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EFFECTS OF AGRICULTURAL SUBSIDIES ON INCOME RISK IN LITHUANIAN DAIRY FARMS

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The aim of the paper is to investigate the effects of agricultural subsidies on income variability of Lithuanian dairy farms. In addition, the observed heterogeneity in income risks across farms and time is explained in terms of farm characteristics. It was employed balanced farm-level panel data of the Lithuanian farm accountancy network (FADN) was used to construct coefficients of variation of five-year gross farm revenues over the period 2010 to 2014. Various econometric models are applied to measure the effect of off-farm income, total subsidies, farm size, and financial immobility on the variability of gross farm incomes. Estimations suggest that agricultural subsidies, liquidity have positive impact on income risk. The age of farmers negatively influences the income risk. There is non-linear relationship between farm size and income risk.

Keywords: income risk, governmental support, dairy farms, robust regression, Lithuania.
JEL Codes: Q12, Q14.

1. Introduction

Risk plays traditionally considerable role in agricultural production because natural forces are beyond to control of farmers (Barry, 2001; Girdžiūtė, 2012a; 2013; Just, 2003). Besides its relevance at the farm level, income risks are also of high policy relevance (El Benni, 2012). The existence of risk is also important argument to justify several governmental interventions in agriculture. It is crucial for policy design to take the correct expected risk behaviour into account and to uncover unexpected behavioural responses (de Mey, 2016). Last decades there is a wealth of literature on the impacts of agricultural policy on farm income risks (de Mey, 2014; 2016; Severini, 2016; Uzea, 2014). Previous research findings suggest that the agricultural policy measures may affects farmers' income risks via diverse pathways.

Although the potential directions of various individual effects of agricultural policy tools on farmers' income risks are well known, it is difficult to predict an unambiguous assessment of the impacts on income variability with a solid theoretical background. While there is extensive research on farmers' risk managing strategy on Western European countries, the knowledge on Central and Eastern European producers' behaviour is still limited. Few researches could be mentioned. L. Girdžiūtė (2012b) analyzed possible farm decision options by using scenario analysis method; A. Kozlovskaja (2013) estimated influence of price volatility on farm income risk; E. Majewski, W. Guba and A. Was (2007) dealt with the assessment of farm income risk for perspective considering different EU farm policy scenarios; A. Kozlovskaja (2014) evaluated the importance of the risk factors for farmers.

The paper also tries to fill this gap. More specifically, the aim of the paper is to analyse the impacts of agricultural subsidies on farmers' income risk in Lithuanian dairy sector.

Dairy has been one of the most important and competitive sector of agriculture and food industry in Lithuania (Ozolins, 2012; Viira, 2015). Milk production accounted for 16.2–22.1% of the total agricultural output during the period 2010–2014. The drop to 16.2% in 2012 was driven by changes in input and output prices. Since the accession to the European Union (EU) in 2004, changes in the dairy took place at the level of producers and processing industry. Both segments had to apply EU quality requirements, Common Agricultural Policy (CAP) including direct payments, milk quotas, export subsidies, EU import licences and tariffs, intervention stores, private storage aid, investment subsidies and other measures (Skarzynska, 2013; Viira, 2015). Restructuring process in dairy sector shared a number of common characteristics for transition countries (Bakucs, 2012). From the aspect of milk farm structure, the pace of concentration, indicated as the share of large scale farms, increased (Jansik, 2014). According to the agricultural Census data, farms with more than 50 dairy cows had a share of 0.1% in 2003, in 2010 – 0.8%, and in 2013 this share increased to 1.1%. One of the major problems of the dairy sectors is the dispersion of milk production (Skarzynska, 2013). Dairy farms with less than 20 units had the biggest share in Lithuania in 2010 – 97%. The number of farms with one or two dairy cows decreased in 29% in 2013 compare to 2010. During the period of 2010–2014, number of dairy cows also decreased by 16% to 315.7 thous. Despite a decrease in dairy cows during the mentioned period, production level increased by more than 3%. It could be explained with the milk yield increase per cow. In 2014 average of the country was 16% larger than in 2010, and reached 5636 kg per cow. The changes in dairy farm structure continue rapidly. According to A. Stalgiene and A. Kuipers (2014), dairy farmers chose to further specialization in dairy as a main farming strategy. Such process is beneficial for dairy sector.

The remainder of this paper is structured as follows. The data and methods used are described in Section 2 and the results are presented and discussed in Section 3. Finally, summary and concluding remarks are presented in Section 4.

2. Data and methods

It was analysed the effect of agricultural subsidies on the income risk of Lithuanian dairy farmers using farm level data from the Lithuanian farm accountancy data network (FADN) farming type 45 collected from 2010 to 2014. The farm accountancy data are an unbalanced panel dataset. Over the time period from 2010 to 2014, a total of 648 dairy farm operations were surveyed, but only 74 (11.4 percent) farms have entries for all 5 years. The sample includes around 330 dairy farms per year. Because high rate of attrition of FADN data, it was decided to use a balanced panel dataset covering 340 observations over the analysed period.

Analysis focuses on the gross farm income. It was measured farmers' income risk by the coefficient of variation at the farm level in order to enable a comparison of income risks across farms and over time. Based on the previous research (El Benni, 2012) it was set the following hypotheses.

- H1: The share of subsidies in gross farm income is negatively related to farm income risk.

It was assumed, that high share of total subsidies in gross farm income may reduce farmers income risk as risk-free income source. It was applied the share of total agricultural subsidy in gross farm income as proxy for subsidy.

- H2: The increase in financial immobility is negatively correlated with income risk.

Liquidity refers to the farm's capability to generate sufficient cash to manage financial commitments when they occur. Thus, sudden income drops due to changing economic environment can be easier managed if the liquidity of the farm operation is high. Assuming liquidity to be an exogenous factor that determines the level of income risk, higher liquidity may allow a farmer to deal with more risks and should therefore be positively correlated with income risk. It was employed the share of fixed to total assets as a proxy for liquidity and referring this as financial immobility.

- H3: Off farm income reduces farm income risk.

Off-farm income can be a tool for farmers to overcome farm income losses or to hedge against the variability in farm income. It was used the share of off-farm in gross farm income as a proxy for farmers' dependence on farm income.

- H4: The age of farmers is negatively correlated with income risk.

It was assumed, that older farmers are more risk averse than young farmers, thus older producer follow more conservative technology yielding less income risk.

- H5: There is non-linear relationship between farm size and income risk.

Farm size is usually considered to explain the level of farm income risk (Barry, 2001). A standard assumption is that growing farm size is associated with economies of scale and improves production efficiencies. Furthermore, larger farms may able to manage more efficiently extreme events. Thus, standard hypothesis is that farm size is negatively associated to income risk. However, too large farms sometimes may face with extra income risk due to suddenly changing business environment. Thus farms after some size can be more vulnerable to income risk especially for specialized farms (Bachev, 2008). It was measured farm size in European Size Unit (ESU).

To consider the non-linear relationship between farm size and income risk, it was added a squared terms of size to our empirical model.

Empirical model is as following:

$$lnRisk_i = \alpha_0 + \alpha_1 lnsubsidy_i + \alpha_2 lnliquidity_i + \alpha_3 lnoffincome_i + \alpha_4 lnage_i + \alpha_5 lnsize^2{}_i + \varepsilon_i 1)$$

Where Risk is income risk for each farms *i* measured by coefficient of variation of gross farm income for five period (2010–2014). All other variables are expressed as five year average of them. Due to relatively small sample size (74) the estimations can be subject to the effects of outliers. Thus, beyond to standard OLS model it was considered the following alternative estimators. First, it was applied median quantile regression. Second, it was estimated various robust regression techniques employing M-, MM- and S-estimators (Bachev, 2008; Verardi, 2009).

3. Results

Figure 1 shows that gross farm income exhibits an increasing drop with a small drop in 2014. Within the gross farm income the market income play dominant role following by total subsidies. It was also found by Augustynska-Grzymek (2015), that the relation of subsidies to income from the farm in Lithuania was relatively small. The share of off farm income in gross farm income is negligible in Lithuanian dairy farms during analysed period.

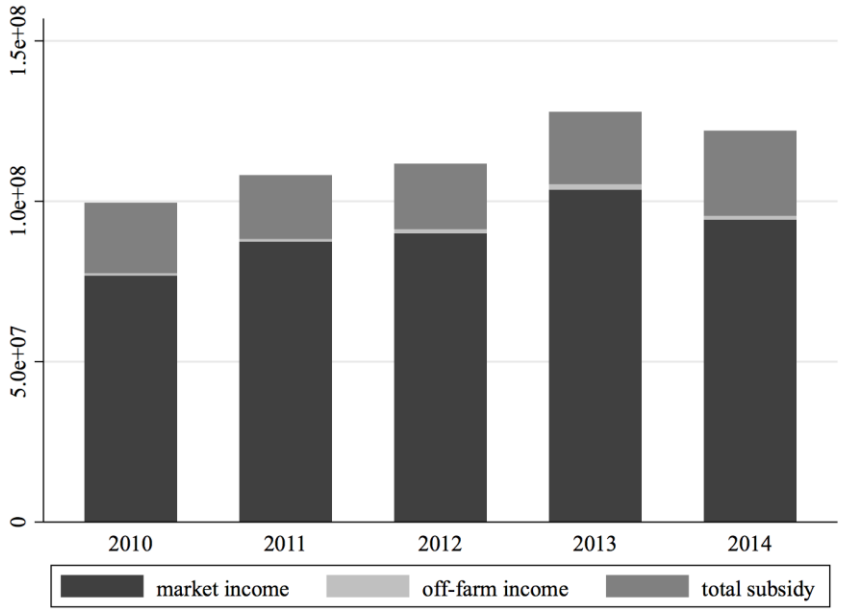

Fig. 1. Gross farm income and its components in Lithuanian dairy farms, 2010–2014

Table 1 shows yearly descriptive statistics of gross farm income. The average gross income continuously increases except last year. The maximum value of gross income also grows permanently, whilst the minimum value of income presents rather

declining trend. As a consequence of it, the standard deviation of gross income also increases. The main interest is the income risk in terms of coefficient of variations also exhibits an upward trend.

Table 1. Descriptive statistics of gross farm income, 2010–2014

Year	Obs	Mean	Std. Dev.	Coeff. of variation	Minimum	Maximum
2010	74	475961	558394	1.17	23671	2808882
2011	74	538213	609575	1.13	20575	3253807
2012	74	575965	693447	1.20	21176	4105188
2013	74	687881	905832	1.32	23927	5580649
2014	74	685664	897296	1.31	15930	5746045

Figure 2 presents boxplots for explanatory variables period in question. The median of farm size is rather stable, but with increasing number of large farms. In Figure 1, the share of off-fam income plays very minor role in gross farm income, just few farms are observable with higher 20 per cent share.

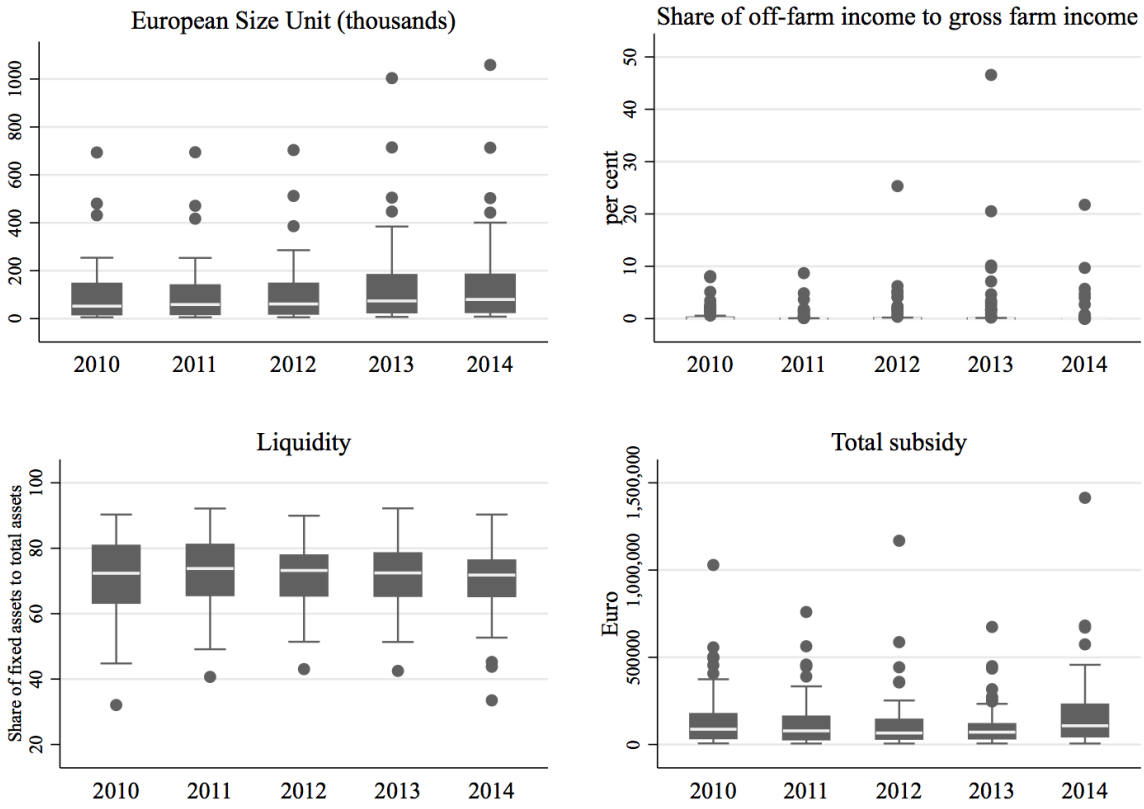

Fig. 2. Explanatory variables of farm characteristics on income risk, 2010–2014

The median value of ratio of fixed to total assets is around 70 per cent which is a lower comparing to Swiss agriculture (80 per cent) what El Benni (2012) find. The median value of total subsidy is rather stable with some high outliers. This also imply some inequality in total subsidy among farmers. Small number of farms receive relatively large fraction of total subsidies which is well-known from literature on the CAP (Severini, 2015)

Table 2. Effects of farm structure on farm income risk

	OLS	q50	M estimator	MM estimator	S estimator
lnsubsidy	0.220	0.044	0.162	0.163	0.220**
lnliquidity	1.106*	1.129*	1.305**	2.242***	2.697***
lnoffincome	0.010	0.020	0.008	–0.023**	–0.020**
lnage	–0.604*	–0.870**	–0.713**	–0.661**	–0.649***
lnsize	–2.587**	–3.046**	–2.749**	–5.972***	–5.723***
lnsize2	0.117**	0.136**	0.123**	0.265***	0.253***
constant	9.299	13.585*	10.054	23.939***	20.478***
N	74	74	74	74	74
R^2	0.157	0.116[a]			

Note: ***,**,* denote significance at 1%, 5% and 10% level, [a] Pseudo R^2

Table 2 shows the results of the five separate cross-sectional models, which explain the instability of gross farm income (i.e. the coefficient of variation) by different farm characteristics. The total subsidy has not significant impacts on gross income risk, except S estimators, where the sign of coefficient is positive. This implies that subsidies increase the gross income risk for Lithuanian dairy farmers. Contrary to expectations financial immobility positively influences farm income risk in all specifications, the size of coefficients are higher for robust estimators especially in the case of MM- and S-regression. Interestingly, financial mobility has not significant impacts in Swiss agriculture (El Benni, 2012). Off-farm incomes reduce the income risk confirming the third hypotheses (MM- and S-regressions). The negative and significant coefficients of age variable in all models suggest those older farmers are less risk lovers than younger ones. These findings are in line with the fourth hypothesis. In line with standard hypothesis, farm size in ESU has a negative effect on gross farm income instability (El Benni, 2012). However, as it was hypothesized this relationship can be non-linear. The coefficients of squared terms of size variable are positively significant implying that too large farms are becoming more risky. In general, the results are rather robust for financial immobility, age of farmers and farm size variables. However, the estimations also highlight the problem of outliers as various robust estimators confirm.

4. Conclusions

1. The paper examined the impacts of agricultural subsidies and farm characteristics on gross farm income risk in Lithuanian dairy sector between 2010 and 2014 using FADN data and found a slightly increasing trend in gross farm income volatility during the analysed period. The gross farm income is dominated by market income and partly agricultural supports, whilst the role of off-farm income is very limited.

2. The estimations imply that agricultural subsidies (S estimator is 0.220), liquidity (MM estimator is 2.242) positively influence income risk. The age of farmers has negative effects on the income risk (in all models). There is non-linear relationship between farm size and income risk.

3. Research had several limitations. First, due to high rate of attrition in the FADN data allows us to examine the research problem only for a restrictive sample. Thus the results should be interpreted only with care. Second, it was presented evidence that outliers in a small sample may cause serious issues, highlighting the importance of various robust regression techniques.

References

Augustynska-Grzymek, I., Czulowska, M., Skarzynska, A., Zekalo, M., Stalgiene, A. (2015). The view of dairy sector and the economic situation of milk producers in Poland and in Lithuania after accession to the EU // In *Challenges of Europe: International Conference Proceedings*. P. 307–323.

Bachev, H., Nanseki, T. (2008). Risk Governance in Bulgarian Dairy Farming // In *Proceedings 12th Congress of the European Association of Agricultural Economists "People, Food and Environments-Global Trends and European Strategies".* P: 1–9.

Bakucs, Z., Fałkowski, J., Fertő, I. (2012). Price transmission in the milk sectors of Poland and Hungary // *Post-communist economies*. Vol. 24. No. 3: 419–432. – https://doi.org/10.1080/14631377.2012.705474.

Barry, P. J., Escalante, C. L., Bard, S. K. (2001). Economic risk and the structural characteristics of farm businesses // *Agricultural Finance Review*. Vol. 61. No. 1: 74–86. – https://doi.org/10.1108/00214760180001117.

de Mey, Y., Van Winsen, F., Wauters, E., Vancauteren, M., Lauwers, L., Van Passel, S. (2014). Farm-level evidence on risk balancing behavior in the EU-15 // *Agricultural Finance Review*. Vol. 74. No. 1: 17–37. – https://doi.org/10.1108/AFR-11-2012-0066.

de Mey, Y., Wauters, E., Schmid, D., Lips, M., Vancauteren, M., Van Passel, S. (2016). Farm household risk balancing: empirical evidence from Switzerland // *European Review of Agricultural Economics*. Vol. 43. No. 4: 637–662. – https://doi.org/10.1093/erae/jbv030.

El Benni, N., Finger, R. (2013). Gross revenue risk in Swiss dairy farming // *Journal of dairy science*. Vol. 96. No. 2: 936–948. – https://doi.org/10.3168/jds.2012-5695. PMid:23219122.

El Benni, N., Finger, R., Mann, S. (2012). Effects of agricultural policy reforms and farm characteristics on income risk in Swiss agriculture // *Agricultural Finance Review.* Vol. 72. No. 3: 301–324. – https://doi.org/10.1108/00021461211277204.

Girdžiūtė, L. (2012a). Risks in agriculture and opportunities of their integrated evaluation // *Procedia-Social and Behavioral Sciences*. Vol 62: 783–790. – https://doi.org/10.1016/j.sbspro.2012.09.132.

Girdžiūtė, L., Slavickienė, A. (2012b). Decision making in agriculture and insurance as a risk management tool // *Zemes Ukio Mokslai*. Vol. 19. No. 1: 45–52.

Girdžiūtė, L., Slavickienė, A., Vaitkevičius, S. (2013). Ekonominės rizikos vertinimas žemės ūkyje // Ekonomika ir vadyba: aktualijos ir perspektyvos. Vol. 4. No. 32: 117–125.

Jansik, C., Irz, X., Kuosmanen, N. (2014). Competitiveness of Northern European dairy chains. – Helsinki: MTT Agrifood Research Finland Economic Research: Publications 116. 161 p.

Just, R. E. Pope, R. D. (2003). Agricultural risk analysis: adequacy of models, data, and issues // *American Journal of Agricultural Economics.* Vol. 85. No. 5: 1249–1256. – https://doi.org/10.1111/j.0092-5853.2003.00538.x.

Kozlovskaja, A. (2013). Kainų kaitos kaip rizikos veiksnio vertinimas Lietuvos augalininkystėje // *Žemės ūkio mokslai*. Nr. 20. T. 3: 211–221.

Kozlovskaja, A. (2014). Rizikos veiksnių aktualumas Lietuvos žemės ūkio produktų gamintojams // *Regional Formation and Development Studies*. T. 12. Nr. 1: 157–170.

Majewski, E., Guba, W., Was, A. (2007). Farm income risk assessment for selected farm types in Poland-implications of future policy reforms1 // *16th International farm management association congress a vibrant rural economy–the challenge for balance*. P: 437–448.

Severini, S., Tantari, A. (2015). Which factors affect the distribution of direct payments among farmers in the EU Member States? // *Empirica*. Vol. 42. No. 1: 25–48.

Severini, S., Tantari, A., Di Tommaso, G. (2016). The instability of farm income. Empirical evidences on aggregation bias and heterogeneity among farm groups // *Bio-based and Applied Economics*. Vol. 5. No. 1: 63–81. – https://doi.org/10.1007/s10663-013-9243-x.

Skarzynska, A., Abramczuk, L., Augustynska-Grzymek, I., Zekalo, M., Stalgiene, A. (2013). The conditions of the development of dairy farms in Poland and Lithuania // *Transformations in business & economics*. Vol. 12. No. 1: 91–107.

Stalgiene, A., Kuipers, A. (2014). Grazing livestock in Baltic countries and development paths of dairy farmers in Lithuania // *Cattle husbandry in Eastern Europe and China*. Vol. 135: 73–83. – https://doi.org/10.3920/978-90-8686-785-1_5.

Uzea, N., Poon, K., Sparling, D., Weersink, A. (2014). Farm support payments and risk balancing: implications for financial riskiness of Canadian farms // *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*. Vol. 62. No. 4: 595–618. – https://doi.org/10.1111/cjag.12043.

Verardi, V., Croux, C. (2009). Robust regression in Stata // *The Stata Journal*. Vol. 9 No. 3: 439–453.

Viira, A. H., Omel, R., Värnik, R., Luik, H., Maasing, B., Poldaru, R. (2015). Competitiveness of the Estonian dairy sector, 1994–2014 // *Journal of Agricultural Science*. Vol. XXVI. No. 2: 84–105.

ŽEMĖS ŪKIO SUBSIDIJŲ ĮTAKA PAJAMŲ RIZIKAI LIETUVOS PIENININKYSTĖS ŪKIUOSE

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Santrauka

Šio tyrimo tikslas – atskleisti žemės ūkio subsidijų įtaką pajamų rizikos kintamumui Lietuvos pieno ūkiuose. Pasirinktų ūkių ir laikotarpių pajamų rizikos heterogeniškumą paaiškina ūkio charakteristikos. Tyrimui naudojami Ūkių apskaitos duomenų tinklo (ŪADT) atrinkti duomenys, apimantys 2010–2014 m. laikotarpį. Siekiant atskleisti subsidijų, ūkio dydžio, ne ūkinių pajamų ir finansinio nejudamumo poveikį bendrosioms ūkio pajamoms, taikyti įvairūs ekonometriniai modeliai. Nustatyta, kad žemės ūkio subsidijos ir likvidumas teigiamai veikia pajamų riziką, o ūkininko amžius daro neigiamą įtaką pajamų rizikai. Nustatytas nelinijinis ryšys tarp ūkio dydžio ir pajamų rizikos.

Raktiniai žodžiai: pajamų rizika, valstybės parama, pieninininkystės ūkiai, robastinė regresija, Lietuva.

JEL kodai: Q12, Q14.