The assessment of the effects of the investment support scheme in the Czech Republic

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1. Abstract

The objective of the poster paper is to identify factors of participation in investment support scheme and to assess economic and other effects of the measures 121 "Modernisation of Agricultural Holdings" and 123 "Increasing of value added" of the Rural Development Programme (RDP) 2007-2013 on the Czech farms. A particular attention is paid to the issues of participation in different measures, differentiated impacts of the supports according to the production conditions and deadweight. In general, the selected measures improved performance of supported farms. Evident differences are among impacts in the farm subsamples – in the sub-sample of farms with a higher density of ruminants the economic impacts are statistically significant while in the other case are not.

Key words: modernisation, value adding, counterfactual analysis, direct nearest neighbour matching, deadweight

2. Introduction

The investment support has been considered as a principal vehicle for enhancing competitiveness of the Czech agriculture since the early days of the economic transition. However, little attention has been paid to the evaluation of actual effects of the corresponding support programmes. The need for a more rigorous assessment arrived with EU rural development programmes, particularly the current one (2007-2013) for which the Commission established the Common Evaluation a Monitoring Framework (EC 2006). However, simple comparison of result indicators (as production or GVA) between supported and non-supported groups is methodologically problematic, since it omits their multiple factors formation and the fact that the measures are targeted to or exploited by only some groups of producers/regions (Michalek 2007). To deal with these shortcomings a more precise counterfactual approach is needed investigating what would have happened if the supported producers did not participate in the programme and then comparing the result indicators (Khandaker et al. 2010). In our previous research (Medonos et al., 2012) we showed using the propensity score matching approach (PSM)[1] that there were benefits of the investment support measures in terms of improved GVA and labour productivity on a sample of about 800 farming companies. However, when extending the sample to about 1400 the heterogeneity of farms increased and we faced a serious problem of heteroscedasticity. To deal with it we adopted an alternative matching approach suggested by Abadie and Imbens (2002).

3. Data and Methods

Since it is principally impossible to observe on the same farm the effects of participation and non-participation in the measure, one has to choose or to construct a control farm with "identical" characteristics from the pool of non-participating producers. We use probit regression to identify key structural variables for construction of control farms.

The standard framework in evaluation analysis to formalise the above problem provides Roy-Rubin-model (Caliendo, Kopeinig, 2005). In this model, the parameter which has received the most attention of scholars is the Average Treatment Effect on Treated (ATT); it is defined:

$$\tau_{ATT} = E[\tau|D = 1] = E[Y(1)|D = 1] - E[Y(0)|D = 1] , \quad (1)$$

[1] *e.g. Caliendo and Kopeinig, (2005), Khandaker et al. (2010)*

where τ=Y(1)-Y(0), Y(D) is an result variable, D equals 1 if the unit got an investment support (treatment) and 0 otherwise. The sample ATT takes the form of

$$\tau_{\mathrm{SATT}} = \frac{1}{N_1}\sum_{i\in particip}\left[Y_i^T(1) - Y_i^C(O)\right], \quad (2)$$

where the upper indices T and C indicate participating (treated) and control farms respectively. Matching estimators are based on imputing a value on the counterfactual outcome for each unit. Abbadie and Imbens (2002), propose direct matching which is based on metric $||x||=(x'Vx)^{1/2}$, where x is a vector of structural variables and V is a positive semidefinite matrix. This metric is used to determine the nearest similar unit(s). The counterfactual is given as an average of the result variable of the few nearest units. Abadie and Imbens (2002) define further a function $K_M(i)$ which indicate how many times a control unit (farm) *i* is matched, and shoved that the ATT estimator as well as its variance depends on it. Following it, they propose approaches for correcting estimation bias and heteroscedasticity. This approach is implemented in STATA as the nnmatch procedure (Abadie et al., 2004).

We used several sources of data on farm characteristics and performance: Albertina database, LPIS, data on agricultural supports published by SZIF[2]. Albertina is main source, it is a database built on annual reports of companies which are oblige to publish their economic and book keeping figures. Since Albertina includes only financial indicators we linked information on utilised agricultural area (UAA) and on land use from LPIS.

In order to investigate differences in investment support impacts we have divided the sample in several sub samples by production conditions and orientation (given by the share of grasslands ≥ 20%, < 20%), and density of ruminants on utilised agricultural land (e. g. ≥ 0.2 resp. < 0.2).

4. Main results

In general, most of the support was directed in the livestock sector in terms of numbers (57%) as well as in terms of funds (72%). This bias against the livestock sector results to large extent from policy preferences. There were 1415 agricultural businesses in the Albertina database which provided all economic figures for all four years of the period 2007-2011. A slightly more than a third of them (583) were awarded an investment support from the Czech RDP (measures 121 and/or 123).

Factor analysis detected 13 factors representing 90% of variability for nearly 50 indicators of economic performance. For selecting the nearest neighbours we used 9 structural variables regarded as factors as possible determinants of farm participation in the mentioned measures. The total cash flow represents size of the business; the share of grasslands indicates if a farm is in the less favoured area, density of ruminants indicates production specialisation and the rest are variables referring to financial sources for investment.

There are significant differences between participating and non-participating farms in the Albertina sample: the average utilised agricultural area of participating farms is substantially greater (1717 ha) than the one of non-participants (1038 ha). The participating farms are on average not only substantially larger but also more capital intensive than non-participating ones. In contrast the groups do not differ (statistically) in terms of the share of grasslands and investment activity.

The participation in investment support programmes is affected by various factors. Using probit regression we can say that size, and density of ruminants affects the participation

[2] *State Intervention Fund for Agriculture - the paying agency.*

positively while high capital intensity (cash flow / labour cost ratio) goes against it. Credit indebtedness is positive factor of participation contrary to total indebtedness which discourages or prevents the participation.

We have chosen 6 performance variables (GVA, GVA/labour cost, Profit, GVA/sales, Operational efficiency[3] and Credit indebtedness) on which we measure results of the investment support programme. Credit indebtedness and operational efficiency exhibit significant and positive average treatment effect on treated (ATT) in all types of participation and both methods of matching see (Table 1). It can be interpreted as a mobilisation of additional resources (bank credits) to finance modernisation of agriculture. From this point of view, we can judge on the rather low deadweight effect of Measures 121 and 123. Significant positive effect was estimated for GVA and GVA/Sales for period 2007-2011 in the case of PSM and also NNM. For NNM the effects in period 2007-2010 are much lower and not significant because of presence the financial crisis. Effects from participation are not significant in case of Labour productivity (with exception of the period 2007-2011) and these effects are strongly variable. Effects for investment supports schemes are not significant for Profit at all.

Table 1 Comparison of the results according to the different matching methods

	PSM - kernel						NNM according Abadie et al. (2004)					
D-I-D	MOD 2010			MOD 2011			MOD 2010			MOD 2011		
Indicator	ATT	SE	Sig.	ATT	SE	Sig.	ATT	SE	Sig.	ATT	SE	Sig.
Gross value added (per farm)	1091	733		1796	870	**	1986	688	***	2195	793	***
Labour productivity	0.045	0.249		0.214	0.127	*	-0.098	0.159		0.108	0.159	
Profit (per farm)	524	619		621	833		789	545		307	1042	
Efficiency	0.221	0.141		0.269	0.162	*	0.188	0.075	**	0.209	0.073	***
Operational efficiency	0.048	0.015	***	0.041	0.014	***	0.043	0.019	**	0.028	0.010	***
Credit indebtedness	0.029	0.005	***	0.040	0.007	***	0.023	0.007	***	0.033	0.007	***

D-I-D: Difference in Difference between treated and non-treated farms and between years 2007 and 2010 or 2011
MOD: treated farms under measure 121 Modernisation of agricultural holdings
Labour productivity = GVA / Labour Costs
Efficiency = GVA / Total Sales
Operational efficiency = (Net Value Added - Labour Costs) / (Intermediate Consumption + Labour Costs + Depreciation)
Credit indebtedness = Bank Credits / Total Assets

With regard to the fact that the differences between groups of farms are more significant under application of matching method according to Abadie et al. (2004) we present results in the rest of results only for this matching method.

When we split farms into two sub-samples according to share of grasslands in total utilised agricultural area then the average treatment effects for both groups are more-less identical in the level as well significance for credit indebtedness and GVA/Sales. Differences are rather evident in GVA per farm and Profit per farm on one hand and in Operational efficiency on the other hand. ATT for GVA per farm in case of farms with higher share of grassland (over 20%) is significant and high – 4 times higher than in opposite group. In case of arable farms (grasslands below 20%) there this effect is moreover insignificant. Much greater difference is in Profit per farm but level of significance is only 0.1 in case of higher share of grassland and the effect is not significant in opposite group. On the other hand ATT for Operational efficiency is significant in the sub-sample of arable farms and insignificant in opposite group. At the same time ATT for this variable is also higher in group with higher share of grassland.

[3] *(Net value added - personal cost)/(intermediate consumption + personal costs + depreciation)*

Table 2 Effects from participation in investment measures for the subsamples divided according to the share of grassland in UAA - NNM according to Abadie et al. (2004)

	share of grassland>=20%			share of grassland<20%			share of grassland>=20%			share of grassland<20%		
D-I-D	MOD 2010			MOD 2010			MOD+AV 2010			MOD+AV 2010		
Indicator	ATT	SE	Sig.	ATT	SE	Sig.	ATT	SE	Sig.	ATT	SE	Sig.
Gross value added (per farm)	2129	603.5	***	433	846.9		2049	607.7	***	370	842.6	
Labour productivity	-0.429	0.249	*	0.101	0.069		-0.423	0.245	*	0.124	0.070	*
Profit (per farm)	931	480.0	*	66	691.4		897	484.7	*	18	684.9	
Efficiency	0.370	0.168	**	0.028	0.012	**	0.364	0.166	**	0.029	0.012	**
Operational efficiency	0.063	0.039		0.024	0.009	***	0.062	0.039		0.024	0.009	***
Credit indebtedness	0.025	0.010	***	0.030	0.008	***	0.026	0.010	***	0.028	0.008	***

MOD+AV: treated farms under measures 121 Modernisation of agricultural holdings and 124 Adding value to agricultural and food products

The situation is different, let say more contrast to previous, in splitting farms according to density of ruminants per hectare. Average treatment effect on treated is significant at the level 0.1 in both sub-samples for GVA per farm and Operational efficiency. Interesting is that ATT is for GVA per farm much higher in farms with lower density of ruminants. For Operational efficiency are values similar with difference in significance. On the other hand ATT for GVA/Sales and Credit indebtedness are more significant and higher for farms with higher density of ruminants. Both results can indicate lower deadweight investment support and their higher efficiency for farms with higher density of ruminants.

Table 3 Effects from participation in investment measures for the subsamples divided according to the density of ruminants - NNM according to Abadie et al. (2004)

	Ruminants >=0.2 LU/ha			Ruminants < 0.2 LU/ha			Ruminants >=0.2 LU/ha			Ruminants < 0.2 LU/ha		
D-I-D	MOD+AV 2010			MOD+AV 2010			MOD+AV 2011			MOD+AV 2011		
Indicator	ATT	SE	Sig.	ATT	SE	Sig.	ATT	SE	Sig.	ATT	SE	Sig.
Gross value added (per farm)	1565	588.5	***	2519	1232.3	**	1835	647.9	***	2155	1272.8	*
Labour productivity	-0.140	0.129		0.236	0.174		0.193	0.099	*	0.066	0.311	
Profit (per farm)	630	480.9		579	924.5		1128	536.2	**	-155	1196.9	
Efficiency	0.206	0.089	**	0.019	0.034		0.249	0.107	**	0.025	0.016	
Operational efficiency	0.037	0.010	***	0.044	0.023	*	0.031	0.011	***	0.028	0.017	*
Credit indebtedness	0.034	0.007	***	-0.001	0.012		0.038	0.008	***	0.006	0.014	

MOD+AV: treated farms under measures 121 Modernisation of agricultural holdings and 124 Adding value to agricultural and food products

If we take the effect of CZK 1 796 000 or CZK 2 195 000 in increasing of GVA per farm (€ 71 847 and €87 810 respectively) and 583 large farms participating in the programme measures Modernisation and Adding value then the overall effect amounts CZK 1 047 172 000 or 1 279 836 000 (€41 887 000 or €51 193 000, respectively) for the first four years of the programme (the period 2008-2011). Finally it represents 1.3 – 1.6 % of the total agricultural GVA produced in this period.

5. Conclusions

Based on our results from the counterfactual analysis we can conclude that selected measures (Modernisation of agricultural holdings and Adding value to agricultural and food products) under the Rural Development Programme 2007-2013 have improved performance of the supported farms in the Czech Republic. Performance indicators that improved in comparison with counterfactual situation, differ as according to which investment measures we take into account, considered periods of evaluation and applied methods. This shows that in evaluation is not sufficient to demonstrate effects of investment support only on one or few

performance indicators. It is necessary to follow more dimensions of the performance and also various periods of evaluation. Application of several matching methods also improve robustness of results – each method creates counterfactual pair in different manner (one can also asses the selection bias). The evident differences are among effects in sub-samples. From this point of view it is useful to take in account various logical sub-samples and observe how the average treatment effects on treated differ.

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