3.2 Empirical field

The empirical field of this study are all Austrian companies/organizations that got support for their investments within the RDP 2014-20, priority 3, focus area 3A. Until the end of 2018, total public support amounted to 2.8 billion Euros (without land-related subsidies). Until the end of 2018, approvals covered 57.1% of the total public support. However, we were only responsible for the evaluation of specific, mainly economic activities/targets (only these codes are listed in Table 1).
In all, the evaluation refers to 313.9 million Euros of public support. 65% of that sum were approved until the end of 2018, 31% were paid out. The most important single activity is code 4.2.1 "Processing, marketing and development of agricultural products" (123.5 million Euros public support) followed by code 3.1.1 "New participation in quality schemes" with 91.0 million Euros. Code 3.1.1 activities (quality schemes) will be evaluated at the end of the RDP after 2020 because the single subsidies are low (more than 43 000 applications). The 2nd mid-term evaluation will include the evaluation of activities/targets codes 3.2.1, 4.2.1, and 16.04.1.[2] The number of approved projects (without code 3.1.1) is 354 with a total support sum of 226.7 million Euros. Within this category 236 projects received payments (63 million Euros), 165 are assumed to be terminated until the end of 2018.

[2] This is not possible for 16.10.1-16.10.3 as no project will be finished until the deadline of the 2nd mid-term evaluation (end of December, 2018).

Table 1. Selected activities/targets of RDP in Austria – approvals and payments

Code [a]	Activities/targets	Public support [Mio. €]	Approvals			Payments			Finished by end 2018 [d]
			Application s	Support [Mio. €]	% of public support	Applications	Support [Mio. €]	% of public support	
3	Quality schemes for agricultural products and food	133.0	43 458	79.6	59.8	31 557	45.5	34.2	
3.1.1	New participation in quality schemes	91.0	43 431	55.6	61.1	31 534	34.4	37.8	[c]
3.2.1	Information and sales promotion activities of agricultural co-operatives	42.0	27	24.0	57.0	23	11.1	26.4	10
4	Investments in physical assets [b]	904.3	21 075	552.4	61.1	15 530	360.9	39.9	
4.2.1	Processing, marketing and development of agricultural products	123.5	293	88.7	71.8	184	41.2	33.4	145
16	Co-operation [b]	117.4	143	59.2	50.4	115	21.2	18.0	
16.04.1	Horizontal and vertical co-operation between members of supply chains/short supply chains, local markets, and respective sales promotion activities	7.5	17	3.0	40.2	13	0.8	10.4	10
16.10.1	Implementation and operation of clusters	33.9	12	19.8	58.3	12	8.2	24.3	0
16.10.2	Implementation and operation of networks	16.0	1	10.5	65.6	1	0.9	5.9	0
16.10.3	Co-operation producer groups/ -organisations, cooperatives, sector associations	3.8	4	3.4	91.4	3	0.8	20.9	0
Total (without land-related subsidies)		2 847.3	86 855	1 626.7	57.1	64 479	869.0	30.5	
Total (including land-related subsidies)		7 698.4					4 133.6	53.7	
Total (relevant for evaluation)		317.7	43 785	204.9	64.5	31 770	97.4	30.7	[c]
Total (relevant for evaluation excl. 3.1.1) [c]		226,7	354	149,3	65,9	236	63,0	27,8	165

[a] selected activities/targets relevant for study; codes are not identical with EU classification
[b] including all other activities/targets [codes] not listed in Table
[c] Code 3.1.1 will be evaluated at the end of RDP (beyond 2020)
[d] Estimation
Status: 17 January, 2019; source: own calculations based on data from Federal Ministry Republic of Austria Sustainability and Tourism (BMNT), Section II/1

4 Results

The following section presents selected results of the evaluation process done so far. After a general description of the sample, we will briefly show insights into investments and the outcome of those. After that, selected result indicators are presented to analyse the economic outcome including approximations of the effects of public support.

4.1 Sample size and structure

Until the end of January 2019, the sample size amounts to 60 companies/organisations[3], almost all of them from code 4.2.1 (*n* = 58) which has by far the highest number of applications (besides code 3.1.1) and finished projects. 2 evaluations belong to code 16 (co-operation). Most other activities will not be finished until the end of February, 2019. It is expected that until the end of 2018 about 165 projects will be finished. Given our actual sample size *n* = 60, we evaluated 36,4% of all finished projects. Until the end of the actual evaluation period, this number will further rise to 41.2%.

Most of the investigated companies/organisations are from the sectors fruits and vegetables (*n* = 14), milk and milk products (*n* = 12) and arable crops (*n* = 11) (Table 2).

Table 2. Sectoral structure of sample

Sector	*n*	*n*%
Fruits and vegetables, incl. ornamental plants	14	23.3
Arable crops (grain incl. corn, oilseeds and protein plants), seeds and planting materials	11	18.3
Wine	7	11.7
Meat	4	6.7
Milk and milk products	12	20.0
Oil pumpkin, other oil and fibre plants, healing and spic plants	1	1.7
Eggs	2	3.3
Others	4	6.7
(Agricultural co-operatives) [a]	(5)	(8.3)
Total	60	

[a] Per se, co-operatives do not belong to one specific sector and would be usually summarized amongst "Others" if they cannot be assigned to one specific sector (e.g., farmers market co-operatives).

In average, the investigated companies/organisations invested about 1.7 million Euros (mean). However, the span of investments is huge with a minimum amount of 20 000 Euros and a maximum of 17 million Euros. The overall distribution of the investments can be taken from Table 3.

Table 3. Investments (*n* = 60)

Distribution	
Mean	1 752 910
Standard deviation	1 983 428
Quantiles	
Minimum	20 000
Lower quantile (25%)	198 873
Median (50% quantile)	792 457
Upper quantile (75%)	1 850 455
Maximum	17 000 000

4.2 Investments

Most of the investments were done to purchase new machines or production facilities (*n* = 47, i.e., 78.3% of all companies invested into new machines/production facilities; multiple answers were possible). 53% (*n* = 32) invested into improvements of production processes, 38.3% (*n* = 23) into storage, and 36.7% into buildings (*n* = 22). Only a minority of companies made direct investments into marketing and sales (*n* = 14, 13.3%). The analysis clearly shows the importance of production related investments.

[3] By the end of February 2019, the sample of the 2nd mid-term evaluation will amount to 69.

Public support is very important concerning the willingness to invest: Only about one third of the companies would have made investments to the same extent even if no subsidies were available (*n* = 19; 31.7%). Another third would have reduced the investments (*n* = 20; 33.3%) and the rest would not have invested at all (*n* = 21; 35%).

4.3 Selected economic result indicators

In the following section important economic result indicators are presented (before and after investment). As not all indicators could be calculated for all participating companies, *n* is usually lower than the full sample size (60).

Change in capacities, degree of production capacity utilisation: One of the most important non-monetary output variables are the change in capacities (production, storage, and machines). The participants in the study produce various goods and services and delivered a broad diversity of capacities (pieces produced, tons, hectolitres, etc.). In all, 47 of 60 companies were able to deliver reliable data for production capacities before and after the investment. The distribution of the change in production capacities[4] (in comparison to degree of utilisation) can be taken from Figure 1. Due to the investments, capacities of most companies/organisations rose significantly (mean: +74%; median: +34%; Table 5 in Annex). While the majority of changes range between +10% to +90%, some companies more than quadrupled their production capacities. At the same time, the degree of capacity utilisation went down (in average by -7.1%) (Table 6 in Annex) which is in view of the significant raise in capacities not at all surprising. Changes in storage and machine capacities are similar and can be taken from Table 6 in Annex.

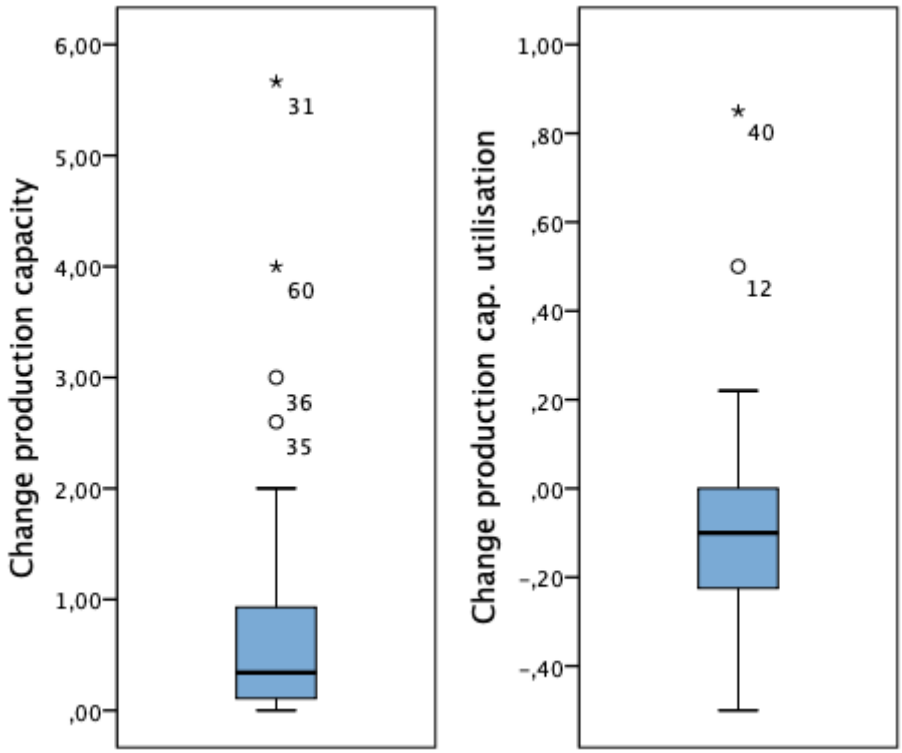

Figure 1. Boxplot: Change in production capacities and production capacity utilisation. Distribution of all evaluated companies/organizations (end of 2018; *n* = 47) (max excluded in Boxplot)

Capital, return on investment (ROI): In average, total capital increased by +1 319 382 (mean; +17.7%). However, equity capital ratio went down by -0.032 points (but is still very high with almost half of the total

[4] The missing data (13) resulted from the inability to deliver valid data, e.g., because the overall capacities within a co-operation of farmers could not be estimated. In addition, the target of two of the projects was to generate completely new capacities. For these projects a before/after comparison of capacities is not possible.

capital). ROI developed comparable, it decreased from 0.106 to 0.083. For both, capital and ROI, the bandwidth is large (see Table 8 and Table 9 in Annex).

Annual depreciation: Based on the fact that most companies/organisations invested into facilities, the mean deviation of annual depreciation rose significantly by +110 741 Euros. However, there is no uniform trend. Figure 2 visualises the percentage deviation of the annual depreciation before and after the investment (not all interviewees delivered reliable data; some projects were initial activities. *n* therefore goes down to 45).

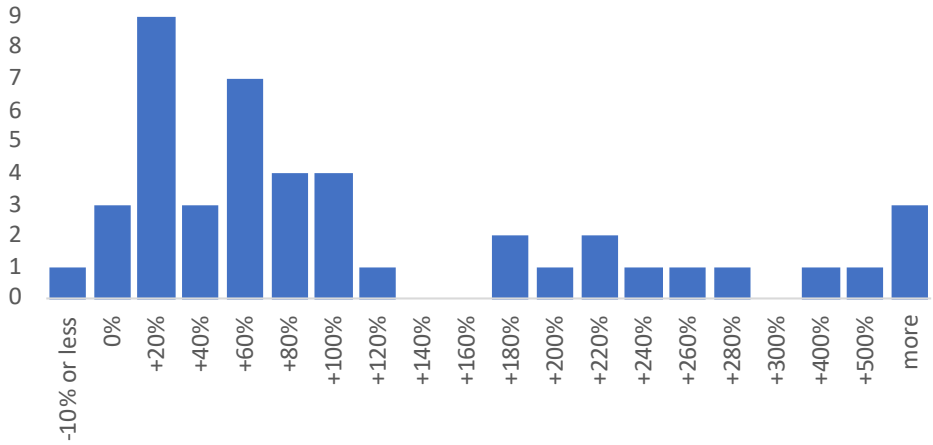

Figure 2. Distribution of change of annual depreciation – before and after investment (*n* = 45)

Value added: The value added was calculated based on monetary input (production cost, staff, annual depreciation, energy cost, and other input data) and output variables (sales, change in inventories). The absolute numbers should therefore not be taken as a complete set of result indicators. Due to missing data, data access limitations, and our efficient approach in data acquisition, only a limited set of variables could be used to approximate the value added before and after the investment. Based on a limited set of complete input and output data (*n* = 39), the value added increased in average by +956 838 Euros (mean; +36.7%) from 2 604 396 to 3 561 234 Euros before and after the investment. The median amounts to +290 770 (+25%; from 379 230 to 670 000 Euros). However, the bandwidth of deviations is large, the boxplot in Figure 3 shows the distribution of the change of value added (in comparison to sales and profit; for graphical reasons, outliers were partly excluded).

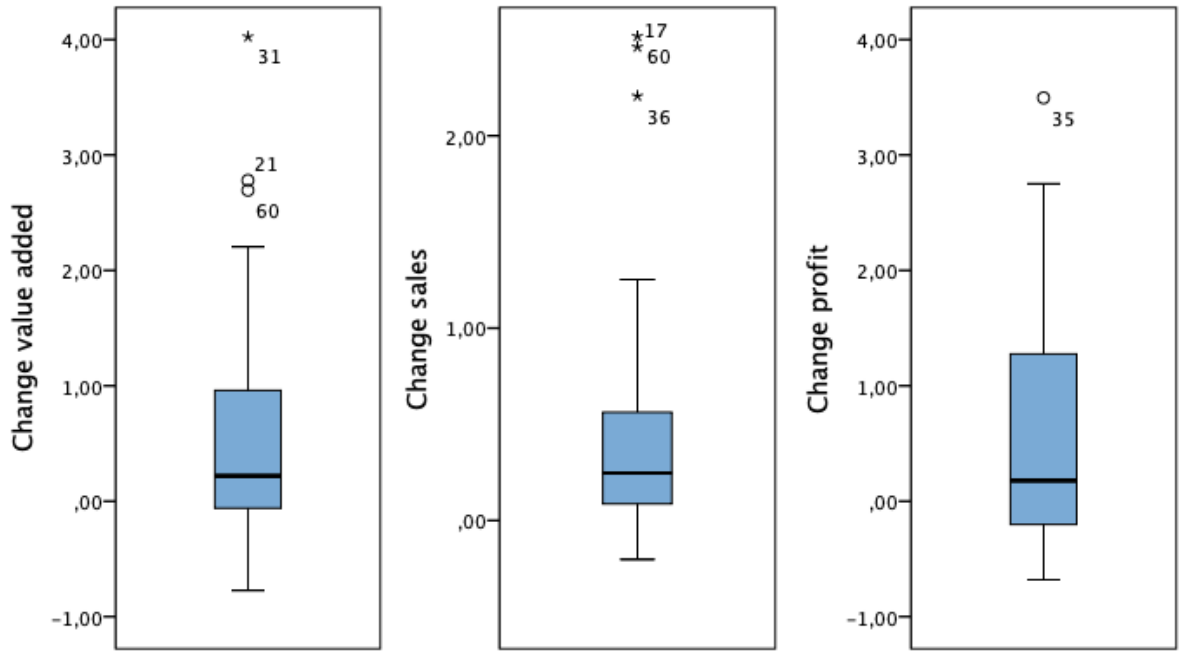

Figure 3. Boxplot: Change in value added, sales, and profit. Distribution of all evaluated companies/organisations (end of 2018; *n* = 39, 46, 41)

Sales, profit: To approximate the economic success of the investments, several output variables were measured. Sales and profit numbers allow to estimate the market success of the companies/organisations before and after the investment. Capital structure and ROI deliver further important result indicators evaluating the overall financial situation and development of the companies/organisations and success of the investment.
In average, sales and profits rose significantly (mean +1 196 371 [+14.2%] and +106 684 [+42%], respectively; Table 7 in Annex). But again, variation of change of sales and profits is large (see boxplot in Figure 3). In particular, there seem to be one group of companies that succeeded in increasing sales to a much higher extent compared to all other companies (Figure 4). Distribution of profits delivers comparable results; the changes are even more divers. Therefore, the calculation of means or medians might be misleading as heterogeneity of individual results is huge (standard deviation in Table 7 but also in all other tables; see Annex). Overall, most companies could increase sales and profits. In all likelihood, they could benefit from investments and subsidiaries.

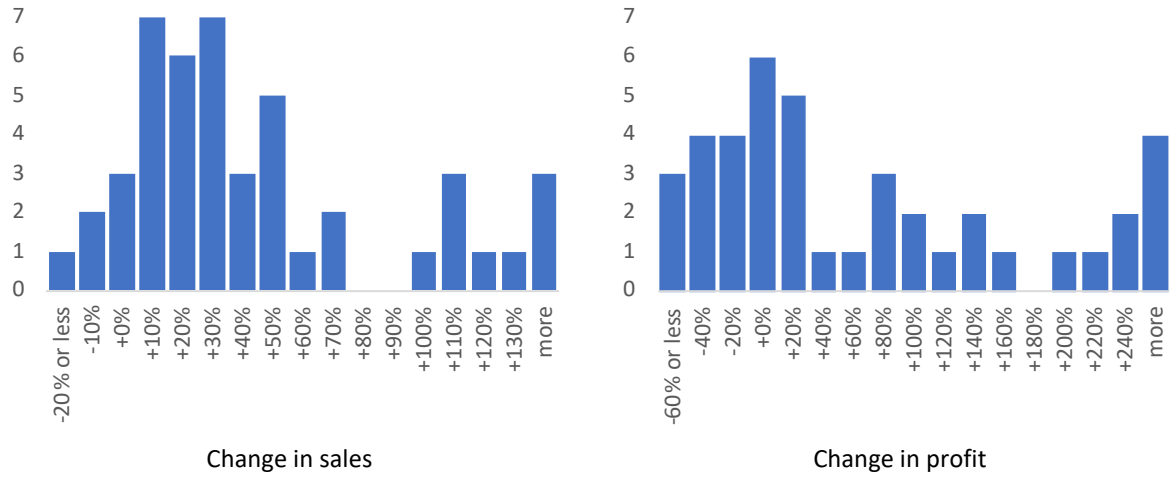

Figure 4. Distribution of change of sales and profit (*n* = 46, 41)

Market share: It was almost impossible for the interviewees to quantify the effects of the investments in view of the deviation of market shares due to the investments. Therefore, we simplified data collection by using a simple Likert scale from 1 (significant reduction of market share) to 5 (significant increase of market share) and a mid-point of 3 (no change). Only 2 companies out of 51 that answered assumed a reduction in market share. Most of them assumed an increase (15; 29.4%) or even significant increase (25; 49.0%). 9 interviewees (17.6%) revealed no change. These qualitative estimations might be too optimistic; however, even if the effects were over-estimated, the general picture is quite consistent compared to the other outcomes concerning sales, profit, and value added. Therefore, we assume that the overall competitiveness of most companies taking part in RDP increased significantly.

4.4 Correlation between result indicators

The core research goal of this study is to approximate the effectiveness of subsidies in view of higher competitiveness and profitability. Therefore, we will identify relations between the different result indicators by means of a simple correlation analysis.[5] The basic hypothesis is, that if companies/organisations are investing money to improve their profitability and competitiveness thereby binding capital (partly supported by public organisations), this will result in higher sales, ROI, profits, etc. If this is true, public authorities should succeed in inducing investments by offering public support. As mentioned above (chapter 4.2), two third of our

[5] As this is only the 2nd mid-term evaluation with a limited set of data (and other limitations that will be discussed below), this simplified analytical approach is sufficient to see if there is any connection between the variables.

sample would change their investments significantly or even refrain from investing at all without public support. Thus, without subsidies (and preconditioned that the hypothesis is true) the economic effects would be much lower.

The results of the correlation analysis can be taken from Table 4 (for full matrix see Table 10 in Appendix). There are some quite interesting assumptions which are feasible based on this explanatory correlation analysis. Of course, not all significant correlations are surprising. In particular, correlation between annual depreciation and capital, equity ratio, and ROI were expected as these variables are interdependent or were used for calculation purposes (like in the case of ROI). The negative relation between the change in production capacity and the degree or production capacity utilisation is not surprising as well (r = -0.421). Increasing capacities probably lead automatically to free capacities. It is not likely that additional capacities can be used immediately without any delay. In particular those companies that operated at full use of capacities in the past will benefit from that and gain higher flexibility.

Table 4. Correlation analysis (reduced matrix) – significant correlation coefficients (r)

	Change in sales	Change in total capital	Change in equity ratio	Change in ROI	Change in production capacity	Change in storage capacity	Change in machine capacity	Change in degree of production capacity utilisation
Investment cost							0.553**	
Changes in annual depreciation	0.416**	0.982**	-0.734**	-0.893**				
Changes in value added	0.467**				0.704**			
Changes in sales		0.440**	-0.331*		0.562**	0.432**		
Changes in total capital			-0.811**	-0.910**				
Changes in equity ratio				0.845**				
Changes in production capacity								-0.421**

**highly significant below 0.01

* significant below 0.05

The size of the investment has more or less no influence on other variables, in particular there is no influence on changes in sales, profits, etc. (with the exception of a significant correlation between investment cost and machine capacities). By contrast, changes in total capital, ROI, and production and storage capacities are positively related to changes in sales, usually with Pearson's ***r*** around or above 0.5. There is also a (slight) negative relation between change in equity ratio and sales (r = -0.331); this correlation could be due to more investments in marketing by use of borrowed capital which leads, of course, to a decreasing equity ratio and positively influence sales (r = 0.440). However, there must be found more evidence for this assumption. The actual simplified correlation analysis is not more than a starting point for further research.

5 Discussion, limitations, and outlook

As we saw from the analysis above, it is difficult to aggregate results. The variation of data is usually large. Nevertheless, taken all the information above and trying to aggregate these results leads to following assumption: Altogether, one may expect that investments induce mostly positive effects. As we saw above, investments usually have a positive effect on important economic variables like sales, ROI, profitability, etc. And as we further argued (based on empirical evidence), one may induce companies to make investments by offering significant subsidies (we saw that most of the respondents would refrain from making investments at least from parts of it without public financial support). However, the limitations of these assumptions are obvious and must be considered.

Up to now the sample size is still rather low even though we succeeded in evaluating 37% (60 of 165) of all finished investments that belong to the relevant areas of the study (see codes in Table 1). Reliability of generalisations is therefore limited. In addition, there are a number of missing values due to non-availability of economic data. As usual in the agricultural sector, this was expected. And as a result of the 1st evaluation period, a number of significant modifications were already introduced in the 2nd mid-term evaluation (e.g.,

qualitative evaluations, verbal description instead of hard facts where appropriate). Some more changes will be included for the final evaluation period beyond 2020.

Heterogeneity of individual results complicate generalisations as well; the range of data is simply too wide for some indicators to make conclusions that are valid for the whole sector. More sophisticated analytical tools will be helpful here (e.g., cluster approaches, regression analysis, structuring equation modelling, etc.) and shall be used in future evaluations and analysis. And finally: To validly approximate the effects of subsidies, a comparable sample of non-supported companies/organisations will be inevitable. This will be done on the occasion of the final evaluation beyond 2020. In addition, a larger sample will be used then.

Altogether, the 2nd mid-term evaluation study showed that public support (EU subsidies within the framework of the RDP) induces investments at least in the part of the agricultural and food sector that was analysed within this study. Based on our empirical results, competitiveness is assumed to increase, profitability and sales as well. Therefore, the answer to our research question is positive: It *is possible to validly measure* the effects of EU subsidies. Their intention to induce investments that should support positive economic effects in view of competitiveness, efficient production, and profitability works. And finally, as the effects are in general positive, the market power of the agricultural sector within the food supply chain is strengthened.

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Annex

Table 5. Capacities

	change production capacity	change storage capacities	change machines
n	47	44	40
Distribution			
Mean	+75.3%	+50.3%	+79.7%
Standard deviation	+108.1%	+69.6%	+305.4%
Quantiles			
Minimum	+0.0%	-30.0%	-26.6%
Lower quantile (25%)	+10.8%	+0.0%	+0.0%
Median (50% quantile)	+34.0%	+27.0%	+61.1%
Upper quantile (75%)	+93.0%	+61.7%	+223.0%
Maximum	+566.7%	+400.0%	+1 935.1%

Table 6. Degree of capacity utilisation (*n* = 49)

	% before invest.	% after invest.	% change
Distribution			
Mean	88.0	80.9	-7.1
Standard deviation	40.7	34.9	
Quantiles			
Minimum	0.0	42.0	
Lower quantile (25%)	90.0	70.0	
Median (50% quantile)	100.0	80.0	
Upper quantile (75%)	100.0	95.0	
Maximum	105.0	120.0	

Table 7. Sales and Profit

	sales before invest.	sales after invest.	sales change	profit before invest.	profit after invest.	profit change
n	47	48		43	41	
Distribution						
Mean	8.441.262	9.637.633	+1.196.371	253.827	360.510	+106 684
Mean change%			+14.2%			+42.0%
Standard deviation	18.891.091	21.093.865		459.260	447.803	
Quantiles						
Minimum	6.900	11.310		-880.000	-474.948	
Lower quantile (25%)	396.803	612.750		30.456	50.705	
Median (50% quantile)	1.440.888	1.832.000		88.000	150.000	
Upper quantile (75%)	7.611.000	8.345.250		283.155	478.719	
Maximum	108.564.448	115.000.000		1.800.000	1.600.000	

Table 8. Capital structure

	total capital before invest.	total capital after invest.	total capital change	equity ratio before invest.	equity ratio after invest.	equity ratio change
n	41	40		41	40	
Distribution						
Mean	7 460 683	8 780 065	1 319 382	0.520	0.488	-0.032
Mean change%			+17.7%			-6.1%
Standard deviation	17 267 036	19 046 400		0.38	0.35	
Quantiles						
Minimum	35 600	39 000		-0.52	-0.50	
Lower quantile (25%)	1 025 919	1 452 314		0.22	0.25	
Median (50% quantile)	2 331 772	3 285 204		0.53	0.44	
Upper quantile (75%)	5 701 528	8 106 411		0.98	0.74	
Maximum	106 837 000	116 665 000		1.00	1.00	

Table 9. Return on investment (ROI)

	ROI before invest.	ROI after invest.	ROI change
n	41	40	
Distribution			
Mean	0.106	0.083	-0.024
Mean change%			-22.2%
Standard deviation	0.18	0.07	
Quantiles			
Minimum	-0.06	-0.02	
Lower quantile (25%)	0.02	0.05	
Median (50% quantile)	0.06	0.07	
Upper quantile (75%)	0.11	0.10	
Maximum	1.04	0.26	

Table 10. Correlation analysis (full matrix)

	Investment cost	Change in annual depreciation	Change in value added	Change in sales	Change in profit	Change in total capital	Change in equity ratio	Change in ROI	Change in production capacity	Change in storage capacity	Change in machine capacity	production capacity utilisation
Investment cost	1										0.553**	
Sig.												
n	60											
… annual depreciation	-0.070	1		0.416**		0.982**	-0.734**	-0.893**				
Sig.	0.649											
n	45	45										
... value added	-0.032	0.072	1	0.467**					0.704**			
Sig.	0.845	0.667										
n	39	38	39									
... sales	-0.145	0.416**	.467**	1		0.440**	-0.331*		0.562**	0.432**		
Sig.	0.338	0.005	0.003									
n	46	43	39	46								
... profit	-0.062	0.068	0.192	0.127	1							
Sig.	0.701	0.679	0.269	0.443								
n	41	39	35	39	41							
... total capital	-0.092	0.982**	0.076	0.440**	0.043	1	-0.811**	-0.910**				
Sig.	0.578	0.000	0.663	0.006	0.804							
n	39	39	35	38	35	39						
... equity ratio	0.116	-0.734**	0.008	-0.331*	0.143	-0.811**	1	0.845**				
Sig.	0.481	0.000	0.964	0.046	0.42	0						
n	39	39	34	37	34	38	39					
... ROI	0.036	-0.893**	0.016	-0.283	0.094	-0.910**	0.845**	1				
Sig.	0.84	0.000	0.931	0.117	0.601	0	0					
n	33	33	30	32	33	33	33	33				
... production capacity	0.014	0.292	0.704**	0.562**	0.108	0.294	-0.1	-0.194	1			-0.421**
Sig.	0.927	0.054	0.000	0.000	0.513	0.074	0.548	0.287				
n	47	44	38	45	39	38	38	32	47			
... storage capacity	0.127	-0.112	0.104	0.432**	-0.294	-0.073	0.078	0.103	0.142	1		
Sig.	0.412	0.488	0.54	0.004	0.077	0.671	0.654	0.587	0.363			
n	44	41	37	43	37	36	35	30	43	44		
... machine capacity	0.553**	0.239	0.062	-0.041	0.152	0.076	-0.096	-0.167	0.141	-0.033	1	
Sig.	0.000	0.148	0.731	0.808	0.392	0.672	0.597	0.395	0.392	0.848		
n	40	38	33	38	34	33	33	28	39	37	40	
... prod. cap. utilisation	-0.245	-0.205	-0.08	0.032	0.12	-0.265	0.186	0.32	-0.421**	0.106	-0.145	1
Sig.	0.097	0.181	0.627	0.834	0.462	0.104	0.256	0.069	0.004	0.499	0.378	
n	47	44	39	45	40	39	39	33	46	43	39	47

** highly significant $p \leq 0.01$

* significant $p \leq 0.05$

Note: In the correlation matrix in Table 10, the lower diagonal part and the upper are equal. In order to visualize significant correlations, in the upper diagonal part all non-significant relations were erased. Only significant correlations are listed there, the additional information incl. n can be taken from the lower diagonal part of the matrix.