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Diversity of Farm Indebtedness in Latvia and Poland: a Comparative Study

Abstract. The use of borrowed capital in Latvian agricultural holdings of different economic size and type of farming is analyzed, as well as a comparative analysis with Polish agricultural holdings is performed, defining essential specificities of financing activities with equity or loan in each state. The liabilities burden in Latvian field crop and dairy farms is calculated and discussed in detail. For the assessment ratio of the statistical significance of differences between Latvian and Polish agricultural holdings the debt-to-equity and total liabilities per ESU, per 1 ha UAA and 1 LU, a statistical testing is carried out and main conclusions about an impact of the type of farming, the economic size and the chronological factor are formulated.

Key words: debt, liabilities, Latvian farms, Polish farms, comparative analysis

Introduction

Agriculture is currently one of the Latvian economy branches to suffer most seriously from the economic recession, essential price fluctuations in the market and the inflation caused price rise. As a result the costs are growing fast, but production the sale prices decrease, tending to drop lower than the product costs. Decreasing revenues hinder repayment of loans by the farmers. In order to relieve the burden of loans a State Support Program for 2009 is supposed to grant an allowance for paying down of actual interest payments by businesses (in case a loan or a leasing was taken to purchase new agricultural machinery and equipment or to construct industrial buildings, etc.), as well as for loan guarantees or for restructuring of existing loans (extension of final date of repayment or loan refinancing) [Par pasākumu… 2009]

According to the Latvian Ministry of Agriculture and a recent information in Latvian press [Latvijā arvien... 2009] big farms are particularly overloaded with credit liabilities, so checking the validity of this statement is topical in this research. The objective of this article is to analyze the use of borrowed capital in Latvian agricultural holdings of different economic size and type of farming and to offer a comparative analysis of Latvian and Polish agricultural holdings, defining essential specificities of activities financed from equity or loan in each state. To achieve this objective, methods of comparative ratio analysis, data grouping and statistical evaluation as well as inductive-deductive reasoning

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are used. All calculations are made by authors and based on data obtained from FADN national liaison agencies[3] in Latvia and Poland.

Financial leverage ratios

As agricultural holdings differ substantially not only by production process specificities (e.g. field crops, horticulture, dairy or granivores type of farming), but also by economic size, financing policy, level of investments and other factors, it is rather difficult to elaborate a general method of agricultural holdings' solvency analysis. Though the ratio analysis is the most widespread express method[4] both for solvency and creditworthiness assessment (especially, if detailed analysis is not possible due to lack of data), it must be taken into account that this method has a number of disadvantages. Most important of them are the following [Zelgalve 2004]:

1) orientation to past experience and a limited ability of making future forecasts;

2) assessment statics, a limited ability to run an analysis of the financial position of agricultural holding as of a continuously functioning enterprise, mostly done for a certain moment of time instead;

3) inability to define the amount of potential loan, necessary to achieve the maximum efficiency in the borrower's business activity.

Financial leverage ratios are used to assess how much financial risk a farm has taken on. There are 2 types of financial leverage ratios [Fabozzi 2003]: component percentages (comparing a farm's debt with either its total capital, i.e. debt and equity, or its equity capital) and coverage ratios (reflecting a farm's ability to satisfy fixed financing obligations, i.e. interest, principal repayment, or leasing payments). Neither practical nor scientific papers agree about which component percentage ratio is more preferable for the analysis of solvency. For example, in a financial analysis practitioner's guide [Guide… 2003], a debt-to-equity ratio (total liabilities/equity) and a financial leverage ratio (share of a company's long-term debt in its capital structure) are mentioned. In another handbook [How… 2000] just a debt-to-equity ratio is included. Some authors [Siegel 1995] call the above mentioned ratio also as a debt to net worth ratio. It is argued [Kohler's… 1983] that the debt-to-equity ratio is normally calculated by dividing total liabilities by total equities[5] or total assets. At the same time many other versions are used: some analysts prefer long-term debt as the numerator, others consider *long-term equity* or just *stockholder's equity* as the denominator. Historically, the debt-to-equity ratio was called the leverage ratio. While the debt-to-asset ratio is used extensively in the press, the leverage ratio has historical importance and is still used by many analysts in the financial sector [Olson 2004; Penson

[3] The EU Commission does not collect data directly. So called FADN liaison agencies (for example, Latvian State Institute of Agrarian Economics in Latvia and Institute of Agricultural and Food Economics in Poland) are responsible for gathering accountancy data from farms for he aims of determination of incomes and business analysis of agricultural holdings.

[4] According to Kovalov [Kovalov & Volkova 2009] the sequence of the so called express financial analysis performance is: 1) formal examination of the content of financial statements, 2) acquaintance with auditor's report, 3) disclosure of „problematic" items and their dynamics, 4) analysis of company's published key ratios, 5) acquaintance with notes to the financial statements, 6) approximate evaluation of company's activity, solvency and financial position using ratio analysis, 7) formulation of conclusions.

[5] Hereinafter the terminology of Kohler's dictionary [Kohler's… 1983] and other cited references is retained without modification.

1982]. Nowadays the debt-to-equity ratio is extensively used in multi-factor models. For example, it is so in an eight factor model[6] (modified Du Pont model) elaborated by Erohin [2007] to determine which of the elements is dominant in any change of farm ROA, effective use of financial resources and financial stability. Bocharov [2005] denotes the proportion of total liabilities and equity as a ratio of financial dependence (*коэффициент финансовой независимости*), their inverse proportion as a ratio of financing (*коэффициент финансирования*), a proportion of total liabilities to total assets as a ratio of financial stress (*коэффициент финансовой напряжённости*).

Earlier research papers [Bórawski 2008; Jakušonoka 2007; Kotāne 2008] analyzed Latvian and Polish agricultural holdings solvency by relating long-term or total liabilities only to values in terms of money (such as total assets, equity etc.). In this article the method has been modified, using the following money values and physical units as allocation base[7] of total liabilities:

a) financial indicator (equity);

b) production resource, 1 hectare of utilized agricultural area (hereinafter UAA 1 ha) and livestock unit (hereinafter LU);

c) production output; European size unit (hereinafter ESU).

Comparative analysis of liabilities burden in Latvian and Polish farms

Researchers [Herczeg 2009] mention the lack of capital and low level of capital accumulation in agricultural holdings as main reasons for increased need for external financial resources. Erohin [2007] is of the same opinion, putting the accent on an important role of long-term loans in the implementation of new production technologies, a replacement of agricultural machinery, an UAA fertility increase. Along with the growth of Latvian and Polish agricultural holding sizes, also the debt-to-equity ratio was growing (Table 1).

The policy of external capital attraction to financing in Latvian agricultural holdings was more active than in the Polish farms, the biggest risks taken by the big holdings (over 250 ESU), where the share of external capital exceeded 1.4-1.65 times the share of equity. In the end of the analyzed period, comparing to 2002, the debt-to-equity ratio in Poland grew most of all in farms smaller than 16 ESU, but in Latvia in farms of size 8 to 16 ESU and 100 to 250 ESU. For Polish farms the fastest chain growth rate[8] of debt-to-equity ratio was observed a year earlier (already in 2003-2004) than in Latvian farms (year 2004-2005). It is necessary to emphasize that in some previous research [Franc 2003] the calculated average debt-to-equity ratio of Polish agricultural holdings (selection of farms from 'Ranking of 300 best agricultural enterprises') in 1994-2000 was remarkably higher. It was

[6] ROA = (profit / sales) × (sales / current assets) × (current assets / short-term debts) × (short-term debts / accounts receivable) × (accounts receivable / accounts payable) × (accounts payable / total liabilities) × (total liabilities / equity) × (equity / total assets) [Erohin 2007].

[7] By analogy with the allocation base (or cost driver) defined in management accounting as the basis that is used to allocate costs to cost objects [Drury 1994], in this paper it is used for the allocation of liabilities to some parameters of agricultural production (production resource, output etc.).

[8] The chain growth rate of time series is a chain growth coefficient which is expressed in percentages and reveals an increase, a decrease or invariability of the current level in comparison with a previous one [Aladjev 2004].

the biggest in 1994 and 2000 (0.78 and 0.66 respectively), the lowest in 1995 (0.28), fluctuating from 0.41 up to 0.60 in other years.

The concept of Standard Gross Margin (SGM) is used to determine the economic size of farms which is expressed in terms of ESU (1 ESU = 1200 EUR/year). SGM of a crop or livestock item is defined as the value of output from one hectare or from one animal minus the cost of variable inputs required to produce that output. All crop and livestock items are accorded an SGM for each region. The FADN liaison agencies calculate the SGM and update them every two years on the basis of empirical data collected from farms. To avoid imprecision caused by fluctuations in production (due to bad weather) or in input-output prices three year averages are taken [FADN Methodology].

Table 1. Debt-to-equity ratio in Latvian and Polish farms (grouped by ESU, 2002 – 2007)

Year	Country	Average	ESU							Vσ (%)[9]
			2-<4	4-<8	8-<16	16-<40	40-<100	100-<250	>=250	
2002	LV	0.26	0.05	0.12	0.16	0.27	1.17	0.46	1.44	106
	PL	0.10	0.02	0.03	0.05	0.10	0.20	---	---	92
2003	LV	0.26	0.02	0.16	0.20	0.34	0.49	0.41	1.14	92
	PL	0.14	0.01	0.03	0.07	0.14	0.25	---	---	96
2004	LV	0.36	0.04	0.09	0.27	0.44	0.52	0.60	1.40	95
	PL	0.11	0.03	0.06	0.09	0.16	0.29	0.37	---	82
2005	LV	0.52	0.06	0.18	0.33	0.57	0.65	0.89	1.65	87
	PL	0.10	0.04	0.05	0.09	0.16	0.28	0.35	---	80
2006	LV	0.43	0.03	0.11	0.28	0.49	0.63	0.82	1.36	87
	PL	0.11	0.03	0.05	0.09	0.16	0.27	0.40	---	87
2007	LV	0.51	0.07	0.13	0.36	0.45	0.65	0.86	1.41	83
	PL	0.10	0.03	0.05	0.08	0.15	0.25	0.39	---	87
Average	LV	0.39	0.05	0.13	0.27	0.42	0.69	0.67	1.40	
	PL	0.11	0.03	0.04	0.08	0.15	0.26	0.37		
[2007]/ [2002] (%)	LV	*193*	*139*	*112*	*226*	*169*	*56*	*185*	*98*	
	PL	*101*	*159*	*183*	*159*	*147*	*125*	---	---	
Vσ (%)	LV	30	38	26	28	25	36	31	12	
	PL	14	36	26	18	16	13	6		

Source: authors' calculations, based on data obtained from FADN liaison agencies in Latvia and Poland.

An analysis of the calculation results (Table 2), with the exception of the farms of size 100 to 250 ESU during the first two years of the analyzed period, shows that in the Latvian agriculture existed a definite trend: the debt-to-equity ratio and the liabilities burden per 1 ESU increased along with the growth of agricultural holding economic size. The liabilities growth comparing to liabilities of the previous (i.e. smaller) economic size group (hereinafter: coefficient of chain growth[10]), always exceeded the coefficient of chain

[9] Coefficient of variation

[10] Simple straightforward growth rate can not be calculated because the amplitude intervals in farm economic size groups (for example 2 ESU in the group „2-<4 ESU", 150 ESU in „100-<250 ESU") and intervals between the

growth for an average economic size of respective agricultural holdings group. If in farms in the group of size 16 to 250 ESU the difference in the coefficient growth fluctuated from 0.4 to 0.95 (only in year 2007 in the group 100 to 250 ESU it was 1.15), then in other groups it was from 2.5 to 4 (reaching its maximum of 7.1 in the group 4 to 8 ESU in 2003). In Polish farms the difference between coefficients of chain growth for liabilities and for an average economic size was essentially smaller. In 2002-2003 it ranged from 1.2 to 1.7, in other years from 0.3 to 0.9. A conclusion can be made that in Poland, unlike in Latvia, the growth of liabilities was just a little ahead of agricultural holdings economic size growth.

Table 2. Total liabilities (EUR) per European Size Unit of Latvian and Polish farms (grouped by ESU, 2002 – 2007)

Year	Counry	ESU								Vσ
		Average	2-<4	4-<8	8-<16	16-<40	40-<100	100-<250	>=250	(%)
2002	LV	1166	406	675	611	963	2074	1298	2529	65
	PL	549	195	188	338	514	768	---	---	61
2003	LV	1063	177	777	911	1047	1440	1239	2270	57
	PL	674	120	211	391	675	945	---	---	73
2004	LV	1347	294	476	1128	1330	1580	1806	2450	58
	PL	624	329	445	529	780	1253	725	---	49
2005	LV	2163	490	1026	1512	2005	2144	2856	3960	58
	PL	644	443	410	558	810	1215	816	---	43
2006	LV	1852	249	629	1312	1856	1997	2645	3482	65
	PL	740	341	425	633	855	1187	1234	---	49
2007	LV	2073	478	756	1629	1633	2014	3016	3664	61
	PL	794	405	477	657	890	1230	1346	---	47
Average	LV	1611	349	723	1184	1472	1875	2143	3059	
	PL	671	306	359	518	754	1100	1030	671	
[2007]/ [2002] (%)	LV	*178*	*118*	*112*	*267*	*170*	*97*	*232*	*145*	
	PL	*145*	*208*	*254*	*195*	*173*	*160*	---	---	
Vσ (%)	LV	30	37	25	32	29	15	37	24	
	PL	13	41	35	25	18	18	30		

Source: authors' calculations, based on data obtained from FADN liaison agencies in Latvia and Poland.

The use of UAA is quite widespread in economic analysis for comparing not only the economic performance of farms in different countries in general [Simon 2002], but also for a calculation of total assets, equity and the burden of total, long-term and shot-term liabilities per UAA 1 ha [Herczeg 2009A].

The statement that due to a larger economic size the agricultural holdings have a heavier liabilities burden was confirmed when total liabilities per UAA 1 ha (Table 3) were calculated. The differences in these values were most pronounced between the groups of largest and smallest Latvian agricultural holdings in 2006 (1549 EUR and 26 EUR) and in

centres of groups are not equal. Therefore the chain growth rate of liabilities and the chain growth rate of allocation base are compared in any two groups independently.

2003 (1005 EUR and 19 EUR), the most insignificant difference in 2007 (1663 EUR and 66 EUR). Those differences were substantially greater that those of the total liabilities per 1 ESU value (in 2006 they were 3482 EUR and 249 EUR, in 2003 respectively 2270 EUR and 177 EUR). An opposite tendency was observed when comparing differences between coefficient of chain growth for liabilities, economic size and UAA. The difference between coefficient of chain growth for liabilities and UAA was smaller, showing, that liabilities growth was more connected to UAA, rather than to ESU growth. Still such a conclusion does not refer to Latvian farms over 250 ESU, where the ratio between coefficients of chain growth for liabilities and UAA growth during the first years of the analyzed period was within the range of 6 – 6.8 but in the end it varied from 3 to 3.4. This clearly shows that agricultural holdings attracted external financial resources for implementation of large-scale investment projects. This difference for medium-size agricultural holdings (16 to 100 ESU) was smaller (within the range of 0.3 – 0.9), thus the liabilities growth was most of all balanced with the UAA growth.

Table 3. Total liabilities (EUR) per utilised agricultural area (hectare) of Latvian and Polish farms (grouped by ESU, 2002 – 2007)

Year	Country	ESU								Vσ
		Average	2-<4	4-<8	8-<16	16-<40	40-<100	100-<250	>=250	(%)
2002	LV	152	37	72	64	121	285	260	1123	137
	PL	275	70	88	176	265	384	---	---	66
2003	LV	149	19	86	108	144	216	229	1005	131
	PL	339	44	97	196	337	523	---	---	81
2004	LV	224	31	59	170	203	261	343	1292	129
	PL	385	142	221	333	594	990	547	---	66
2005	LV	372	54	132	213	321	358	531	2141	135
	PL	365	166	189	326	573	943	687	---	64
2006	LV	328	26	84	217	311	379	567	1549	116
	PL	420	132	199	374	606	907	745	---	63
2007	LV	435	66	114	288	327	439	695	1663	107
	PL	449	163	232	391	623	880	831	---	59
Average	LV	277	39	91	177	238	323	438	1462	
	PL	372	119	171	299	500	771	703	---	
[2007]/ [2002] (%)	LV	*286*	*179*	*158*	*449*	*271*	*154*	*267*	*148*	
	PL	*163*	*234*	*264*	*223*	*235*	*229*	---	---	
Vσ (%)	LV	43	46	30	46	39	26	43	28	
	PL	17	42	37	31	31	33	17		

Source: authors' calculations, based on data obtained from FADN liaison agencies in Latvia and Poland.

In Polish farms the coefficient of chain growth for liabilities, in most cases, exceeded the UAA coefficient of chain growth only by 1.1 – 1.5 (during the last years 0.9 – 1.3). The difference was even smaller in the group of largest holdings, where it fluctuated from 2.4 (in 2004) to 0.35 (in 2007). This allows to conclude that Polish farmers' strategy of

borrowed capital handling was better adapted to changes in the agricultural production resources (UAA) than in the Latvian agriculture.

By analogy with UAA, LU was chosen as an allocation base of liabilities for the analysis of average results in Latvian agricultural holdings and dairy farms. With growing economic size of Latvian agricultural holdings the total liabilities per 1 LU grew only in holdings smaller than 100 ESU and reached maximum in the group 40 to 100 ESU (Table 4). The liabilities burden in farms over 250 ESU made in turn just 55 % (in 2004) up to 85 % (in 2007) of the level in the previous group. In the group of largest Polish agricultural holdings, as compared with the above, the liabilities burden for 1 LU was smaller only in 2004-2005. In the other years this paradox was not observed and the largest Polish farms had the heaviest liabilities burden. If in 2002-2003 the difference between coefficient of chain growth for liabilities and LU fluctuated from 1.2 to 1.7, then in the following year it diminished and exceeded value 1 only in farms of size 40 to 100 ESU. Along with this by the lapse of time the liabilities growth and the LU growth became more equalized, especially in farms smaller than 40 ESU.

Table 4. Total liabilities (EUR) per livestock unit in Latvian and Polish farms (grouped by ESU, 2002 – 2007)

Year	Country	ESU								Vσ
		Average	2-<4	4-<8	8-<16	16-<40	40-<100	100-<250	>=250	(%)
2002	LV	590	162	297	373	672	1819	664	1168	79
	PL	446	149	140	252	393	759	---	---	76
2003	LV	511	62	349	481	751	1252	686	839	60
	PL	510	88	150	280	501	725	---	---	75
2004	LV	715	117	200	646	1026	1752	1353	964	69
	PL	474	262	325	377	555	919	798	---	50
2005	LV	1185	172	495	1086	1335	2361	2425	1683	63
	PL	461	352	299	396	567	916	565	---	44
2006	LV	1019	98	301	658	1226	2373	1807	1515	73
	PL	534	264	314	441	603	891	901	---	49
2007	LV	1293	225	416	969	1186	2043	3531	1709	78
	PL	623	322	367	479	681	1081	1236	---	55
Average	LV	886	139	343	702	1033	1933	1744	1313	
	PL	508	240	266	371	550	882	875	---	
[2007]/ [2002] (%)	LV	*219*	*139*	*140*	*260*	*176*	*112*	531	146	
	PL	*140*	*217*	*262*	*190*	*173*	*142*			
Vσ (%)	LV	37	42	30	39	26	22	63	29	
	PL	13	43	36	24	18	15	32		

Source: authors' calculations, based on data obtained from FADN liaison agencies in Latvia and Poland.

Both in Poland and in Latvia an external financing was used most intensively by agricultural holdings of the same types of farming, namely horticulture, granivores and field crops (Table 5). Still the proportions of assets financing from equity and borrowed capital were different. During the first years of the analyzed period the biggest debt-to-equity ratio was stated for Latvian field crop (0.4 – 0.56) and granivores farms (around 0.8).

In further years this value grew fast in horticulture farming. In such farms total liabilities exceeded equity 1.5 – 2 times in 2004 and 2007, while in 2006 they were equal. In granivores farms the debt-to-equity ratio had an average of 1.26 in 2002-2007, fluctuating between 1.2 to 1.7 from year to year, which is considered a very high level of financial risk. The debt-to-equity ratio in Polish holdings of the mentioned type of farming was on average 0.15 – 032, but the biggest did not exceed 0.33 – 0.37 in 2004-2005, which is considered an optimum value from the point of view of financial analysis.

Table 5. Debt-to-equity ratio in Latvian and Polish farms (grouped by types of farming, 2002-2007)

Year	Country	Field rops	Dairy cows	Granivores	Horticulture	Mixed crops	Mixed livestock	Mixed crops and livestock	Permanent crops	Grazing livestock
2002	LV	0.56	0.21	0.82	0.21	0.06	0.06	0.07	---	---
	PL	0.15	0.09	0.07	---	---	---	0.08	0.13	0.11
2003	LV	0.41	0.19	0.79	0.29	0.13	0.04	0.10	0.51	---
	PL	0.17	0.13	0.15	---	---	---	0.11	0.12	0.18
2004	LV	0.51	0.16	1.23	1.57	0.11	0.11	0.14	1.01	---
	PL	0.11	0.08	0.16	0.37	---	---	0.06	0.11	0.10
2005	LV	0.66	0.30	1.71	0.79	0.21	0.08	0.24	0.55	---
	PL	0.11	0.08	0.16	0.33	---	---	0.06	0.10	0.09
2006	LV	0.56	0.30	1.43	1.05	0.08	0.06	0.30	0.33	---
	PL	0.15	0.08	0.17	0.27	---	---	0.07	0.10	0.11
2007	LV	0.62	0.31	1.60	2.05	0.49	0.06	0.36	0.24	---
	PL	0.13	0.09	0.17	0.30	---	---	0.07	0.11	0.11
Average	LV	0.55	0.24	1.26	0.99	0.18	0.07	0.20	0.53	---
	PL	0.14	0.09	0.15	0.32	---	---	0.07	0.11	0.12
Vσ (%)	LV	16	28	31	73	88	33	58	56	
	PL	17	24	25	14			26	9	27

Source: authors' calculations, based on data obtained from FADN liaison agencies in Latvia and Poland.

Analysis of liabilities burden in Latvian field crop byand dairy farms

Field crops and milk production are still those Latvian agricultural production sectors that form the largest part of agricultural production value (in 2007 it was 27% and 21% respectively) [Vēveris 2008].

Similar to the average liabilities ratios in Latvian agriculture, in the ***field crop farms*** they varied substantially depending on the economic size of farms (Table 6). In the years 2003-2004, in the groups of the smallest and the largest Latvian agricultural holdings the differences between debt-to-equity ratio, liabilities burden per ESU and per UAA 1 ha tended to decrease, but in the further years they increased anew, reaching the maximum in 2006. Many creditors think that the loan should not exceed the equity [Bednarskis 1992].

Farms over 100 ESU have already reached this limit since the liabilities made 80-90 % of equity. Liabilities burden per 1 ESU also had a tendency to grow along with the growing economic size of agricultural holdings. It decreased only in farms 100 to 250 ESU in 2002-2003, as well as in the groups 4 to 8 ESU in 2004 and 8 to 40 ESU in 2005-2006. Still those exceptions were mostly accidental and could be caused by a non-representative sampling. When compared with total liabilities per 1 ESU, the total liabilities per UAA 1 ha were characterized by bigger coefficient of variation Vσ, demonstrating greater variability of this value in different economic size groups.

Table 6. Debt-to-equity ratio and total liabilities (EUR) per 1 European Size Unit and per utilised agricultural area (ha) in Latvian field crop farms (grouped by ESU, 2002-2007)

Year	ESU								Vσ
	Average	2-<4	4-<8	8-<16	16-<40	40-<100	100-<250	>=250	(%)
Debt-to-equity ratio									
2002	0.56	0.35	0.13	0.20	0.30	1.73	0.85	2.39	103
2003	0.41	0.05	0.15	0.13	0.35	0.55	0.64	2.09	125
2004	0.51	0.22	0.07	0.19	0.46	0.57	0.83	1.72	98
2005	0.66	0.02	0.35	0.37	0.49	0.78	1.09	2.00	90
2006	0.56	0.01	0.17	0.19	0.38	0.65	0.92	1.58	99
2007	0.62	0.05	0.10	0.26	0.48	0.62	0.81	1.76	101
Average	0.55	0.12	0.16	0.22	0.41	0.82	0.86	1.93	
Vσ (%)	16	120	63	37	19	56	17	15	
Total liabilities / ESU									
2002	1643	1607	596	706	1116	2500	1433	3165	59
2003	1384	365	646	651	1082	1772	1644	2962	69
2004	1650	1529	342	819	1163	1819	2241	3131	59
2005	2208	151	1610	1594	1376	2105	3203	4059	64
2006	1938	38	983	660	1187	1832	2861	4220	85
2007	2543	456	732	1109	1543	1824	3048	6716	98
Average	1894	691	818	923	1244	1975	2405	4042	
Vσ (%)	22	101	54	40	14	14	31	35	
Total liabilities / UAA (hectare)									
2002	195	107	54	70	133	340	329	750	97
2003	183	35	57	78	129	258	339	689	103
2004	257	125	37	126	175	280	448	757	90
2005	352	14	193	224	229	342	578	972	87
2006	328	4	112	109	204	328	575	992	104
2007	465	82	96	175	279	343	603	1435	111
Average	297	61	92	131	192	315	479	932	
Vσ (%)	36	83	62	46	30	12	26	30	

Source: authors' calculations, based on data obtained from FADN liaison agency in Latvia.

Table 7. Debt-to-equity ratio and total liabilities (EUR) per 1 European Size Unit and per 1 livestock unit in Latvian dairy farms (grouped by ESU, 2002-2007)

Year	ESU							Vσ
	Average	2-<4	4-<8	8-<16	16-<40	40-<100	100-<250	(%)
Debt-to-equity ratio								
2002	0.21	0.00	0.17	0.15	0.18	1.20	0.27	133
2003	0.19	0.02	0.25	0.15	0.34	0.27	0.26	52
2004	0.16	0.02	0.08	0.25	0.29	0.23	0.31	59
2005	0.30	0.07	0.15	0.33	0.70	0.44	0.53	65
2006	0.30	0.04	0.09	0.30	0.68	0.53	0.75	75
2007	0.31	0.05	0.06	0.24	0.47	0.69	0.87	85
Average	0.24	0.03	0.13	0.24	0.44	0.56	0.50	
Vσ (%)	28	64	54	31	48	64	53	
Total liabilities / ESU								
2002	1078	16	1377	983	595	2929	817	89
2003	926	146	1590	736	1196	836	867	54
2004	881	190	466	1341	1439	994	1275	54
2005	1922	529	1058	1782	3776	2344	2653	58
2006	1706	357	537	1724	3270	2735	3003	65
2007	1369	282	302	1143	1798	2551	2700	73
Average	1314	254	888	1285	2012	2065	1886	
Vσ (%)	33	70	60	32	62	44	53	
Total liabilities / LU								
2002	242	4	281	232	114	743	202	97
2003	215	37	380	134	291	202	207	57
2004	224	51	111	348	365	253	323	55
2005	495	141	266	476	929	601	679	56
2006	544	118	176	522	1030	851	951	65
2007	603	117	139	497	766	1161	1190	74
Average	387	78	225	368	583	635	592	
Vσ (%)	46	70	45	43	65	58	70	

Source: authors' calculations, based on data obtained from FADN liaison agency in Latvia.

When analyzing the use of borrowed capital in Latvian dairy farms it was found that in 2003-2006 the debt-to-equity ratio as well as the liabilities burden was growing together with the growth of farm economic size only in agricultural holdings smaller than 40 ESU and over 100 ESU (Table 7). In farms 40 to 100 ESU they decreased in turn by 20-40% of the values in the group 16 to 40 ESU. The growth of dispersion characterized by Vσ revealed during the analyzed period still bigger differences in the attraction of external financing. However, in dairy farms the variability range was narrower than in field crop farms. A more detailed research lets the authors conclude that between the debt-to-equity ratios in farms with size over 250 ESU and below 4 ESU existed the biggest numerical

differences (11-17 times) and more moderate between the total liabilities per 1 ESU and per 1 LU (5-10 times).

Statistical evaluation of results

In order to assess the statistical significance of the differences between Latvian and Polish agricultural holdings the debt-to-equity ratio and the total liabilities per 1 ESU, per UAA 1 ha and 1 LU a statistical hypothesis testing has been undertaken [Arhipova 2006].

Table 8. Results of F-Test for equality of two standard deviations (α = 0,05) and T-Test for equality of the mean (α = 0,05) in Latvian and Polish farms grouped by type of farming, by ESU and years

Para-meter	Type of farm											
	Field crops		Dairy cows		Granivores		Horticulture		Mixed crops and livestock		Permanent crops	
Debt-to-equity ratio												
F	14.88		9.49		108.46		247.86		37.69		823.14	
F crit	5.05		5.05		5.05		9.01		5.05		5.19	
T-test	0.00		0.00		0.00		0.07		0.04		0.04	
Type/year	A[11]	B	C	D	E	F	2002	2003	2004	2005	2006	2007
Debt-to-equity ratio												
F	3.04	9.71	27.04	21.61	51.81	79.56	39.92	3.30	2.91	5.93	4.63	4.89
F crit	5.05	5.05	5.05	5.05	5.05	9.01	6.39	6.39	5.05	5.05	5.05	5.05
T-test	0.04	0.00	0.00	0.00	0.01	0.02	0.26	0.15	0.17	0.08	0.13	0.08
Total liabilities / ESU												
F	1.07	2.12	8.78	9.55	2.16	6.79	7.30	1.83	3.37	7.77	5.61	5.43
F crit	5.05	5.05	5.05	5.05	5.05	9.01	6.39	6.39	5.05	5.05	5.05	5.05
T-test	0.56	0.00	0.01	0.01	0.00	0.03	0.14	0.15	0.16	0.04	0.14	0.11
Total liabilities / UAA (ha)												
F	8.07	5.34	1.27	2.78	9.24	0.41	1.73	7.09	6.82	3.21	2.41	1.76
F crit	5.05	5.05	5.05	5.05	5.05	0.11	6.39	6.39	5.05	5.05	5.05	5.05
T-test	0.01	0.02	0.03	0.01	0.01	0.03	0.30	0.23	0.07	0.17	0.16	0.23
Total liabilities / LU												
F	3.03	1.14	9.61	7.65	10.95	15.72	6.88	2.93	5.82	17.22	10.18	10.25
F crit	5.05	5.05	5.05	5.05	5.05	9.01	6.39	6.39	5.05	5.05	5.05	5.05
T-test	0.06	0.21	0.03	0.01	0.00	0.12	0.36	0.35	0.32	0.09	0.23	0.23

Source: authors' calculations, based on data from Table 1-5 using Excel functions.

The ***F-Test for equality of two standard deviations*** was used to check whether the borrowed capital values variance in the relevant Latvian and Polish agricultural holdings

[11] Codes for economic size groups: **A** '2-<4 ESU'; **B** '4-<8 ESU', **C** '8-<16 ESU', **D** '16-<40 ESU', **E** '40-<100 ESU', **F** '100-<250 ESU'.

groups (grouped by type of farming, economic size and year) was equal (H_0) or different (H_1).

H_0: $\sigma_1^2 = \sigma_2^2$

H_1: $\sigma_1^2 \neq \sigma_2^2$

The calculations indicate (Table 8) that with a probability of P = 95 % H_0 can not be rejected (i.e. $F < F_{crit}$) and, along with this, there were no statistically significant differences of the debt-to-equity ratio dispersion between Latvian and Polish smallest farms (smaller than 4 ESU), excluding the years 2002 and 2005. When calculating the total liabilities per 1 ESU, the dispersion degree was equal for farms of size below 8 ESU and over 40 ESU, also in 2003-2004, and so for total liabilities per UAA 1 ha in medium-size farms group (from 8 to 40 ESU), also in the beginning (2002) and in the end (since 2005) of the analyzed period. The dispersion of total liabilities per 1 LU did not differ for farms below 8 ESU and in year 2003.

In order to find out whether the Latvian and Polish farms could be assigned to the same population the ***Student's T-test*** was calculated assuming the two groups had the same mean of debt-to-equity ratio and also for total liability ratios.

H_0: $\mu_1 = \mu_2$

H_1: $\mu_1 \neq \mu_1$

With a probability of P = 95 % it was possible to reject the hypothesis H_0 (value of T-test > α, α = 0.05) for the total liability ratios in Latvian and Polish agricultural holdings grouped both by the type of farming (except horticulture) and by the economic size (except for the total liabilities per 1 ESU and 1 LU in the group of the smallest farms). Statistically significant differences were observed. When analyzing the differences between the Latvian and Polish farm total liability ratios in different years (chronological aspect), it could be concluded that they were statistically insignificant (with the exception of total liabilities per 1 ESU in 2005).

Table 9. Results of two factor analysis of variance (α = 0,05) in Latvian and Polish farms

Factor	Latvia			Poland					
				No I. '2 – < 100 ESU'			No II. '2004 – 2007'		
	F	*P value*	*Fcrit*	*F*	*P value*	*Fcrit*	*F*	*P value*	*Fcrit*
Debt-to-equity ratio									
Year	2.163	0.085	2.534	9.947	0.000	2.711	0.443	0.654	4.103
ESU	69.773	0.000	2.421	349.104	0.000	2.866	245.654	0.000	3.326
Total liabilities / ESU									
Year	9.256	0.000	2.534	30.878	0.000	2.711	1.886	0.202	4.103
ESU	46.984	0.000	2.421	209.110	0.000	2.866	28.837	0.000	3.326
Total liabilities / UAA (ha)									
Year	4.628	0.003	2.534	9.434	0.000	2.711	1.862	0.205	4.103
ESU	66.253	0.000	2.421	55.73 2	0.000	2.866	216.146	0.000	3.326
Total liabilities / LU									
Year	5.204	0.001	2.534	33.053	0.000	2.711	3.110	0.089	4.103
ESU	18.292	0.000	2.421	291.326	0.000	2.866	14.991	0.000	3.326

Source: authors' calculations, based on data from Table 1-4 using Excel function.

In order to statistically evaluate the dependence of debt-to-equity ratio and total liability ratios per 1 ESU, per UAA 1 ha and per 1 LU on factors (years and economic size), the t***wo-factor analysis of variance (ANOVA)*** was performed and hypotheses formulated:

for the *economic size* factor H_0: $\mu_{1\ ESU} = \mu_{2\ ESU} = \mu_{3\ ESU} = ... = \mu_{i\ ESU}$
H_1: not all $\mu_{i\ ESU}$ are equal

for the *year* factor H_0: $\mu_{2002} = \mu_{2003} = ... = \mu_{2007}$
H_1: not all $\mu_{i\ year}$ are equal

As the data on Polish agricultural holdings of economic size 100 to 250 ESU in 2002-2003 was not collected and published, the Polish farms set was divided into 2 subsets for creating 2 adjacent ranges of data: farms of size below 100 ESU in 2002-2007 (No I in Table 9) and farms of size below 250 ESU in years 2004-2007 (No II in Table 9).

Basing on the calculation results (Table 9) it may be said that, with 95% probability, both the Latvian agricultural holding economic size and the chronological factor had a significant influence upon the total liability ratios. When analyzing the chronological factor's impact on the debt-to-equity ratio it was impossible to reject ($F < F_{crit}$, $\alpha = 0.05$) the hypothesis H_0. The impact of this factor is accepted as statistically insignificant. If in the subset of Polish farms (size below 100 ESU, No I in Table 9) with 95% probability the impact of both factors was determined as significant, the chronological factor had no significant influence upon the ratios (debt-to-equity, total liabilities per 1 ESU, per UAA 1 ha and per 1 LU) in another farm subset (No II in Table 9).

Table 10. Results of two factor analysis of variance ($\alpha = 0.05$) in Latvian farms

Factor	Average					
	F	*P value*	*F crit*			
	Debt-to-equity ratio					
Year	0.872	0.471	3.072			
Type of farming	17.389	0.000	2.488			
	Field crops			Dairy cows		
	F	*P value*	*Fcrit*	*F*	*P value*	*Fcrit*
	Total liabilities / equity					
Year	2.354	0.065	2.534	1.163	0.355	2.603
ESU	57.713	0.000	2.421	6.627	0.000	2.603
	Total liabilities / ESU					
Year	1.638	0.180	2.534	3.023	0.029	2.603
ESU	19.012	0.000	2.421	6.562	0.001	2.603
	Total liabilities / UAA (ha)			Total liabilities / LU		
Year	3.718	0.010	2.534	4.670	0.004	2.603
ESU	52.518	0.000	2.421	6.190	0.001	2.603

Source: authors' calculations, based on data from Table 5-7 using Excel function.

A two-factor analysis of variance in Latvian farms (Table 10), grouped by type of farming and years (Table 5), as well as in Latvian field crop (Table 6) and dairy farms (Table 7), grouped by years and ESU, reveals that in certain cases the impact of chronological factor was insignificant. When analyzing the impact of this factor on the

debt-to-equity ratio, as well as on total liabilities per 1 ESU in field crop farms, the hypothesis H_0 could not be rejected with 95% probability. Such factors as the type of farming as well as the economic size of farms should be considered as significantly influencing the analyzed ratios.

Proposals

The community-supported agriculture is a socio-economic mode of agriculture and food distribution. Although it is very popular all over the world[12], it is widespread neither in Latvia nor in Poland. Groups of consumers and farmers form cooperative partnerships which usually focus on a system of weekly delivery or pick-up of vegetables and fruit, a type of a vegetable box, sometimes also dairy products and meat to the consumers. The system has many variations in the farm budget support by the consumers. By providing a guaranteed market through prepaid annual sales at the beginning of the production process (mostly in spring), consumers essentially support and help to finance farming operations, reducing the required amount of borrowed capital.

During summer months some farmers receive subsidies (less favorable area, direct and decoupled payments), which form an important part of their gratis financial sources, from the state budget and the European Agricultural Guarantee Fund. A transfer of the time f payments to the spring would significantly improve the inflow of highly necessary resources before the start of agricultural production process and partly reduce the attraction of short-term loans for the current assets acquisition. An increase of the amount of subsidies to interest repayments could also unburden and help farmers with repayment of loans. However, the economic crisis has a negative impact on the state budgets both in Latvia and in Poland and therefore the sums available for allocation to the support of agriculture.

Conclusions

Along with the growing economic size of Latvian and Polish agricultural holdingsan the share of external borrowed capital aimed at increasing the farms performance also increased. The borrowed capital was widely used in field crop, granivores and horticulture farms. Latvian farmers used borrowed capital more actively than Polish farmers, thus taking bigger financial risk (especially the farms of size over 250 ESU). The introduction of community-supported agriculture, the transfer of subsidies (less favorable area, direct and decoupled) payment time from summer to spring and an increase of interest subsidies could improve the well-timed inflow of resources, unburden farmers and reduce the required amount of borrowed capital.

The differences between the coefficient of chain growth of liabilities and of farms average economic size and of average UAA in Latvian farms were bigger than in Polish

[12] For example, AMAP (*Association pour le maintien de l'agriculture paysanne*) in France, *Landwirtschaftsgemeinschaftshof* in Germany, ASC (*Agriculture soutenue par la communauté*) in Canada, CSA (*Community supported agriculture*), *Reciproco* in Portugal, Teikei (□□) in Japan etc.

ones. This reveals that Polish a strategy of the borrowed capital handling better adapted both to changes in agricultural output (measured in ESU) and resources (UAA).

The assessment of the statistical significance ($\alpha = 0,05$) of results in the Latvian and Polish agricultural holdings comparative analysis shows that there existed significant differences in the two states between the debt-to-equity ratios and between the total liabilities per 1 ESU, 1 hectare of UAA and 1 LU in farms grouped both by types of farming and by economic sizes. Such factors as the economic size and the chronological aspect (years) significantly influenced the Latvian agricultural holdings liabilities ratios (except for the chronological factor's impact on debt-to-equity ratio). While the impact of the two above mentioned factors on Polish smaller farms (size below 100 ESU) subset was significant, then for the farms subset concerning years 2004-2007 the impact of chronological factor was statistically insignificant.

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