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The effects of the participation in producer organisations on the performance of dairy farmers in the Czech Republic and future challenges

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Abstract: This study focuses on milk producer organisations (MPOs) acting in the Czech Republic, examines in counterfactual design economic benefits of MPO members, explores the expectations and satisfaction of farmers with services provided by MPOs and discusses changes in MPO strategies in response to market developments. The economic benefits were evaluated econometrically using a direct matching method, while for the assessment of MPOs services and strategies we designed a survey among the members which was complemented by interviews with managers of the three largest MPOs. The results confirm positive economic benefits for farms and rather high farmers' expectations and also satisfaction with the MPOs activities. However, while farmers, put most emphasis on common roles as price bargaining and securing sales, the MPO managers show future-looking approaches to strategies referring to consumer environmental and health concerns or vertical collaboration along the value chain.

Keywords: counterfactual analysis; direct covariate matching; economic performance; services to members; strategies

The globalisation trends in foods production and marketing prolong the distance between producer and consumer and bring a range of intermediaries into the food value chain (Bunte and Dagevos 2009). The organisation of such a chain puts extraordinary emphasis on the effectiveness of not only every chain element but also on their interrelations (Hartwich and Tolla 2007; Dervillé and Allaire 2014). Firstly, the economic pressure stems from the global scope of competition (Swinnen 2010; Cakir and Nola 2015), as advanced logistic prefers the economically most suitable regions to be selected, and secondly, the pressure arises from

the number of chain participants. Producer organisations (POs) work as mediators between farmers and the downstream industry. However, not all farmers enter the organisations, and many sell their products without this intermediary. A number of authors have dealt with the incentives why individuals participate in joint actions (Thomson et al. 2008). As pointed out by Ostrom (1990), collective action uses the common interests and goals to achieve certain benefits and reduces transaction costs.

There are not many studies measuring the benefit of participation in producer groups. Duvaléix-

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Treguer and Gaigne (2015) estimate the impact of different POs on the cost structure and the margins of French hog farmers. They found large differences in the performance among types; apparently, the best-performing ones were those which included some extent of vertical integration. Michalek et al. (2018) adopted counterfactual approach on Slovak farm data, finding that members exhibit better economic figures than non-members and supported POs perform worse than not supported.

Alho (2015) conducted a qualitative study utilising farmers' self-reported valuation of benefits from the membership of Finish dairy and meat POs. The results correspond with the Duvalaix-Treguer and Gaigne (2015) finding that the level of benefits depends on the type of cooperation. Other studies like Ricard (2015) or Garnevská (2011) show how factors, such as the type of the landscape, legal environment, government technical and financial support and other aspects are important in a decision on milk marketing.

The objective of the study is to understand better the benefit of dairy farmers' participation in producer groups (marketing cooperatives) and what strategies have these adopted to secure the benefits in the future. We focus our investigation only on the milk sector, and we consider its specific policy context. In order to operationalise the objectives, we stated three research questions or specific objectives: *i*) if those farms participating in milk producer organisations (MPOs) show better economic and production performance than non-members; *ii*) whether the MPOs meet farmers' expectations, and *iii*) what strategies the MPOs have adopted to secure the benefits to members also in the future.

METHODOLOGY

Our analysis pursues the conceptual framework showed in Figure 1. In the above part, we present milk producer organisations and in the lower part, all the other key actors of the dairy value chain. Market constitutes relationships among actors.

As it is evident from the objectives defined in the introduction our research focuses on the upper part, i.e. on individual benefits, expectations of members and the strategies of the MPO (in the circle) in response to or context in the lower part. MPOs provide benefits for members in terms of income (resulting from the joint sales of milk) and advice and information on market and technologies. To satisfy the expectations of members (mainly concerning the sales and income), the management of MPO has to understand changes in the markets. The MPOs (at least the investigated ones) adopt two strategies: a defensive one aiming at lowering costs by joint purchases of inputs (the left blue arrow) and a progressive one responding to the changes in the downstream part of the value chain (the right orange arrow). The government (national one or the European Union bodies) can also intervene in favour of the MPOs – either by direct or indirect subsidies or by convenient regulations (EU 2012; EU 2013).

For each of the objective, we adopt different analytical methods: *i*) individual benefits are assessed economically using a matching method in the counterfactual design; *ii*) a survey among the members provides information on their expectations towards their MPOs and their fulfilments – actual benefits. The survey is complemented by several interviews with farmers (managers of farming companies); and *iii*) the case

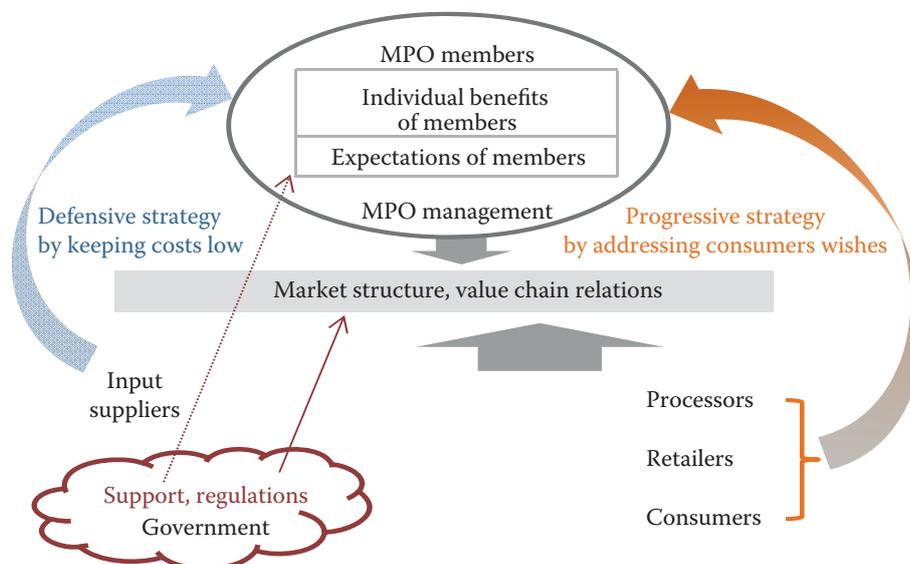


Figure 1. Conceptual framework
Source: Own proposition

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studies based on interviews with the management of the three largest MPOs shows what strategies are followed to assure fulfilment of members’ expectations.

In addition, we do a brief overview of the structural changes in the dairy market and review the literature and governmental documents to provide a context of decisions on the strategies of MPOs.

To quantitatively assess the benefits of participation in MPO, we used a farm level counterfactual analysis similar to the one adopted by Michalek et al. (2018). In contrast to Michalek et al. (2018), we follow direct covariate matching (DCM) between treated and control groups based on Mahalanobis metric (Abadie and Imbens 2002) considering 4 nearest neighbours. We first run a probit model to determine the constituents of participation in MPOs, which later were used as matching covariates (instead of generating propensity scores; Caliendo and Kopeinig 2008). We also adopted a non-parametric difference in difference (*d-i-d*) estimator, which allows for controlling unobservable, linear and time-invariant effects (Heckman et al. 1998). Similarly to Kirchweger and Kantelhardt (2015), we assess the dynamic effects of the treatment – in our case “participation in MPOs”. This is done in the following way:

- i)* Two treatment variables are considered – membership in 2011 and in 2012;
- ii)* The effects are assessed in the following years 2012 to 2017; to moderate annual fluctuations we introduced 3 year moving averages (MA) of effects;
- iii)* The base period for the difference in differences approach includes three optional 3 year periods (2007–2009, 2008–2010, 2009–2011);
- iv)* The performance is measured as 3 year MA in the period 2011 to 2017 (the year refers to the last year in the MA [(2009, 2010, 2011), ..., (2015, 2016, 2017)]).

Matching is based on a set of 4 structural covariates involving herd size, production condi-

tions [the share of land located in less-favoured areas – LFA (before 2015) or areas with natural constraints – ANC (after 2015)], the intensity of production (livestock density) and financial health of the farms. The effects are measured by six indicators: profit, gross value added (GVA), labour productivity (GVA/labour cost), total factor productivity (Thiel-Tornquist total factor productivity index – TFP; Capalbo and Antle 1988), number of dairy cows (herd size) and annual milk delivery. For details see Supplementary Material S1 in electronic supplementary material (ESM); for ESM see the electronic version.

In the study, we use a sub-sample of 658 farming companies (thus legal entities) from the Bisnode MagnusWeb Database (Bisnode 2019) containing economic and financial data from the annual reports of companies for the period 2007–2017. There was a change in the reporting obligations in 2016, since that year, the number of items has been reduced, and no longer we can calculate the TFP index. This Bisnode (2019) sub-sample is enriched by data on land use, livestock herds, production orientation (MoA 2018) and participation in MPOs (SAIF 2019). In the sample of 658 farming companies, we have 451 members of MPOs and only 207 non-members. This proportion (68% of members) is in favour of members comparing to the national level (41% of members). Comparison of the two subgroups in the sample is given in Table 1. It also provides information on the characteristics of farms in terms of area, employed capital, agri-ecological conditions (the share of LFA/ANC), size of the herd and livestock production intensity. Obviously, farms are big in both subgroups, and milk production can account for a third of farm income (we can only estimate, we do not have such information in the sample). The subgroups are very unbalanced in terms of the number of farms and the commonly used *att*, i.e. the average treatment (membership) effect on treated (members) will be in-

Table 1. Characteristics of the subgroups of members and non-members (in year 2011)

Indicator	Before matching				After matching			
	mean_T	mean_C	SE	P	mean_T	mean_C	SE	P
Utilised agricultural area (UAA; ha)	1 775	1 112	1 133	0.953	1 784	1 804	100	0.844
Share of land (LFA/ANC)	65%	43%	0.442	0.000	64%	63%	0.005	0.304
Total assets (EUR thousand)	5 131	4 097	11 812	0.347	5 767	6 443	915	0.439
Number of dairy cows	399	255	288	0.445	408	402	24	0.780
Livestock intensity (LU/ha)	0.462	0.167	0.173	0.550	0.468	0.468	0.003	0.953
Bank indebtedness	0.153	0.104	0.102	0.000	0.164	0.157	0.002	0.001

suffix *T* – treated, i.e. members of dairy cooperatives in 2011 (451); suffix *C* – controls, i.e. non-members (207); LFA/ANC – less favoured area/areas with natural constraints; LU – livestock units; the exchange rate used 25.143 CZK/EUR for 2012 (CNB 2019)

Source: Own calculations based on Bisnode (2019) economic data

Table 2. Organisation of milk sales in the Czech Republic

	Unit	2011	2016	2018
Total raw milk sales in the Czech Republic	thousand t	2 614.5	2 959.8	3 056.8
Number of marketing organisations	<i>n</i>	39	27	29
Raw milk exports	%	16.8	21.6	–
Share of MPO deliveries on the total raw milk sales	%	58	61	62
Share of TOP4* MPOs on the total raw milk sales	%	34.9	40.7	41.4
Share of TOP4 Czech dairy processors on raw milk purchases	%	37.7	34.8	–

*TOP3 after the merge of the third and fourth largest milk producer organisations (MPOs) in 2018

Source: Own calculation based on data of the State Agricultural Intervention Fund (SAIF 2019) and the Czech Statistical Office (CZSO 2019)

convenient. Therefore, we use average treatment effect (*ate*) which takes into account a complementary point of view – the effect of treatment (membership) on non-members (*atc*, matching non-members with members); the resulting *ate* is an average of *att* and *atc*.

The quality of the matching is illustrated by comparing the before matching and after matching blocks of Table 1. It is evident that means are much closer after matching than before matching and also the respective standard errors are much smaller after matching than before matching. Thus in spite of persisting statistically significant difference after matching in the case of indebtedness, the actual difference is negligible. If we take membership in 2012 as a starting point, all differences will be insignificant after matching.

Overview of the national milk market structure. Agriculture and the dairy sector, in particular, experienced a turbulent development after political changes in 1989. During the transition, the number of dairy producers significantly dropped as many farms gave up milk production. In the late 1990s, dairy farmers sought salvation in forming milk marketing cooperatives (Milk Producer Organisations, MPO) in large number. At the beginning of the new millennium, the sector recovered, and milk production rose. Since that their number has continuously declined; nowadays there are less than 30 of them while their deliveries have grown slightly, with the current share on total raw milk sales above 60%. Three of the MPOs (in Table 2 presented as four, before the third and fourth largest merged in November of 2018) are considerably large.

Their share on the total raw milk sales grew from 35% in 2011 to about 40% in the last couple of years. The mentioned merge of the third and fourth biggest

MPOs concluded in 2018 made the new producer group the second largest (almost as big as the largest one). Thus the volume of raw milk controlled by producers not only grew but also concentrated in the several few largest MPOs. Actually, raw milk delivered by the TOP3 MPOs (formerly TOP4) accounts for 66% of the total volume controlled by producer groups (MPOs). It is vital to mention that the TOP4 milk buyers-processors purchase as a similar amount of milk as the TOP3 (TOP4) MPOs and that direct purchases of these large processors from individual farmers account for only 18% of the total traded raw milk. It illustrates gradually strengthening the position of MPOs and thus farmers.

The milk producer organisations have received no direct support since their emergence (Ratinger and Boskova 2013). However, two measures of the so-called “Milk Package”¹ launched by the European Commission to moderate the impact of the abandonment of quotas in 2015 provided important indirect assistance:

- i*) Relaxing the ceiling for milk purchase by a single producer group to 33% of national milk production;
- ii*) The indirect incentive for farmers to participate in the POs can be set at the national level.

The measure *i*) – clearly an exceptional intervention in the EU competition policy in favour to the milk sector – allowed further concentration of milk suppliers. Concerning *ii*), for example, in the Czech Republic, members of the milk producer groups can gain preferential points² in the evaluation of their applications for investment support projects (M04) of the RDP 2014–2020. Interviewed applicants confirmed that often this preference made the projects getting through.

¹Regulation (EC) No 261/2012 amending Regulation 1234/2007/EC on the Common Market Organization.

²POs recognized according to the Article 152 of the Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products.

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RESULTS

The econometric assessment of the benefits of MPOs to members. Similarly to propensity score matching procedure, we conducted probit regression in order to identify variable which determines the participation of farms in MPOs (participations in 2011 and 2012). From a number of variables which we selected as potential candidates using factor analysis (more precisely the principal component analysis; PCA), we found two significantly (at $\alpha = 0.01$) affecting the decision of joining MPOs: being in areas with natural constraints (such as mountain areas) and having a low level of indebtedness. There are no substantial differences between participation years. This is, of course, understandable, since the changes in the participation of farms in MPOs are not dramatic between years. The other two structural variables [the size of the dairy herd and production intensity, i.e. cattle livestock units (LU) per hectare] which we considered as the structural covariates are not significant determinants of participation, nevertheless we believe that they are essential for stating the similarity and thus for comparison of indicators.

For the presentation of results, we divided the output indicators into three groups: *i*) indicators capturing the changes in production structure (dairy cow herd size and annual milk delivery to the milk buyers, Figure 2); *ii*) absolute economic performance indicators (profit, GVA, Figure 3); and *iii*) relative economic performance indicators (labour productivity and TFP).

The estimated *d-i-d* indicators (average net effects) are accompanied with the upper and lower bounds of the 95% confidence interval and presented over the period 2012–2017. It allows showing the dynamics of the selected indicators. The calculations of the difference in differences (*d-i-d*) estimators refer to the period 2008–2010 in both figures. However, the net effects are very similar for any of the other two considered reference periods (2007–2009, 2009–2011).

The both indicators Dairy herd size and Total annual milk delivery (Figure 2) exhibit higher growth on the farms of MPO members: for example the number of dairy cows increased on average by 16 heads and milk delivery by 137 000 kg more on the farms participating in MPOs than on the farms of non-members between 2012 and 2017. Also, we can see that net effects of milk deliveries is higher than the net increases of dairy cows (in relative terms) what suggests that members of MPOs also exhibit more progressively increasing milk yield than non-members. In turn, it means that farms participating in MPOs are more dynamic in milk production than the farms delivering individually to milk processors.

Concerning the economic performance, members of MPOs exhibit on average a slightly better profit and value added than non-members over the period 2012–2017 (Figure 3). It is the only one figure we present the absolute differences and not *d-i-d*. The 95% confidence interval is broad, suggesting that statistically there is no evidence for better performance of mem-

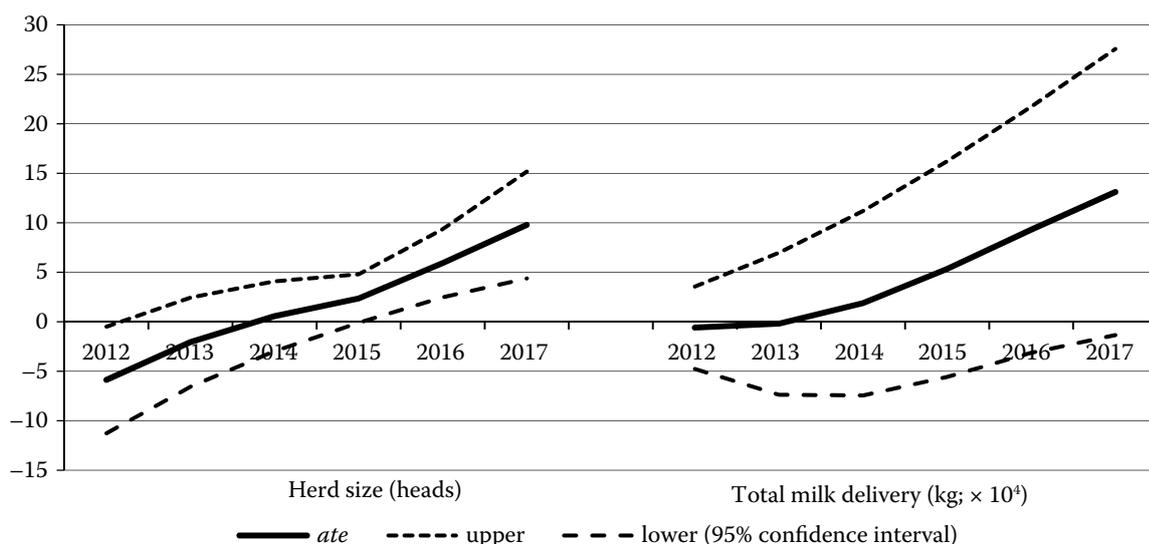


Figure 2. Structural effects of the participation in milk producer organisations (MPOs) (*d-i-d*)

d-i-d – reference period 2008–2010; total milk delivery is scaled down by the multiplier 0.0001; *ate* – average treatment effect

Source: Own calculation using the *teffects* routine of STATA on the Bisnode (2019) data

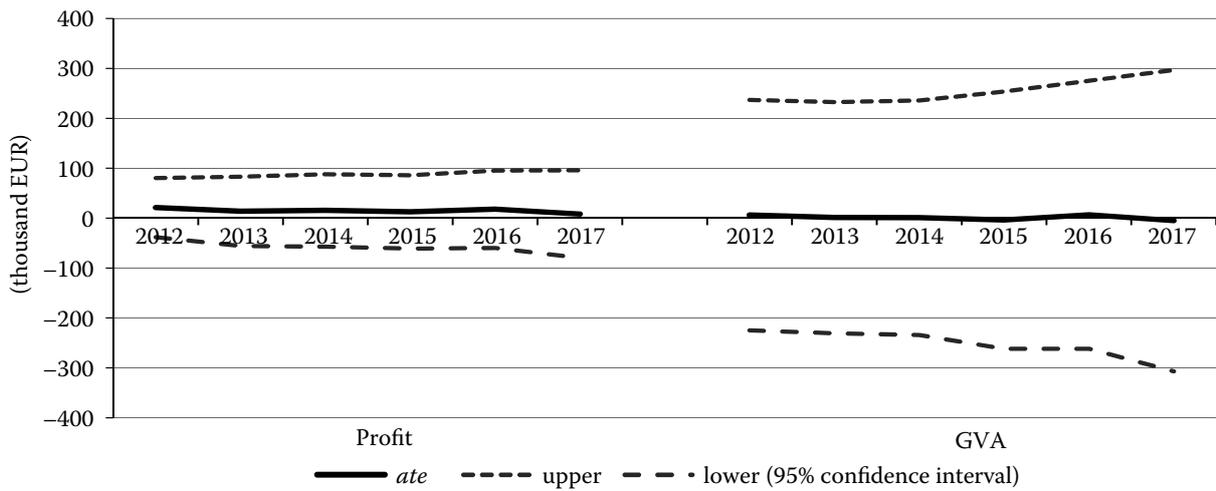


Figure 3. Economic performance effects of the participation in milk producer organisations (MPOs)

ate – average treatment effect; GVA – gross value added; calculated in CZK, results transformed in EUR using the annual exchange rates of the Czech National Bank

Source: Own calculation using the *teffects* routine of STATA

bers. Moreover, the *d-i-d* calculation (which we do not display) will show declining relative performance. It is worth to stress that GVA does not include area payments (direct payments and payments for natural constraints) and production subsidies. It likely explains high variability of this indicator as well as the one of labour productivity (GVA/labour costs).

Members of MPOs show higher labour productivity than non-members over the period 2012–2017 (Figure 4). Also, we can see clearly improving total factor productivity in the period 2012–2015 (we had no data for 2016 and 2017). It holds for both the *d-i-d* calculations as well as for absolute figures (not displayed) which

are also statistically significant at $\alpha = 0.05$. It is vital to stress that the performance indicators in Figures 3–4 refer to the whole farm business and not just to the dairy enterprise since we lack details on the share of milk production on the whole business revenue and costs.

The assessment of the members' satisfaction with MPOs' services. In this section, we complement the accounting figures with the farmers' subjective opinion on services provided by MPOs which eventually lead to the success of MPOs in terms of members satisfaction and commitment. These opinions were examined in a sample of farm managers who participated in the training course on the Markets

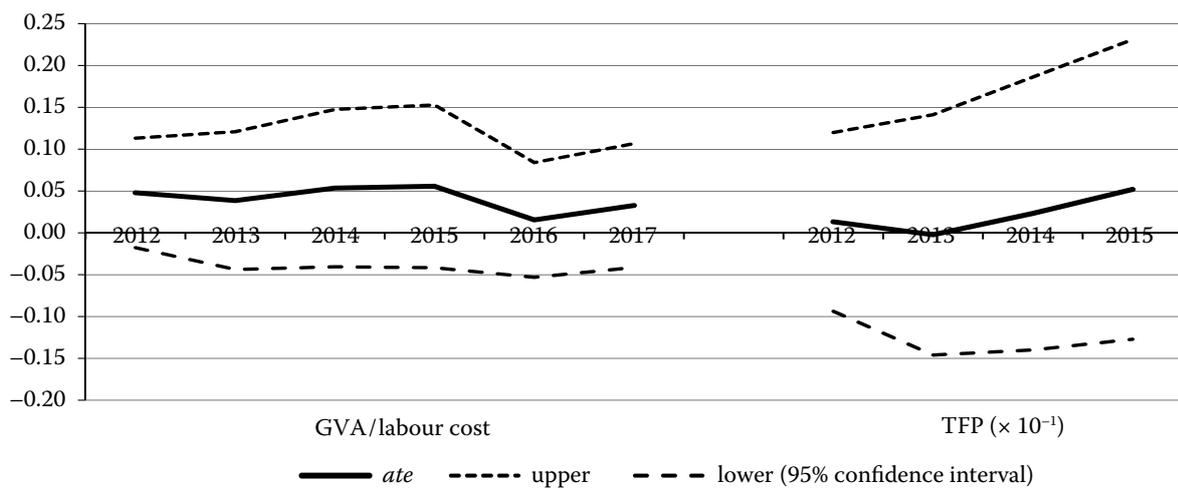


Figure 4. Labour productivity and total factor productivity (*d-i-d*)

d-i-d – reference period 2008–2010; Thiel-Tornquist total factor productivity index (TFP) is scaled up by multiplying the values by 10; *ate* – average treatment effect; GVA – gross value added

Source: Own calculation using the *teffects* routine of STATA

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development assessment and risk management measures. The training course was organised by the Institute for Education in Agriculture – a non-profit spin-off of the Agricultural Association of the Czech Republic. The participants in the training and thus respondents recruited from the members of the Agricultural Association, it means from farming companies of considerable size [dairy farms usually cultivating over 1 000 ha of agricultural land (UAA)]; thus the results are biased towards large farms. The training was organised in the 11 of 14 NUTS 3 regions at the turn of 2018 and 2019. Participants received a printed questionnaire which they filled indirectly at the seminar. The responses of 77 farm managers were collected; 39 were MPO members and 38 non-members. The sample covers farmland of 102 thousand ha ($\approx 3\%$ of the national UAA).

The respondents of the MPO members were asked to mark services provided by their MPOs (in the list prepared by the authors) and to state their satisfaction with them on the scale 0 to 4. About two-thirds of the surveyed members were from the three/four largest MPOs in the country, while the rest represented farms participating in rather local MPOs. “Negotiating fair price” and “Securing sales” are the most appreciated MPOs’ services by their members (Figure 5). Around 60% of the investigated MPOs’ members agreed that they received useful information on “the milk market outlook” and “price developments”. It is a bit in contrast to the answers of the managers of the largest MPOs emphasising that informing their members on the market and price outlooks regularly and frequently is one of their priorities³. Possibly, the level or quality of information does not entirely match the expectations of some members. Collective purchases of inputs with better prices reported 30% of respondents. On the other hand, some benefits (such as providing information about technologies, implementing common risk fund or milk processing activities) are marked as provided by only very few respondents from MPOs’ members. It can well be that technological information is exchanged informally among the members, and thus it was not understood by respondents as an activity of the MPOs while missing the effect of social capital generated in the collective action enabling such trustful informal exchange. The common risk fund was established by only one large MPO by the time of the survey. All three minor

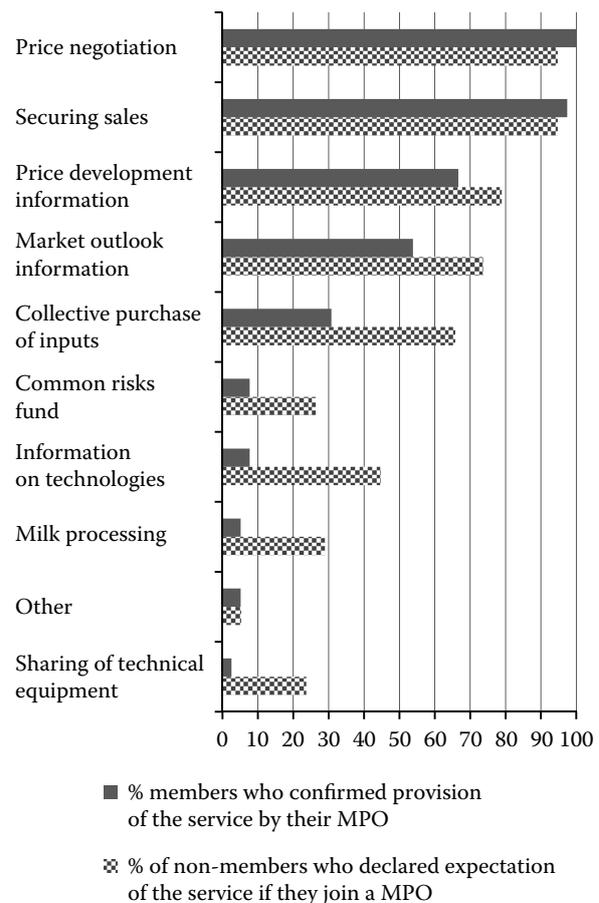


Figure 5. Members and non-members statements about milk producer organisations’ (MPOs) services

Source: Own investigation

services are appreciated (scored high) by the respondents – however, we cannot fully assess their general benefit, since they are not provided commonly.

Managers of the non-member farms were asked about reasons for staying aside (not joining a MPO) and whether they would join under certain conditions. Out of the offered answer options, the "preference for an independent decision making" was chosen as the most frequent reason for staying aside. As far as the eventual entry is concerned, most of the respondents selected "availability of financial support" and "nearby existence of a well-functioning MPO". Generally, the expectations of non-members are higher than the actual level of the provision of the services as answered by the member-respondents except "securing sales" and "negotiating price" (Figure 5). A noteworthy finding is also the fact that respondents

³We are quite sure on that, because the Institute of Agricultural Economics and Information has provided various background studies and materials to the management of many MPOs.

attended the risk management training, but no member expressed a wish to set up a risk management fund in its MPOs, and only every tenth non-member would require such a service.

The assessment of the strategies of MPOs' management to deal with new challenges. The positions of MPOs' managements about the success and future of their organisations were gathered in the three largest MPOs. The in face to face semi-structured interviews concentrated on 2 areas of our interests: *i)* changing MPOs' roles and services over the last ten years; and *ii)* current challenges the MPO is facing and responses to them.

All the three top managers agreed on dramatic market turbulences associated with the quota abolishment in 2015, the global market volatility and tough competition home and in Europe. Although the goals of the three MPOs are basically the same (securing fair income from milk sales), their answers to challenges to assure sustainable milk production differ. The board of the Czech largest MPO managed ten years ago to negotiate with all members to accept the uniform milk price to all members regardless of their particular delivery points (dairy processors)⁴. Despite the tough struggle to gain consensus, the final outcome strengthened the position of the MPO's management and raised the commitment of its members. In 2018, the MPO faced a new challenge resulting from the expanding business relationship with the German customer, buying now more than a third of the MPO's raw milk supply. The German dairy plant pressed for glyphosate free⁵ milk production. The management of that MPO asked all members to convert in the glyphosate free production, since, a partial solution would become a limiting factor for milk collection and generally, would undermine the trust of the German customer. The commitment will increase costs for farmers, but the German customer will pay a premium because German consumers are willing to do it. The management of the given MPO believes that there are consumers in the Czech Republic who will also be willing to pay for glyphosate free products in the near future. Thus the MPO aims to take advantage of the situation and to differentiate their product (raw milk) from other suppliers. Obviously, they will need the downstream industry to collaborate. In spite of the current struggle to find a processor who will produce glyphosate free

products, the managers of the other two MPOs believe that the act of that mentioned MPO has already changed the domestic landscape and sooner or later domestic market for glyphosate free dairy products will emerge and expand.

The other interviewed MPO also struggles to transmit the quality of its members' milk to the consumers and earn a premium for it. The collapse of contracted processing (of soft cheese and yoghurt) under the MPOs logo shook with organisation ten years ago. The new management has consolidated the situation and instead of enhancing downstream cooperation has turned upstream and has developed a service of collective purchase of inputs at discount price. In effect, the number of members and the traded volume of raw milk have increased. Recently, the discussion on adding value to MPO members' milk has resumed. The MPO's management has found that retailers will be ready to promote link between consumers and primary producers, while the processors are deaf to it. The latter makes the management reluctant to any similar attempt as in the past, considering the risk of failure high.

The managers of all the three large MPOs emphasised that poor downstream links (lack of coordination) threaten the future of milk producers. They account it to the myopic self-interest of the processors. They believe that strong MPOs can exercise pressure on the processors and therefore, the medium-term strategy of the MPOs rest in their growth. This strategy led to the merge of the third and fourth largest MPOs in 2018, making thus the second biggest milk supplier in the country.

DISCUSSION AND CONCLUSION

The quantitative assessment indicated some positive effects of the MPO membership both in production and economic terms. This is in accord with Michalek et al. (2018) who showed positive effects of the membership in the producer organisations in Slovakia, particularly, if these were not initiated and supported by the policy. It is actually the case of MPOs which emerged spontaneously in the middle of the 1990s in the Czech Republic. However, it is important to emphasise that except the expansion of milk production, the other positive effects are rather marginal and statistically insignificant with respect to the non-members. The economic benefits (produc-

⁴For more details see Rättinger and Bošková (2013).

⁵<https://www.agrarheute.com/wochenblatt/maerkte/glyphosat-einstieg-totalen-ausstieg-541676>

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tivity) and the continual expansion of the dairy enterprises on the members' farms are positively reflected in the answers of the farm managers in our survey. While the members appreciated the current services, they also exhibited little innovative thinking in terms of possible new services. From the surveys and interviews, it becomes apparent that the leaders of the MPOs pursue long terms strategies trying to steer the organisations along with the anticipated trends, while the members rely on leaders. It actually confirms a high level of trust which is otherwise so scarce in agriculture. Our hypothesis is that the hard process of negotiating uniform price formula for all members, which experienced all three investigated MPOs, contributed to the internal cohesion of the MPOs and thus strengthened trust among members and between the management and the members (compare with Barraud-Didier et al. 2012). Another factor which likely increased trust in the MPOs' managements was successful passing through the abolishment of milk quotas and other market shocks. It has also appeared in our research that there is a slight discrepancy between the MPO leaders and members: while the members are risk-averse and would like to concentrate only on production, the leaders do market-oriented business and feel a need for innovations with, of course, some risk. It seems that the boards of managers of the investigated MPOs are aware of it and try to pursue safe ways combining defensive strategies as cost minimisation through the collective purchase of inputs with more progressive risky strategies anticipating new market opportunities or conditions. The response to the challenge of the glyphosate free production is a good example of the progressive strategy carrying the non-negligible risk. Exercising bargain power stays as a backbone strategy of all the investigated MPOs, similarly like 6 years ago (Ratinger and Boskova 2013), and in line with most European producer groups (Wijnands et al. 2017).

Referring to rather small economic benefits of the membership (measured by profit and GVA or even labour productivity) in the context of their dominant share on milk deliveries we state the hypothesis that MPO have affected the marketing and price conditions for all producers (non/member can be perceived as "free riders" in economic – not moral sense). And one can expect that this will also happen with the MPOs' responds to consumers wishes for higher quality and safety of milk and environmental responsibility – that due to MPOs these will become rewarded for every producer.

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