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Abstract

This paper investigates the potential impact of post EU-accession public support, namely the introduction of the decoupled Single Area Payment (SAP), in Lithuania on its farming sector's restructuring and future efficiency. Analyses are based on efficiency calculations with 2001-2002 FADN data for fieldcrop farms, and on the same sample's farmers' intentions to remain in the sector and to expand their area post EU-accession under two scenarios: a hypothetical scenario of continuing pre-accession national policies, and a realistic scenario of fully decoupled SAP introduction with coupled national top-ups. Our results suggest that, before accession to the EU, the smallest inefficient farms remained in the sector thanks to the policy support. However, the SAP introduction could potentially give the right incentives to Lithuanian farmers for a quicker restructuring and an increase in farm efficiency, although such change may be impeded by the lack of available agricultural land.

Keywords: Single Area Payment, technical efficiency, size, subsidies, Lithuania

JEL classifications: D24, Q12

Impact potentiel des paiements directs de la PAC sur la restructuration et l'efficacité des exploitations agricoles en Lituanie

Résumé

Nous analysons ici l'impact potentiel du soutien public en Lituanie après l'adhésion du pays à l'Union Européenne (UE), c'est-à-dire l'impact des paiements directs à l'hectare (« Single Area Payments », SAP) sur la restructuration et l'efficacité future du secteur agricole. Nos analyses reposent sur des calculs d'efficacité à partir de données individuelles pour les exploitations de grandes cultures du RICA 2001-2002, et sur les intentions de ces mêmes exploitations de rester dans le secteur agricole et d'agrandir leur surface après l'adhésion à l'UE selon deux scénarios : un scénario hypothétique de la conservation des politiques nationales appliquées pré-adhésion, et un scénario réaliste d'introduction des paiements directs découplés de la PAC (les « SAP ») et des paiements supplémentaires couplés pris en charge sur le budget national. Nos résultats suggèrent qu'avant l'adhésion à l'UE les plus petites exploitations inefficaces restaient dans le secteur grâce au soutien public national. Néanmoins, l'introduction des paiements directs découplés de la PAC peuvent potentiellement encourager une restructuration plus rapide et une augmentation de l'efficacité des exploitants agricoles lituaniens, bien que ce changement puisse être limité par une disponibilité restreinte de terres agricoles.

Mots-clefs : PAC, paiements directs, efficacité technique, taille des exploitations, soutien public, Lituanie

Classifications JEL : D24, Q12

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1. Introduction

Understanding the determinants of farm survival and growth is critical if one wants to comprehend structural change in agriculture (Ehrensaft *et al*., 1984). As a result, economic studies of such determinants have become an important topic for investigation in the last decade (e.g. Kimhi and Bollman, 1999; Kimhi, 2000; Stiglbauer and Weiss, 2000; Möllers and Fritzsch, 2010). Some studies have even focused on the impact of specific policies on the decision to exit (Pietola *et al*., 2003).

At the same time, the relationship between support and farm efficiency has received increasing attention in the recent past, in particular in the context of the recent reforms of agricultural policies in the European Union (EU) and in the United States (e.g. Latruffe *et al*., 2009; Serra *et al*., 2008; Zhu *et al*., 2008). Farm support is generally expected to distort farmers' decisions and may correlate negatively with efficiency, but less so the more support is 'decoupled' from production decisions. However, even if decoupled from production choices, support may still influence farmers' decisions through a number of channels, and prevent efficiency gains that would otherwise be achieved through the closure of less efficient units and the growth of more efficient ones. In this context, the distortions created by a policy scheme can be empirically explored by investigating the links between efficiency and policy.

In the new member states (NMS) of the EU the issue is even more sensitive for two reasons. Firstly, these transition economies are in need of vigorous restructuring in order to achieve efficiency levels comparable to those seen in the established EU member states, and secondly, the amount of support received by farmers in these countries is higher after EU accession than before. In this regard, a proven negative relationship between support and efficiency could have serious negative effects on the restructuring of the farming sector in these NMS.

Indeed, since their accession to the EU in 2004 (for ten countries) and in 2007 (for two countries), farmers in the NMS are eligible to payments from the European budget, within the framework of the Common Agricultural Policy (CAP). Such payments are delivered in the form of a Single Area Payment (SAP) (except in Slovenia and Malta), that is to say payments fully decoupled from production (they are provided on every hectare of land managed, whatever the production) but still attached to land. Farmers can also receive coupled (to crop and livestock) payments from the national budget, the so-called top-ups. The NMS governments had the possibility of giving these additional payments to their farmers, owing to the phasing-in of SAP: the support provided through SAP is lower than the payments received by farmers in the EU-15 to start with, but increases progressively until a similar level is reached in 2013. In this context, and despite the fact that SAP is often presented as a form of decoupled payment, the implementation of such a scheme led some to fear that the high level of support introduced would make farmers less responsive to markets signals, preventing the full restructuring of the farming sector that is needed since the end of the socialist era in the beginning of the 1990s.

As far as the agricultural sector is concerned, the transition to a market economy was expected to promote the creation of commercial farms that would be able to compete internationally. It was expected that market signals would provide incentives to farmers to use their production factors more efficiently. For example, Swinnen and Vranken (2006) show that changes in the constraints faced by farmers in input and output markets during transition led to an increase in farm efficiency. Despite the wide-ranging effects of EU accession on farms' operating conditions in the NMS, we focus here only on the effect of SAP introduction after EU accession. This is made possible by the use of the survey of intentions, in which farmers were asked to state their intentions to remain in farming and expand their farm size under two scenarios in which only the type and level of farm policy support differs.

Most of the former socialist countries started the transition with very large-scale units (State and collective farms) utilising most of the agricultural land, and millions of household plots which only allowed for subsistence agriculture. In the early 1990s, debate about an optimal farm size was raging. Large farms were thought to be advantaged by scale economies and easier access to inputs, but plagued by labour supervision costs (e.g. Schmitt, 1991; Sarris *et al.*, 1999). The theory regarding the restructuring of the farming sector was, however, straightforward: in the case of a well-functioning land market and no distorting support policy, farms would adjust to an optimal medium size, with the least efficient farms leaving the sector and the most efficient ones growing. The reality was, however, less simple. Stopping the support to agriculture all at once would mean a human and economic disaster in countries where agriculture was very important in the economy and to employment, and played the role of economic buffer for millions of redundant industrial workers during the transition period. Moreover, the appeal of a potential future EU accession implied that countries started to align their agricultural policies with the CAP. At the same time, the institutions (including a fully functioning property rights regime), required for a well-functioning land market to develop, took time to establish. In this context, the transition may not have yet created the conditions necessary for an efficient agricultural sector, and accession to the EU might not allow these conditions to emerge or to be maintained, when support to farming increases significantly with accession.

This paper aims at shedding light on the potential effect of the CAP introduction in the NMS on their farming sectors' restructuring and efficiency. The illustration given is Lithuanian agriculture, for two reasons. Firstly, Lithuania is one of the rare NMS where a dual farming structure was not created with the end of the communist regime, as medium-size individual farms are most commonly observed. On the contrary, in most of the other NMS very large-scale units (companies, cooperatives and even individual farms) now co-exist with much smaller family farms, leading to a double-peaked farm size distribution. The continuum of farms observed in Lithuania makes the analysis clearer. Secondly, on the eve of EU accession, the land market in Lithuania was one of the most developed of all new entrants (Latruffe and Le Mouël, 2006). This may allow the analysis to capture the effect of SAP primarily, disregarding market constraints.

The paper is structured as follows. The next section reviews the channel through which support can affect farm decisions and efficiency, and discusses the differences between the support received by farmers in Lithuania before and after accession. Section 3 describes the relationship between farm size, support and technical efficiency in Lithuania before EU accession. The following section discusses the potential effect of SAP, with an analysis of farmers' intentions to remain in the farming sector and to expand their area. Section 5 concludes.

2. Farm support and decisions

Public support to farmers may affect restructuring in general, and the distribution of efficiency in particular, to the extent that it may affect farmers' decision-making and make them less responsive to economic and technical signals. Therefore, any distorting effect of a support measure is likely to translate into overall losses of efficiency in the agricultural sector.

It is normally accepted that there are three types of distorting effects produced by agricultural policies that are coupled to production choices. These are commonly recognised as 'static effects', 'effects under uncertainty' and 'dynamic effects' (OECD, 2000). Whenever a policy affects the trade equilibrium and/or the adjustment process to external shocks, this policy straightforwardly creates distortions in the market and these effects are called 'static effects'. They have been extensively studied for policy packages that are coupled to production choices or partially decoupled (see, for example, Moschini and Sckokai, 1994). 'Effects under uncertainty' depend directly on operators' risk aversion. Two forms of uncertainty effects may be distinguished, namely the 'income or wealth effect', which depends on the relative risk aversion of operators with respect to their total wealth (Hennessy, 1998) and the 'insurance effect', which depends on the perceived level of risk incurred (Young and Westcott, 2000). Finally, the 'dynamic effects' describe the long-term changes in operators' behaviour. Policies may change the investment and saving decisions of operators in response either to current policy signals or to expected policies (Rude, 2000) and therefore affect production in the long-run.

With accession to the EU, the support provided to farmers in Lithuania is progressively switching from a low level of payments provided on an area basis and that is product specific, to a high area payment decoupled from production decisions. In this context, the (coupled) support received prior to accession can be assumed to have had a direct impact on farmers' decisions covering all the effects described above. In contrast, SAP could be said to be decoupled at the intensive margin, since the removal of the link between support and production choices represents a removal of the policy-created incentives to produce, but still coupled at the extensive margin as the transfers are still conditional on land management and thus create an incentive to extensively use this resource (Piet *et al.*, 2006). Additionally, SAP is likely to affect the farm structure heavily through the effects described as 'effects under uncertainty' and 'dynamic effects', thanks to the comparatively high level of support received.

3. Farm technical efficiency, size and support before EU accession in Lithuania

3.1. Methodology and data

Farm technical efficiency before EU accession in 2004 is analysed here using a sample of individual crop farms in Lithuania. Individual farms prevail in Lithuania. The sample is restricted to farms specialised in crop production for two reasons: i) the expansion of their activities is highly dependent on land; ii) they constitute a rather homogenous group of farms in terms of technology used, of policy change faced, and of indicator of farm size used for analyses. Data for 147 farms in the Lithuanian Farm Accountancy Data Network (FADN) are used. Data on farm input, output and subsidies are used as averages for the years 2001 and 2002, in order to smooth for potential shocks on production. Table 1 presents some descriptive statistics for the sample used. On average, the sample's farms utilised 105 hectares (ha) of land and received 33 euros of net current subsidies per ha during the period 2001-2002.

Table 1: Description of the sample used (2001-2002 averages).

Variable	Mean	Standard deviation
Total agricultural output (euros)	121,951	149,811
Capital (euros)	15,878	15,594
Utilised land (ha)	105	86
Labour (hours)	5,108	4,015
Intermediate consumption (euros)	81,590	81,070
Net current subsidies (euros)	2,890	2,866
Net current subsidies per ha (euros)	33	29

The farms' technical efficiency scores are computed with Data Envelopment Analysis (DEA). Introduced by Charnes *et al.* (1978) following the seminal work of Farrell (1957), DEA is a non-parametric method that uses linear programming to construct the efficient frontier with the best farms of the sample. When an output-oriented model is used, by construction the efficient units (i.e. the units located on the efficient frontier) have a score of one, while any inefficient unit is given a score greater than one. The difference between the output-oriented efficiency score and one represents the proportionate feasible increase in output that could be achieved by a technically efficient unit using the same input level as the inefficient unit. Thus, within the output-oriented framework, the score obtained is greater for more inefficient units. Thus, although it is called an efficiency score, it in fact represents inefficiency levels.

DEA suffers from the shortcoming of not accounting for noise in the calculation of efficiency, contrary to the alternative approach to efficiency measurement based on stochastic frontier analysis. However, by contrast to stochastic frontier, DEA does not rely on distribution and specification assumptions and thus avoids errors. Moreover, it enables scale efficiency to be calculated. To do this, for each farm of the sample a DEA score is first calculated under the constant returns to scale (CRS) assumption, and then a new DEA score is calculated under the variable returns to scale (VRS) assumption. The score under CRS is called the total technical efficiency score, while the score under VRS is called the pure technical efficiency score; the ratio of the former to the latter gives the farm's scale efficiency. Scale efficiency identifies whether the farm operates at an optimal scale, while pure technical efficiency assesses the management practices irrespective of the farm size. Even though the scores relating to total technical efficiency, pure technical efficiency and scale efficiency are described in the results section for a broader picture, the core analyses of the paper will focus on total technical efficiency scores. Indeed, total technical efficiency scores are commonly used as an aggregate measure of efficiency on farms (e.g. Helfand and Levine, 2004; Mathijs and Vranken, 2001; Swinnen and Vranken, 2006) and are viewed as a better benchmark than pure efficiency scores when one wants to compare performances across a large range of farm sizes (Coelli *et al*., 1998; Mathijs and Vranken, 2001). All efficiency scores are computed using the FEAR package developed by Wilson (2008, 2009) within the R-project (R Development Core Team, 2009). The output-orientated DEA model includes one single output (value of total agricultural output) and four inputs (utilised agricultural land in ha, total labour used in hours, value of capital used and value of intermediate consumption, both in euros).

DEA may be criticised for its sensitivity to sampling. This weakness arises from the fact that the frontier is constructed with farms within a specific sample: the sample used for the computation of the DEA scores is indeed unlikely to include all fully efficient units of the population, and thus the scores obtained may not reflect the absolute level of efficiency that could be attained in the population of interest. Correcting for the sampling error, enables this overestimation of the farms' efficiency to be accounted for: farms would then obtain lower levels of efficiency (that is to say higher DEA output-oriented efficiency scores). With the DEA method, bootstrapping is the only way to obtain biases and confidence intervals for the efficiency scores (Simar and Wilson, 2000a). The method followed here is that proposed by Simar and Wilson (1998, 2000b) and used, for example, in agriculture by Brümmer (2000), Latruffe *et al*. (2005) and Balcombe *et al*. (2008). The procedure relies on mimicking the data generating process and repeating the DEA computation a large number of times. In this study, in order to evaluate the DEA scores' accuracy by taking into account the sampling error, biases and confidence intervals are computed for the scores obtained with DEA under both the VRS and CRS assumptions.

In order to describe the relationship among farm support, size and efficiency, the sample's farms are separated into quartiles based on their size in hectares, and efficiency scores and support level are compared across quartiles, in order to assess the relationship among farm size, efficiency and support prior to accession. As pre-accession support was provided to farms on an area basis and the amount received by farms depended on production choices, investigating the efficiency scores and levels of support received across size groups enables the trade-off between being efficient and maximising support prior to accession to be evaluated. Comparisons across groups were firstly performed with standard ANOVA F-tests of equality of means. However, as the validity of ANOVA relies on the homogeneity of variances across groups, which was not always confirmed here (based on Levene's test of equality of variances), the Welch robust test of equality of means is used instead. Non-parametric regressions are also performed to further assess the relationship between farm size and efficiency, and between farm support and efficiency. Finally, an econometric regression is carried out to assess more generally the determinants of the farms' technical efficiency. The explanatory variables included in the regression contain socio-demographic and farm characteristics recognised in the existing literature as determinants of farm efficiency.

3.2. Results

Efficiency scores

Table 2 displays the various efficiency scores, as averages for the sample in the 2001-2002 period, as well as the shares of fully efficient farms in the sample. As explained above, as the DEA model is output-oriented, larger scores indicate lower efficiency (and a score of one indicates a fully efficient farm, i.e. on the frontier).

Table 2: DEA output-oriented efficiency scores: sample's averages and shares of fully efficient farms in the sample in 2001-2002.

	DEA score (mean value)	Share of fully efficient farms (%)
Total technical efficiency	2.97	6
Pure technical efficiency	2.49	16
Scale efficiency	1.29	6

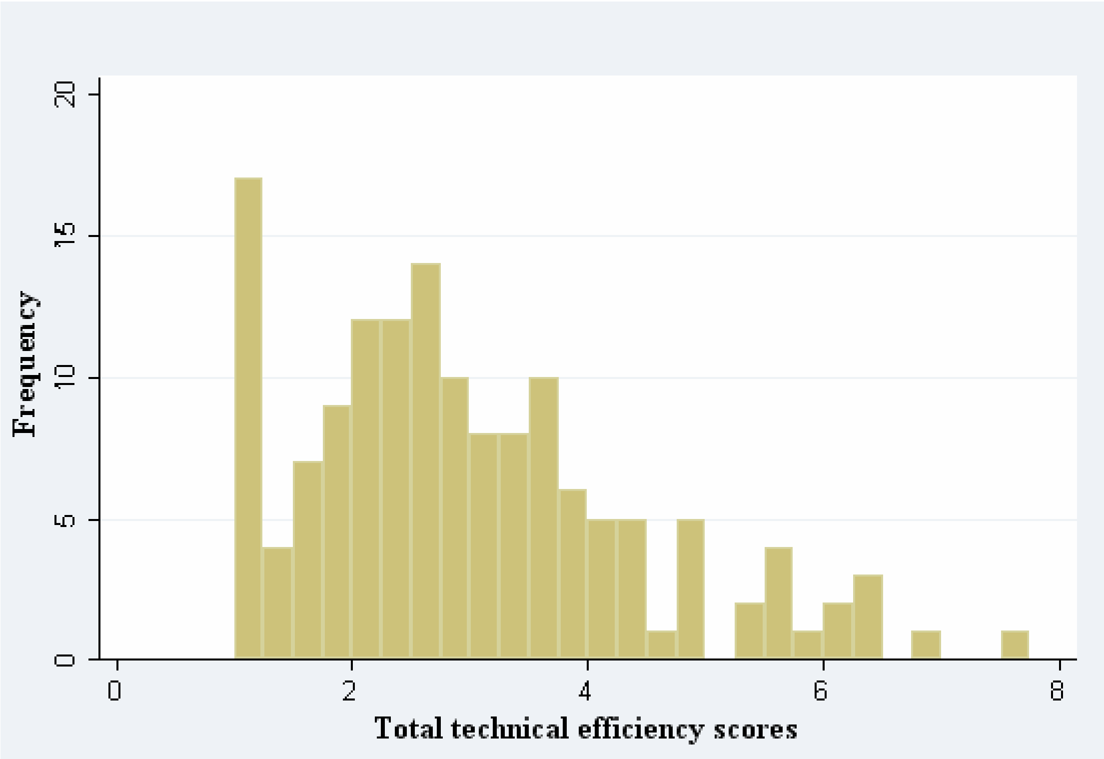
Note: As the DEA model is output-oriented, higher efficiency scores indicate lower efficiency levels.

The average total technical efficiency score of 2.97 indicates that the average farm in the sample would have been able to produce about three times as much output, using the same level of inputs, had it been as efficient as the most efficient farms in the sample. Such a high average score reflects a highly spread distribution of efficiency scores and highlights the extent of substantial efficiency gains that were possible in Lithuania before accession to the EU. The distribution of total efficiency scores, shown in Figure 1, in fact shows a double-peaked distribution with a first peak of fully efficient farms (scores of 1), a second peak aggregating a larger number of farms at higher score levels (around 2.5) and a long tail of inefficient farms. This is fully consistent with the research by Swinnen and Vranken (2006) investigating the technical efficiency of crop farms in a number of transition economies of Eastern Europe[1]. These authors argue that farm inefficiencies in Eastern European countries are likely to be related to the countries' overall progress along the transition path. Indeed, they find that countries more advanced in the process of reforming institutions, not only agricultural ones, show less dispersed efficiency scores distribution. This

[1] Swinnen and Vranken (2006) report average efficiency scores between zero and 100 percent which can be likened to scores between zero and one, with greater scores indicating higher efficiency levels and a score of one for fully efficient farms. Taking the inverse of our output-orientated scores leads to comparable scores with those of Swinnen and Vranken (2006): in this case the measure of total technical efficiency for our sample would then be on average 0.34, a value that compares well with the results presented by Swinnen and Vranken (2006) for Albania (0.25), Bulgaria (0.37), Slovakia (0.41), the Czech Republic (0.43) and Hungary (0.47), where Albania is the only country in their study with family farms only. It must be noted that these comparable low average scores indicate a comparable large spread in the distribution of efficiency scores and the high efficiency gains that are possible in these countries, but say nothing about relative efficiency across countries.

finding is consistent with the idea that an environment more favourable to competition in the up- and down-stream industries can lead to efficiency gains in farming itself.

Figure 1: Distribution of total technical efficiency scores of Lithuanian crop farms.



A paired sample t-test reveals that the efficiency scores obtained under VRS and the ones obtained under CRS are sufficiently different to assume that they come from a different distribution (Kittelsen and Magnussen, 1999). Therefore, it can be concluded that most of the field-cropping farms studied here operate under VRS. The average scale efficiency score is low, indicating high levels of scale efficiency within the sample. This suggests that Lithuanian farmers would have achieved lower efficiency gains by merely improving the scale of their holdings, than they would have done by improving their technical abilities or adopting better farming practices.

Bootstrapped scores are presented in Appendix 1 Table A1. As explained above, DEA overestimates efficiency: bias-corrected efficiency scores are higher (thus indicating lower efficiency levels) than DEA scores. Also, DEA efficiency scores are not included in the confidence intervals, since the scores are downward biased due to sample bias. The confidence intervals' widths are reasonable compared to similar studies (Brümmer, 2001; Latruffe *et al*., 2005; Balcombe *et al*., 2008). The relatively narrow confidence intervals mean that we can have confidence in the quality of the uncorrected scores. The corrected scores do confirm a large heterogeneity among farms in the sample in terms of efficiency, and reinforce the finding that there was substantial scope for adjustment towards higher efficiency pre-accession.

Support and efficiency by farm size

Statistics by size quartiles are shown in Table 3. The land area averages for all quartiles confirm the above-mentioned continuum of farm sizes and the absence of very large-scale units. Table 3 reveals that, in Lithuania prior to accession, large farms tended to be more efficient (with lower average scores), whatever the measure of efficiency considered (total, pure or scale). Smaller farms were clearly less efficient (with higher average scores). The distribution of efficiency scores by farm size can be further investigated using non-parametric regressions. Simple Lowess smoothing regressions, presented in Appendix 2, show a negative relationship between farm size and total technical output-orientated efficiency scores, that is to say a positive relationship between farm size and levels of total technical efficiency. A similar relationship is shown for pure technical efficiency. By contrast, smaller and larger farms are less scale efficient than medium-sized farms.

In addition, a negative link between policy support and farm technical efficiency levels before accession is suggested by the results in Table 3, and confirmed with the use of bias-corrected efficiency scores shown in Table A2 in Appendix 1. Such a negative relationship is a widespread finding in the existing literature on Western countries and on Eastern European countries (see, for example, a review in Latruffe, 2009). It is commonly explained by the reduced effort of farm operators receiving certain financial support, resulting in an increase in input waste or in the choice of inefficient input or output combinations. A non-parametric regression of total technical efficiency scores on the support received by farms per ha (whose results are not reported here) confirms this negative relationship although the link is weak.

Table 3: Distribution of support and efficiency scores across size quartiles.

	Mean for size Quartile 1	Mean for size Quartile 2	Mean for size Quartile 3	Mean for size Quartile 4	Test of equality of means
Size (utilised land in ha)	27.7	59.1	106.4	230.5	
Net current subsidies per ha (euros)	41.4	29.5	34.31	27.1	***
Total technical efficiency	3.66	3.47	2.84	1.90	***
Pure technical efficiency	2.62	3.03	2.64	1.65	***
Scale efficiency	1.68	1.21	1.08	1.16	***

Note: *** denotes a significant difference at the 1 percent level. Quartile 1 includes the smallest farms, while Quartile 4 includes the largest farms. As the DEA model is output-oriented, higher efficiency scores indicate lower efficiency levels.

Since small farms show lower levels of efficiency before EU accession, farm restructuring could give rise to efficiency gains, as small inefficient farms would either exit the farming sector and free up land, or remain in the sector and grow, allowing them to overcome some of the difficulties associated with smaller structure, such as more difficult access to factor and output markets. Table 4 reports the estimated determinants of total technical efficiency. It should be noted that the dependent variable is the output-oriented efficiency scores, which are higher for lower efficiency levels: hence, a negative regression coefficient indicates a determinant increasing efficiency levels, while a positive one indicates a determinant decreasing efficiency levels. Results show that being larger and more specialised in cereals significantly decreases the output-oriented efficiency scores and therefore increases efficiency levels, while farms where a larger share of production is self-consumed rather than sold tend to be less efficient. Larger farms with higher specialisation and greater market orientation tend therefore to be managed in a more efficient manner.

Table 4: Determinants of total technical efficiency scores prior to accession.

	Coefficient and significance
Farm size in ha	-0.005 ***
Specialisation in cereals (dummy)	-0.444 **
Farmer's age	-0.003
Share of production used for self-consumption	0.044 **
Organic farming (dummy)	0.319
Share of land rented in	0.231
Share of hired labour	0.034
R-squared	0.18

Note: *, **, *** indicate significance at the 10, 5, 1 percent level. As the DEA model is output-oriented, higher efficiency scores indicate lower efficiency levels. Results for location dummies are not reported.

4. The potential effect of SAP implementation on farm technical efficiency

4.1. Methodology and data

Investigating the role of SAP implementation on the persistence of inefficient small farms in Lithuania could be based on annual data of farm exits from the farming sector. However, such data rarely exist. The commonly used FADN database cannot provide information on farm exits from the farming sector, as the absence of a farm in the FADN sample may simply indicate that it was not surveyed that specific year. For this reason, we investigate the potential effect of SAP implementation with the help of farmers' intentions.

The reliance on intentions or stated preferences data is becoming more common when studying farmers' future decisions and adjustment to potential changes. Such data have proved useful and reliable in a large array of situations, as they reveal, if not the likely future actions of decision-makers directly, the respondents' frame of mind which is very likely to shape actions in the short-run (Harvey, 2000). For examples of studies making use of intention surveys in the context of decoupling of agricultural policies, see Tranter *et al.* (2004) or Breen *et al.* (2005).

The intentions used here are those of the farmers operating the 147 individual farms of the FADN sample described in the previous section. Their intentions were collected through face-to-face interviews between February and April 2005. Farmers were asked to indicate how they were planning the evolution of their farm within the five years following the interview, under two different policy scenarios: a hypothetical scenario of the pre-accession policy continuing after accession to the EU (Scenario 1) and a realistic scenario of CAP implementation including SAP and national top-ups (Scenario 2). Specifically, farmers were asked to indicate whether or not they were planning to stay in farming in the next five years, and if so, whether they would expand their farmed area.

Farmers' intentions between both scenarios are compared, and statistical tests across the size quartiles are applied, as in Table 3. Additionally, the determinants of the intentions to remain in farming and expand the farm size are investigated through a two-step Heckman model, ran successively under both scenarios. It is standard in studies focusing on survival and growth to apply a Heckman model (Heckman, 1979), where a Probit model on the decision to exit is estimated in a first stage, followed by a second-stage Ordinary Least Squares (OLS) regression on farm growth for the farms remaining in farming during the period considered. In order to account for selection, the inverse Mill's ratio extracted from the first stage is added in the second stage, its significance indicating that both decisions are linked. In our case, a Probit model is also used in the second stage instead of OLS, as our survey results do not include a continuous measure for farm growth intentions, but only the intention to grow or not. In this context, the selection is captured through the parameter rho, its significance indicating that both decisions are linked. Comparing the determinants of intentions to remain and to grow across both scenarios can give deeper insights into the effect of SAP introduction. The specification of explanatory variables in both models includes socio-demographic and farm variables likely to impact on farmers' decisions (namely farmer's age and farm capital), the total technical efficiency score, and farm size as land area.

4.2. Results

Table 5 presents the number of farmers intending to stay or exit the farming sector, and intending to grow or not among the 147 fieldcrop farmers interviewed. The number of farmers willing to stay and the number willing to exit are similar under both scenarios (106 to stay and 29 to exit), as a very limited number of respondents changed their intentions between scenarios, and these changes occurred both ways in equal numbers. Among the 106 farmers planning to remain in farming, 23 intended to expand their farm size under the hypothetical scenario of continuing pre-accession policy (Scenario 1), and 75 intended to decrease or keep the same farm area. Under the realistic SAP and top-ups scenario (Scenario 2), though, the respective figures were 50 and 40. This reveals that, although the change in policy does not affect the number of farmers planning to exit the farming sector in Lithuania, the number of farmers willing to grow under SAP more than doubles compared to continuing pre-accession policy (23 *vs*. 50 farmers).

Table 5: Intended behaviour of the sample's farmers in the next five years.

	Scenario 1 (continuation of pre-accession policy)	Scenario 2 (implementation of SAP and top-ups)
Total number of surveyed farmers	147	147
Intentions regarding the stay or exit from the farming sector		
- Number of farmers intending to stay	106	106
- Number of farmers intending to exit	29	29
Among those intending to stay, intentions regarding the farm size		
- Number of farmers intending to grow	23	50
- Number of farmers not intending to grow	75	40

Note: Figures do not add to the total number of respondents, due to missing answers.

The description of the size quartiles in the previous section revealed that farmers with larger farms were more efficient but received less support pre-accession. As seen in Table 6, in a situation where pre-accession policy would have been continued (Scenario 1), the intentions of the farmers interviewed reveal that larger farms were more likely to remain in the farming sector (91 percent of Quartile 4 intend to remain) and that medium-sized farms were more likely to grow (33 percent of Quartile 2 and 30 percent of Quartile 3 intend to grow, *vs*. 19 percent of Quartile 1 and 11 percent of Quartile 4). This is consistent with the existence of a well-functioning land market where the most efficient farms (large and medium-size farms) appear to survive and thrive. This could, thus, support existing reviews of the land market functioning in Lithuania: for example, Latruffe and Le Mouël (2006) present figures indicating that in 2001-2002 more land was transferred in the market in Lithuania than in other NMS and EU-15 countries (2 percent of Lithuania's utilised area *vs*. less than 1 percent in the other EU-25 countries studied). A dynamic market in Lithuania could thus allow land to be transferred from small inefficient farms to more efficient medium-size farms, even in the presence of potentially distorting policy support.

Table 6: Comparison of farmers' intentions across size quartiles.

	In size Quartile 1	In size Quartile 2	In size Quartile 3	In size Quartile 4	Test of equality of means
Scenario 1: Continuation of pre-accession policy					
Share of respondents intending to stay in the farming sector (%)	53	82	83	91	***
Share of respondents intending to expand their farm size (%)	19	33	30	11	Ns
Scenario 2: Implementation of SAP and top-ups					
Share of respondents intending to stay in the farming sector (%)	57	79	81	94	***
Share of respondents intending to expand their farm size (%)	43	64	48	61	Ns

Note: *** denotes a significant difference at the 1 percent level. 'ns' means not significant. No significance is revealed when the four quartiles are compared together, but there is a significant difference between two sets of quartiles. Quartile 1 includes the smallest farms, while Quartile 4 includes the largest farms.

The picture under the SAP implementation is, however, different (Scenario 2 in Table 6). Despite the mostly unchanged intentions regarding the decision to stay in or exit from the sector (under Scenario 2, a number of farms comparable to Scenario 1 intend to exit and the largest farms are also more likely to remain in the farming sector), farmers across all quartiles are more likely to want to expand their area under the new policy of Scenario 2. Moreover, the increase in the number of farmers willing to grow, between Scenario 2 and Scenario 1, is higher for the quartile including the largest farms (61 *vs*. 11 farmers). Thus, the effect of the change in policy between pre- and post-accession periods, implying an increase in support, is more important for larger, more efficient, farms.

Tables 7 and 8 present further insights into the effect of SAP introduction with the results of the two two-stage Heckman models on the determinants of farmers' intentions to remain in the sector and to grow (Table 7), and the overall marginal effects (Table 8). The models reported in Table 7 are significant, and under both scenarios the parameter rho (representing the link between the first and second stages) is insignificant, showing that the selection process (i.e. the intention to remain in farming) does not impact on the intention to expand the farm size (second stage). The intention to stay in farming under the continuation of pre-accession policy (Scenario 1) appears to be explained by the age of the farmer and the total technical efficiency of the farm. The relationship between the farmer's age and the propensity to remain active is straightforwardly negative, as expected. The relationship between efficiency and the decision to remain in farming has, however, a more complex shape, as shown by the positive sign of the output-oriented efficiency score and the negative sign of its squared value: farms with lower efficiency levels (i.e. those with a higher efficiency score) are more likely to remain in the sector, but the effect slows down for very low efficiency levels. Considering the decision to expand farm size, again a negative link is observed with age, while efficiency and expansion are also related through a quadratic relationship: the negative sign of the output-oriented efficiency score and the positive sign of its squared value indicate that farms that are less efficient (i.e. with a higher efficiency score) are less likely to expand their area, an effect that is reduced over the efficiency distribution.

The overall relationship between efficiency and growth, controlling for selection through survival, is captured through the overall marginal effects reported in Table 8. Results confirm that, under a hypothetical scenario of continuing pre-accession policy, farmers managing units with lower efficiency levels are less likely to plan on expanding. By contrast, under the realistic scenario of implementation of SAP and national top-ups (Scenario 2), both growth and exit are driven by farmer's age, similarly to the findings under Scenario 1. However, under Scenario 2, larger farms are more likely to remain in the sector (positive and significant coefficient for the farm area in the first stage), and no significant relationship between growth and efficiency is identified.

The determinants of intentions identified under the scenario of continuing pre-accession policy (Scenario 1) highlight the fact that competition over land under this policy scenario was mainly between the most and least efficient units, a pattern which is unlikely to lead to rapid efficiency gains in the sector. However, with the introduction of SAP, decisions do not appear to be related to efficiency in any way. The only barrier to planned survival or growth appears to be the age of the farmer, and it appears that the promise of larger payments as implemented under SAP does prevent some farms from exiting the sector.

Therefore, it may seem unlikely that the implementation of SAP will lead to a more efficient farming sector in Lithuania, as plans to survive and expand appear unrelated to efficiency. Least efficient farms intend to remain in the sector. However, farmers' intentions do reveal an increased competition over land (all farms want to grow), which could be the catalyst towards longer-term efficiency gains, especially as the least efficient farms in the sample do not appear to be more willing to grow than medium efficient farms under SAP, which was the case under pre-accession policy.

Table 7: Determinants of farmers' intentions.

Heckman stages		Scenario 1 (continuation of pre-accession policy)	Scenario 2 (implementation of SAP and top-ups)
First stage (selection): Intend to remain in farming (dummy = 1 if yes, = 0 if no)	Farm area (size)	0.002	0.005*
	Efficiency score	0.976***	-0.056
	Efficiency score squared	-0.137***	
	Farmer's age	-0.065***	-0.077***
	Farm capital	-0.001	-0.001
	Constant	2.607***	4.747***
Second stage: Intend to expand farm (dummy = 1 if yes, = 0 if no)	Farm area (size)	-0.002	0.001
	Efficiency score	-0.907**	0.026
	Efficiency score squared	0.138**	
	Farmer's age	-0.032**	-0.047***
	Constant	2.036**	1.869***
	Rho	0.999	0.999
Model significance		Wald-chi2=9.86, P=0.04	Wald-chi2=19.8, P=0.001
LR test of independent equations		Chi2=0.45, P=0.50	Chi2=1.74, P=0.18

Note: *, **, *** indicate significance at the 10, 5, 1 percent level. As the DEA model is output-oriented, higher efficiency scores indicate lower efficiency levels.

Table 8: Intentions to expand the farm area – marginal effects controlling for selection.

Marginal effects	Scenario 1 (continuation of pre-accession policy)	Scenario 2 (implementation of SAP and top-ups)
Farm area (size)	-0.001	-0.001
Efficiency score	-0.225**	0.009
Efficiency score squared	0.034**	
Farmer's age	-0.008**	-0.018***
Farm capital	0.000	0.000

Note: *, **, *** indicate significance at the 10, 5, 1 percent level. As the DEA model is output-oriented, higher efficiency scores indicate lower efficiency levels.

5. Conclusions

This paper has investigated the likely impact of post EU-accession public support in Lithuania on its farming sector's restructuring and future efficiency. There were fears that the introduction of high-level EU support (via the SAP) in the NMS might not give the right incentives to farmers and prevent restructuring and consequently efficiency growth. However, such an effect is not straightforward, since post-accession support is not only different from pre-accession national support in terms of level, it also differs in terms of type, with SAP being much more decoupled. Thus, with the SAP, differences in the level of support per ha across farms fade away, as support becomes independent of production choices, and therefore the subsidies per ha received by farms equalise across farm size classes. Our analyses were based on efficiency calculations with 2001-2002 FADN data for fieldcrop farms, and on the same sample's farmers' intentions to remain in the sector and to expand their area post EU-accession under two scenarios: a hypothetical scenario of continuing pre-accession national (coupled) policies (Scenario 1), and a realistic scenario of fully decoupled SAP introduction with coupled national top-ups (Scenario 2).

Our analyses point to two main findings: (i) a clear change in plans between pre-accession policy and SAP, and (ii) a possible increase in the competition for land in Lithuania. (i) A negative link was identified between farm efficiency and subsidies in pre-EU accession Lithuania, as well as a greater likelihood for inefficient farmers to remain in the sector. This might reveal that, before accession to the EU, the smallest inefficient farms remained in the sector thanks to the policy support (the small size group received the highest support on average), taking their input and output decisions not in a way that maximises efficiency. (ii) More farmers plan on trying to expand their farmed land after accession, and even though this trend is uncorrelated to efficiency levels, the least efficient farms do not appear to have stronger incentives than the other groups (the opposite to the pre-accession situation) and the increased competition could trigger an accelerated restructuring of the sector.

Thus, the SAP introduction could potentially give the right incentives to Lithuanian farmers for a quicker restructuring and an increase in farm efficiency, compared to a situation where no EU support would have been provided and small inefficient farms would have persisted and may have prevented changes in the farming sector. However, despite a relatively well-functioning land market in Lithuania which could allow land to be transferred between farms, farm enlargement may be impeded by the lack of available agricultural land since more farmers want to grow than want to exit the sector. This could prevent farmers from attaining an efficient farm size. Restructuring and efficiency increase in the farming sector will therefore depend on the availability of State land, and possibly on policy measures aiming at encouraging the exit of farmers out of the sector. Moreover, for benefits in efficiency increase to be sustained within the farming sector in Lithuania, large farms should not expand beyond an optimal farm size, or their efficiency could be reduced due to scale diseconomies or supervision difficulties. Further research could thus investigate farm efficiency using FADN data for post-accession years, in order to shed light on the relationship between efficiency and size under the SAP situation.

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Appendix 1: Bootstrapping results

Table A1: DEA and bootstrapping results: means for the sample in 2001-2002.

	DEA score	Bias corrected score	Bias	Confidence interval's lower bound	Confidence interval's upper bound
Total technical efficiency	2.97	3.45	-0.47	3.06	3.88
Pure technical efficiency	2.49	2.99	-0.49	2.58	3.35

Note: As the DEA model is output-oriented, higher efficiency scores indicate lower efficiency levels.

Table A2: Distribution of bias corrected efficiency scores across size quartiles.

	Mean for size Quartile 1	Mean for size Quartile 2	Mean for size Quartile 3	Mean for size Quartile 4	Test of equality of means
Total technical efficiency corrected	4.25	4.07	3.24	2.20	***
Pure technical efficiency corrected	3.26	3.63	3.07	1.98	***

Note: *** denotes a significant difference at the 1 percent level. Quartile 1 includes the smallest farms, while Quartile 4 includes the largest farms. As the DEA model is output-oriented, higher efficiency scores indicate lower efficiency levels.

Appendix 2: Non-parametric regressions of efficiency scores and farm size

Figure A1: Total technical efficiency score (under CRS) by farm size (land area in ha).

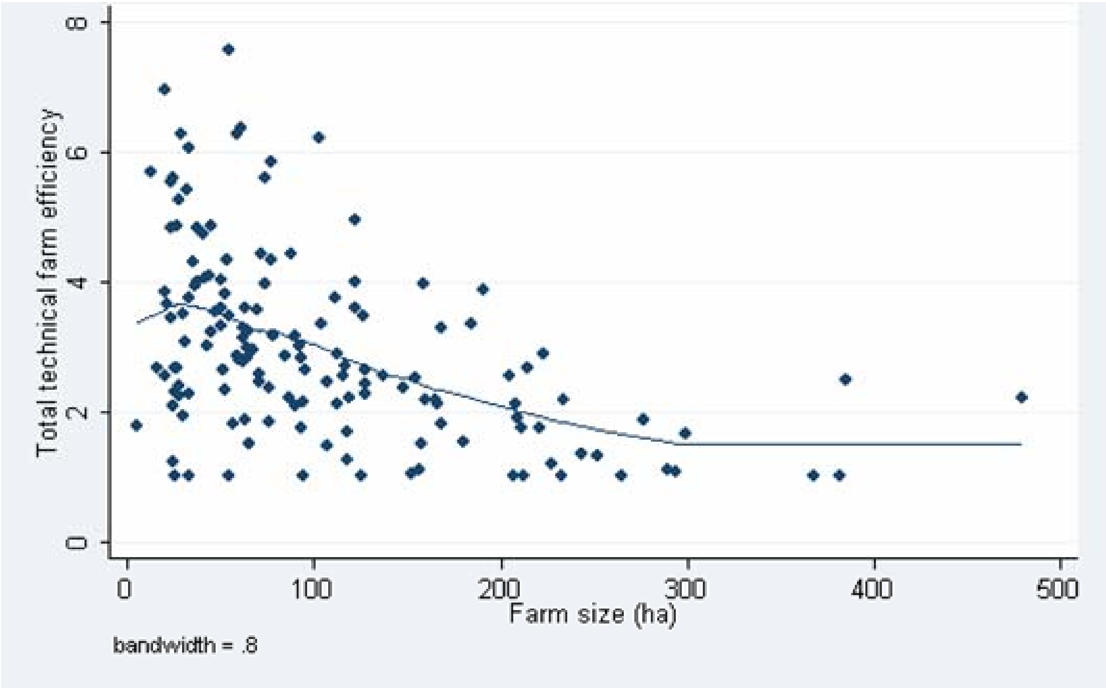


Figure A2:. Pure technical efficiency score (under VRS) by farm size (land area in ha).

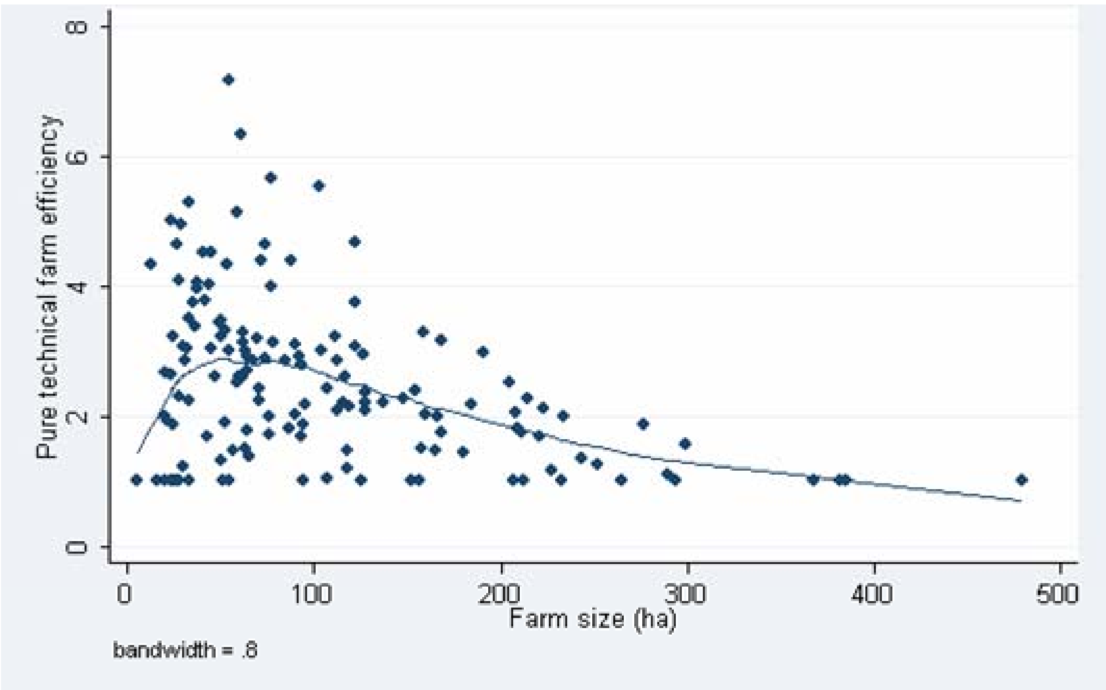
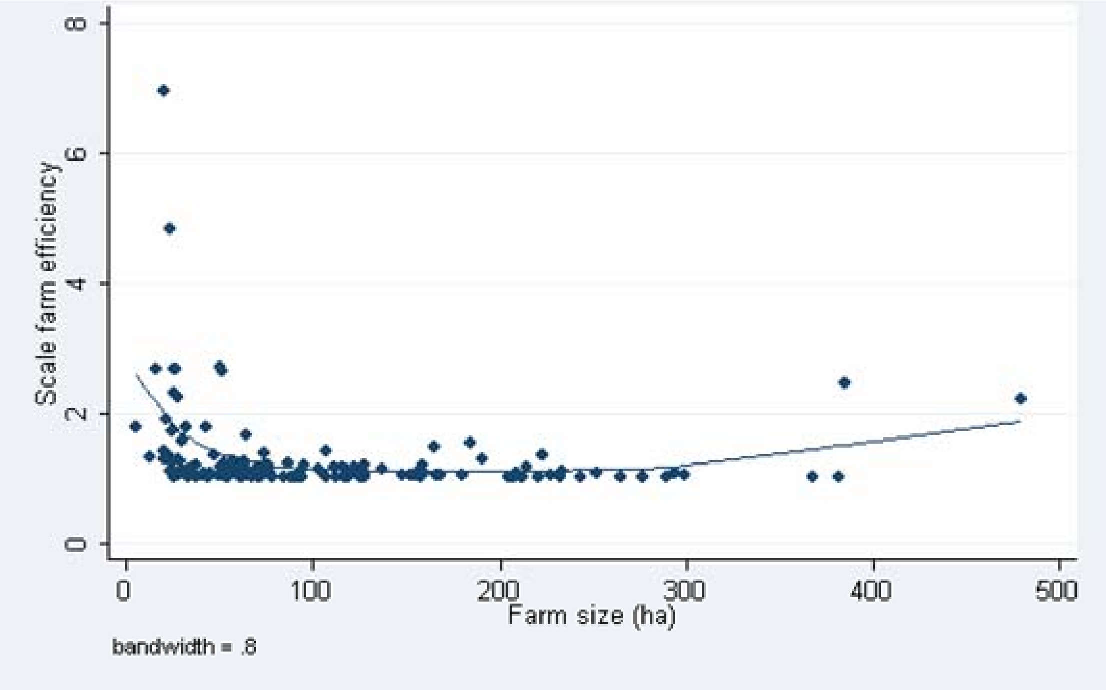


Figure A3: Scale efficiency score by farm size (land area in ha).



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