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PILOT PROJECTS ON STATISTICS:

COMPONENT: AGRICULTURAL SECTOR MODELLING

Generation of Data on intermediate consumption in Latvia – Approach Comparison

Final report

Liene Dambina, Valda Bratka, Andris Miglavs

Latvian State Institute of Agrarian Economics

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INTRODUCTION

This study is prepared under the Contract "Provision of Services from the Phare Countries" in the framework of "Multi Country Statistical Cooperation - Pilot Projects on Statistics", Component: Agricultural Sector Modelling.

It is a continuation of work carried out by LSIAE within a sub-project in the frame of the Pilot Project on Agricultural Sector Modelling (ASM) during February – April, 2001, where the input use coefficients were calculated, based on available Latvian FADN database. The results of that study were submitted to EUROSTAT and also presented during the ASM-Workshop in April 2001 in Riga.

In the workshop also the model "COUTPROD", built by INRA and INSEE, France, was presented (in the following called the "INRA-Model"). The model uses the FADN data, which is an annual survey in EU on the structure, the receipts, the expenditures and the income of the commercial farms. With the help of the model, the production coefficients and production costs were calculated for the 15 EU member states between 1990 and 1997.

During the workshop it was agreed to apply the INRA-model for two candidate countries, one of them being Latvia.

In May LVAEI sent the data necessary to run the model to J.P. Butault (INRA). The model was applied on these data in the beginning of July and L. Dambina and V. Bratka participated in the workshop in Nancy from July 5-8.

The objective of this sub-project is to compare the INRA-model, running with Latvian Data, with the Latvian approach for using data from the FADN and other data sources for generating input coefficients per Agricultural Activity, worked out within the previous sub-project.

The result of this sub-project shall be an assessment on how the INRA-model suits with Latvian data and approaches for the continuous generation of input data per activity in Latvia.

1. A SUMMARY OF THE APPROACH FOR THE USE OF FADN DATA IN LATVIA (LATVIAN APPROACH)

"Latvian approach" for using data from the FADN and other data sources for generating input coefficients per Agricultural Activity was developed in February – April, 2001 as the output of the EU Phare financed subproject. The focus of the study was to elaborate a methodology, which could be applied on a regular basis and which would provide a regular data flow to Eurostat concerning input coefficients.

As the starting point the thesis that, in the perspective, FADN might become as the main information source in respect to intermediate consumption in agriculture, where, applying the calculated coefficients to crop areas or to number of animals, one can arrive at the respective aggregate intermediate consumption item, to be used for EAA.

This particular study could be counted as the first stage in the solving of the problem, and its particular task was to try to meet Eurostat minimum requirements – to obtain data on the key cost items by Agricultural Activity. Apart from that, there was an attempt to break down the labour costs, rent and interest payments as well.

Since the main task of the project was to use FADN data in order to obtain input use coefficients by Agricultural Activity, FADN database was analysed, including its compliance with the present EAA data set and AgrIS requirements.

To calculate input use coefficients, a multiple linear regression (hereafter – regression) method was selected. This choice was based on our own considerations, as well as on the experience of other countries (namely, Denmark), and recommendations (distributed by ASA). Following the theory, this method is applied to analyse relationship between several independent variables and one dependent variable. In case of our problem, crop areas and number of animals were taken as independent variables, while the dependent variable was common individual cost items, which, of course, depend on the number of ha or on number of animals. The obtained regression coefficients basically describe the effect of each independent variable (area or number of animals) on the dependent variable (total respective costs). In our case, regression coefficients would be the respective costs by Agricultural Activity per ha or per animal.

Input use items required by AgrIS information system were compared with the items available in FADN data base. Information, needed to obtain data on input use items at AgrIS top aggregation level was available both in ABTA table and in FADN database. Similarly, Agricultural Activities were compared and assessed. Although FADN database has a very detailed breakdown by Agricultural Activity, for each individual activity the number of farms varied, and in many cases it was too small. Therefore, for the purpose of the study, an Agricultural Activity aggregation level was selected which allowed obtaining a data set, which could meet the representation requirements for mathematical analysis. The selected aggregation level allows comparing FADN data with ABTA table data; however, it does not fully correspond to the minimum list of activities, specified in AgrIS system.

As in input item, FADN data set was prepared for each individual cost item to apply regression method, selecting farms where respective costs are relevant. For example, some of the cost items are relevant exclusively to crop farming or to animal production –

pesticides apply exclusively to crop production. In this case farms with dominating livestock production were excluded from the input data set for analysis.

The initial analysis for individual production activities ended up with negative regression coefficients, which are not feasible. Assessment of FADN data led to a conclusion that negative figures are generated by production activities, which have comparatively small scale (small areas or small number of animals) or represented in very few farms. Therefore, activities with possibly similar cost items were grouped. Some farms with very specific production activities (e.g. fungus) were altogether excluded from the input data set.

Some cost items, for example, electricity and fuel for heating, motor fuel, maintenance costs are applicable to entire agriculture and also to non-agricultural secondary activities. Second step was to break down agriculture-related costs by Agricultural Activity.

The first attempts to break down labour costs and fertiliser costs by Agricultural Activity did not result in credible coefficients. They were either negative, or else, very large positive figures. In these cases additionally the so-called "*Activity-wise cost analysis*" method was applied, however, even this did not end up in credible results in all cases. This means that in the analysis in question, the selected method could not find a constructive (credible) solution for the specified data set.

Multiple linear regression equation includes also intercept. If its value is not a zero, it means that all costs have not been distributed by Agricultural Activity or vice versa - over distributed. The study included calculations both for the cases when intercept is a 0 and when it is not, and there were attempts to find the most credible solution.

Credibility of the results and their quality can be valuated also by such criteria as standard error and determination coefficient. The result is better if the coefficient standard errors are smaller and determination coefficient is larger.

Applying regression analysis to variously grouped FADN data and applying different assumptions, varying results were obtained, of which the most credible were selected for further analysis. Yet, due to various circumstances and some issues that remain unsolved so far, even these results by no means can be taken as final and correct.

The data quality is one of the prerequisites for obtaining credible coefficients. Latvian FADN database contains information on different farms – small farms with a couple of ha of agricultural land and a few animals, as well as large farms with 100 and over ha of land and a large number of animals. Consequently, technologies and even farming strategies may largely vary between the farms. The farms also differ by type of farming. There are mixed farms where it is hard to identify the core business, and there are market-oriented farms with comparatively narrow specialisation.

The quality of data recorded at the farms and entered into FADN data base might also be the cause of the problem, especially the stock and output evaluation practices and the scales used for that, the record accuracy of use of labour and other inputs; differing prices of the used resources.

These could be the reasons for obtaining negative or large positive and incredible input use coefficients. To improve the results, the farms were grouped in various ways by activities, and, on separate occasions, were altogether excluded from input data set. However, it is impossible to exclude too many farms, because this reduces the representative quality of the obtained set.

Similarly, it is premature to conclude that the obtained coefficients might describe the average level of agriculture in Latvia, since the Latvian FADN database is under development and does not represent the entire agricultural sector that will be possible only after carrying out agricultural census in Latvia.

The technical calculations were done applying regression analysis tool, included in EXCEL. Yet, it does not allow to define with sufficient accuracy the limiting factors for the problem solution, which, possibly, could solve several issues related to result credibility and logic – negative figures and extreme figures. Similarly, it allows a limited number of variables, which does not allow including simultaneously all activities that are analysed. In future it is recommendable to use statistics software, e.g. SPSS or SAS, which offers more ample possibilities to formulate the problem.

The key intermediate consumption and other cost item breakdown coefficients by Agricultural Activity can be counted as one of the result of the study.

The input use coefficients obtained in the last phase of the study were compared with the existing ones. Presently it would not be correct to evaluate whether the obtained coefficients are better, because only the first step has been taken to develop a new methodology, and the method has not been sufficiently elaborated. Likewise, the analysed data set itself calls for further development and improvement, too.

2. A SUMMARY OF THE INRA APPROACH FOR THE USE OF FADN DATA

"COUTPROD INRA-INSEE" is an econometric model developed in France, for the purposes of breaking down costs by production activity. With the help of this model cost breakdown is calculated for the European Union member states. FADN is used as data source for the model.

2.1 Description of the Latvian FADN data sent to INRA

The assignment was to allocate farm costs to individual farm production activities, using data from Latvian Farm accountancy data network (FADN) and applying INRA model. Cost distribution - calculation of inputs coefficients has been done based on Latvian FADN database for 1999 containing 520 farms data.

2.1.1 FADN farm sample in 1999

Setting up of farm account statistics (SUDAT) based on the principles of EU Farm Accountancy Data Network has been started in Latvia in 1996 and first publication was prepared for 1996 based on the 222 Latvian Agricultural Advisory Center (LAAC) bookkeeping farms data; for 1997 number of farms has been increased to 398 and for 1998 to 825: as an additional source to LAAC bookkeeping farms, data obtained from farms applying for subsidies were used.

Sample of 500 farms for SUDAT has been designed in the spring of year 2000. Farm sample has been designed based on three criteria: type of farming, economical size and region. Due to lack of farm register containing all necessary information for SUDAT: sown areas by different type of crops and number of animals (only data about total agricultural land operated by farm are available in farm registered maintained by CSB) sample has been designed based on the sources of information available at current stage: data from agricultural producers - legal entities and data from 13 thousand farms obtained from farm structural survey.

Farms are classified by three criteria compatible with EU: type of farming, economical size and region. Type of farming and economical size has been based on standard gross margin concept at current stage calculated only for the whole Latvia. Regional breakdown is based on NUTS level 3. Farm business analysis has been performed by regions, by utilized agricultural area, type of farming and economical size of farms.

Only 222 farms out of selected 500 were able and agreed to submit the data for 1999. With a design to have certain number of farms at SUDAT for 1999 as a temporary solution has been accepted to include data from 298 LAAC bookkeeping farms (as an additional source of information).

Therefore the farm account results for 1999 could not be considered as completely representative for Latvian agriculture, but they are able to give some inside view on processes taking place in Latvian agriculture.

2.1.2 FADN data

A. Structure and content of Latvian FADN database

Latvian FADN database has several parts and contains the following data:

- **General data** about the holding,
- **Farm land**: own land, rented agricultural land and land rented out;
- **Labour input**:
  - data about farm manager and holder;
  - annual working units and worked hours in agriculture, forestry and other farm businesses for paid and unpaid labour, regular and casual;
- **Number and value of livestock** at the beginning and at the end of year, average number of livestock by categories:
  - cattle: calves for fattening under 5 months, other cattle less than one year old, male cattle from one to less than two years old, female cattle from one to less than two years old, male cattle two years old or more, breeding heifers, heifers for fattening, dairy cows, cull dairy cows, other cows,
  - pigs: piglets, breeding sows, pigs for fattening, other pigs,
  - sheep: ewes and other sheep,
  - goats, breeding females and other goats,
  - poultry: table chickens, laying hens, other poultry,
  - rabbits, breeding females,
  - horses,
  - other animals,
  - beehives;
- **Movement of livestock**: purchases, birth, sales and farm household consumption by groups pf livestock: cattle, pigs, sheep, goats, poultry, rabbits, horses, other animals, beehives;
- **Production data** by types of crops and livestock products (except data on meat and live animals counted above), processing of agricultural products:
  - use of the agricultural land by crops (except livestock products and processing),
  - opening valuation: stocks and values of products,
  - production for the accounting year: quantities,
  - sold quantities and sales values,
  - quantities and values of farm use: for seeds, for feeding, for processing,
  - quantities and values of farmhouse consumption;
  - closing valuation: stocks and values of products,
- Data about **other farm receipts:** rural tourism, forestry and other farm businesses;
- **Farm costs**:
  - labour and machinery costs: wages paid and social security, contract work, current upkeep of machinery and equipment, motor fuel and lubricants,

- specific costs of crop production: purchased seeds and seedlings, fertilizers and soil improvements, crop protection products, other specific crop production costs,
- specific costs of livestock production: purchased concentrate feed for grazing livestock, other purchased feed for grazing livestock, purchased feed for pigs, purchased feed for poultry and other livestock, insemination and veterinary fees, other specific livestock production costs,
- specific forestry costs,
- other farm businesses specific costs,
- farming overheads: upkeep of land improvements and buildings, electricity, heating fuels, water supply, insurance, environmental tax and other dues, other farming overheads;
- land charges: rent paid, insurance for farm buildings, taxes on land and buildings,
- interest paid: on loans for land and buildings, on loans for machinery and equipment, on other loans,
- extraordinary items,
- income tax on farming activities;

- **Subsidies and state support**: subsidies for crop production, subsidies for livestock production, general subsidies for farm, compensation of excise tax;
- **Fixed farm assets**: agricultural land, forest land and standing timber, buildings, machinery and equipment, circulating capital, financial investments and acquisition costs for quotas and other rights (opening and closing valuation, investment, sales, depreciation);
- **Farm taxes**: opening, closing, calculated and paid value;
- **Farm liabilities:** opening, closing, increase and paid back value**.**

B. Structure and content of Latvian FADN data sent to INRA

Latvian FADN data sent to INRA has several parts and contains the following information:

- **General data:**
  - Exchange rate with EURO,
  - Weight (if the sample is weighted, it is the coefficient with witch the farm represent a number of farm),
  - Accounting year,
  - Country,
  - Region (the typology region, if it exists),
  - Type of farming (type of farming, if it exists),
  - Economic size (in ESU),
  - UAA in owner occupation and rented UAA (ha*100),
  - Age of holder
- **Labour input** (hours and AWU*10):

- Holder,
- Spouse,
- Other family labour,
- Paid labour

- **Average number of livestock** (head*10 and livestock units):
  - Equine,
  - Cattle: calves for fattening, other cattle < 1 year, male cattle 1-<2 years, female cattle 1-<2 years, male cattle > 2 years, heifers (> 2 year), dairy cows, other cows,
  - Breeding goats and other goats,
  - Ewes, other sheep,
  - Pigs: piglets, breeding sows, pigs for fatting,
  - Poultry: table chickens, laying hens, other poultry,
  - Other animal,
- **Value of production: animals (without animal products, LVL):**
  = closing valuation of stocks - opening valuation of stocks + sales + farmhouse consumption - purchases of animals
  - Equine,
  - Cattle,
  - Sheep,
  - Goats,
  - Pig,
  - Poultry,
  - Other animals,
- **Costs (LVL):**
  - labour and machinery costs: wages, contract work, upkeep of machinery and equipment, motor fuel and lubricants, car expenses,
  - specific costs of livestock production: coarse fodder for grazing livestock, purchased concentrate feeding stuffs for grazing livestock, pigs, poultry and others animals, feedstuffs produced on farm: coarse fodder for grazing livestock, for pigs, poultry and others animals, other specific livestock cost (veterinary,…),
  - specific costs of crop production: seed purchased, seed produced at farm, fertilisers, crop protection products, other specific crop costs,
  - specific forestry costs,
  - farming overheads: upkeep of land improvements and buildings, electricity, heating fuels, water supply, insurance (without buildings), taxes (without taxes on land), other farming overheads,
  - land and other charges: rent paid, insurance of farm buildings, taxes on land, total interest paid,- on land, -other interest,

- **Value of production (LVL):**
  1. **with production used on farm:**
     = closing valuation of stocks - opening valuation of stocks + sales + farmhouse consumption + production used on farm
     for forage: = closing valuation of stocks - opening valuation of stocks + sales;
  2. **without production used on farm:**
     = closing valuation of stocks - opening valuation of stocks + sales + farmhouse consumption;
- **Quantities produced with production used on farm (100 kg)**
  = closing valuation of stocks - opening valuation of stocks + sales + farmhouse consumption + production used on farm
- **Areas (ha*100)**

Areas, produced quantities and values of production have been given in details, for wheat, barley, grain maize, other cereals, dry pulses, potatoes, sugar beet, rape, other oilseed, other industrial product, vegetables, flowers, harvested forage, fallow land, temporary grass, forage, others arable crops, meadows and permanent pasture, fruits and berries, others permanent crops, other vegetal product, cows' milk and milk products, sheep milk, goats' milk, wool, eggs, others animal products, forestry products, others receipts.

- **Others variables and controls variables:**
  - Total depreciation, depreciation on buildings, machinery,
  - Current subsidies, investment subsidies,
  - Family farm income,
  - Total capital: - of which land, -of which building, -of which machinery,
  - Long and medium loans, short terms loans and creditors.

Latvian FADN database contains data on costs for current year, but for crop year farms submitted cost adjustment data for crop year valued as one figure. Taking into account low income level in agriculture, Latvian farmers have to find other income sources and for some farms the share of forestry and other industries in the income structure is rather big. FADN data deals only with agriculture and income in forestry, but due to the reason mentioned above, if it was not possible to separate agricultural production, especially for fixed costs, it is allowed to submit all the data including specific forestry costs and specific costs in other occupation. Some big farms are very much involved in other occupation beside the agriculture: process plant and animal products in a quite large scale buying a lot of raw materials from outside, therefore farmers have been asked not only to submit the data about income from processed crop and animal products, but the balance of production (quantities): opening and closing stocks, produced, sold, household consumption, use for seed, for feed and use in other occupation as well.

2.2 Description of the test run of the model with Latvian FADN data

INRA model was run on the basis of prepared and received data. Running the model on FADN data, results were obtained by specified cost items and by different production activity detail levels.

Model inputs

The model allows obtaining results at different cost item detail level. The following cost items were selected:

1) feedstuffs;
2) veterinary;
3) seed;
4) fertilizer;
5) crop protection;
6) petrol;
7) other energy;
8) upkeep building;
9) upkeep machinery;
10) other goods and services;
11) rent paid;
12) interest;
13) taxes (excluding land);
14) depreciation.

The following production activity groups were selected to arrive at a result:

a) 16 activities - wheat, barley, other cereals, potatoes, sugar beets, oilseeds, other field crops, vegetables and fruits, non-agric. activities, other crops, cattle, pigs, poultry, milk, eggs, other animal products;

b) 14 activities - cereals, potatoes, other field crops, vegetables, fruits, non-agric. activities, other crops, cattle, pigs, poultry, other animals, milk, eggs, other animal products;

c) 13 activities – wheat, barley, other cereals, potatoes, other field crops, non-agric. activities, other crops, cattle, pigs, poultry, milk, eggs, other animal products;

d) 11 activities –cereals, potatoes, other field crops, non-agric. activities, other crops, cattle, pigs, poultry, milk, eggs, other animal products;

Test runs

Initially the model was run on all FADN, i.e., on 520 farms. The problem was that two major farms contributed to a visible part of total output in some of the activities (~36%), consequently, the data from these farms had a significant effect on all obtained results. The model was launched once again, however, the two large companies were excluded, and a cost breakdown was obtained which significantly differed from the first attempt.

There was also an experiment to use only farms with crop production or dairy production for the model input data; also the detail level of production activities for which cost breakdown would be calculated was changed.

The reasons for the problems to operate the model on Latvian FADN data were:

1) the high self-consumption level at farms – self-produced seed, feed, as well as consumption by other activities (for the purposes of assessing the products and costs, the model **does not** take into account self-consumption),

2) FADN data base contains both very small farms where only a fraction of output goes to market – more often than not crops are produced nearly exclusively for feed; and some very large farms. There two are completely different groups of farms with differing production technology, utilisation of resources, use of labour and technical support;

3) non-agricultural activities (forestry, tourism, processing etc.), where the costs have not been separated from those of agricultural production.

Outputs

Applying the model on different sets of input data, different cost breakdown variants were obtained. The table below describes the variants obtained.

Table 1.

	Model running code	Number of farm in data set	Description of data set	Number of activities
1	LATOT14A	520	All farms, current year	14 activities
2	LATOT14A w	518	Without 2 large eggs and pigs farms, current year	14 activities
3	LATOT11B	520	All farms, crop year	11 activities
4	LATOT11B w	518	Without 2 large eggs and pigs farms, crop year	11 activities
5	LATOT11BC	61	Only companies, crop year	11 activities
6	LATOT11BF	459	Only family farms, crop year	11 activities
7	LAGC16A	165	Crop farms, current year	16 activities
8	LAGC16B	165	Crop farms, crop year	16 activities
9	LAGC14A	165	Crop farms, current year	14 activities
10	LAGC14B	165	Crop farms, crop year	14 activities
11	LAGC13A	165	Crop farms, current year	13 activities
12	LAGC13B	165	Crop farms, crop year	13 activities
13	LA41_11B	73	Milk+cattle>0,6*total product, crop year	11 activities
14	LAMILK11B	186	Milk+cattle>0,6*total product, crop year	11 activities

There are five summary tables presented in the Annex. The tables give 14 different results for some kind of agricultural activities – cereals, potatoes, milk and pigs. The more realistic and usable variants are marked with dark.

3. COMPARISON OF DATA (RESULTS OF INRA MODEL COMPARED TO ORIGINAL LATVIAN DATA)

Analysing the results of these two approaches, one should, first of all, take into consideration that in both cases the costs have been distributed applying different parameters: in the LSIAE exercise it was based on the planted areas and average number of animals per farm, whereas in the INRA model the costs were distributed proceeding from the output value. It should be taken into account that the INRA model included only the so-called end product, which leaves the farm and is not further consumed in the farm itself (also for other activities). In case of Latvia, farm self-consumption is a significant amount, which might cause a problem to operate the model. For the cost breakdown purposes, in LSIAE, much like in the case of INRA model, linear regression analysis for output value was done as a two-step regression: first, fixed costs or costs applicable to all activities were distributed, and then the calculations were repeated on the basis of planted areas or average number of farm animals.

The cost breakdown performed by the LSIAE was only the first exercise of this kind. Moreover, only the first part of the work was done. The next step would be to apply the results obtained by linear regression method on each farm recorded in the database, and further, from the cost breakdown for each individual farm the cost breakdown for the whole group of farms could be obtained.

The cost items were the same in both approaches, since the INRA model allowed using the same cost item aggregation level, which was used in the Latvian study.

It was more difficult to compare the production activities. Only the main activities, which produce the largest output volumes, were analysed separately by the model, and the rest were aggregated. The model would not give a credible breakdown of costs for activities practised at a small number of farms and contributing a small share in total output value

The tables below provide a cost breakdown comparison for different cost items for selected crop and animal farming activities. Three results were compared. The first column contains data from the INRA model, using FADN database. The second column, "Latvian approach", contains the results of the previous sub-project, where FADN database was used as well. The third column, "old approach", contains the cost coefficients currently in use; their source has been described in Item 1, however, they have not been adjusted with total costs in Latvian agriculture, which are the data of Central Statistical Office.

Table 1. Input coefficients for pesticides and seeds (LVL per ha)

Production activity	Pesticides			Seeds		
	FADN data		Old approach	FADN data		Old approach
	INRA model	Latvian approach		INRA model	Latvian approach	
Wheat	15.9	11.75	27.17	8.3	29.08	15.99
Barley	14.7	8.13	13.00	26.3	6.81	12.93
Other grain products	…	6.31	13.00	…	5.66	12.15
Potatoes	84.6	61.46	28.27	182.9	282.14	156.37
Sugar beets	102.3	150.24	102.00	56.6	89.67	65.00
Rape	…	34.71	39.00	…	18.21	10.14

"…" – means that the figure has either a negative or a high positive value.

Table 2. Input coefficients for veterinary expenses and feeding stuffs (LVL per head)

Production activity	Veterinary expenses			Feeding stuffs		
	FADN data		Old approach	FADN data		Old approach
	INRA model	Latvian approach		INRA model	Latvian approach	
Cattle	4.9	2.05	1.20	5.2	307.18	86.99
Poultry	…	0.11	0.135	…	3.35	1.642
Dairy cows	31.5	15.16	10.64	38.9	2.55	147.19
Pigs	9.7	1.72	0.85	84.5	54.61	69.13

Table 3. Input coefficients for petrol and lubricants, electricity and fuel (LVL per ha or head)

Production activity	Petrol, lubricants			Electricity, fuel		
	FADN data		Old approach	FADN data		Old approach
	INRA model	Latvian approach		INRA model	Latvian approach	
Wheat	33.0	15.7	16.46	1.0	…	1.35
Barley	32.3	14.89	15.38	…	…	1.28
Other grain products	46.8	34.41	16.37	7.2	…	1.28
Potatoes	89.3	47.49	31.56	2.5	1.99	1.35
Sugar beets	46.6	34.42	36.81	1.1	5.72	0.70
Rape	1270.6	13.40	19.47	…	1.90	0.43
Flax		13.40	25.99	…	1.90	0.55
Cattle	34.6	23.40	1.17	3.7	12.75	3.46
Dairy cows	40.6	7.78	1.90	20.0	24.97	10.00
Poultry	…	0.05	0.012	…	0.45	0.42
Pigs	7.9	0.71	0.83	4.5	5.25	2.05

4. ANALYSIS OF DIFFERENCES IN THE DATA

Prior to operating the INRA model, initially it was decided to take all feed costs together, without separating electricity and heating costs, and to take together all service costs. The cost detail level remained the same for variants over the model operation time. The selected activity detail level has been described under Item 2.2.

For some of the items, the difference in data was immense. This is due to the specific features of Latvian agriculture described under Item 2.2, and also due to the fact that some types of activities are represented by a small number of farms. This means that the output of these activities is not high, and the model has a problem to break down the costs for the said activities. In crop production, these activities are vegetable farming, horticulture, oil-seed plants. Poultry is problematic activity in animal farming.

In the model activities with a small output value have been aggregated, for example, other crop production, other animals, other animal production. Also the costs are attributed to these aggregated items – only the largest activities are singled out.

The most credible cost breakdown was obtained for cereals, potatoes, dairy farming and pork production. Standard deviation of the model was taken into account upon assessment, as well as expert assessment whether such costs are possible at all = for some of the activities the costs were either negative of very high-value positive figures.

In one of the working variants of the model the cereals were analysed separately – wheat, barley and others (see Annex, table 5). In this case, major differences between wheat and barley were observed for individual cost items (seed, fertiliser). The case was worse with other crops, because some of the costs were even negative (seed, fertiliser, plant protection chemicals). The explanation could be that barley is prevailingly used for feed, to be consumed at the very same farm. However, the model, as it was already stated, does not take into account self-consumption at farm. The same might be true for other cereals.

The attempt to separate vegetable production from horticulture also ended up with a failure. The data obtained on horticulture were absolutely incredible, and also vegetables had negative figures for some of the cost items (seed, fertiliser).

The model accounts only the procured feed for the calculation of feed costs. This makes the item hard to compare with the existing data.

Beef production did not end up with credible results either. The explanation might be that dairy farming prevails in Latvia, and beef in most cases is a by-product of dairy farming. Similarly, there was a poor success with poultry, because very few farms produce poultry.

5. CONCLUSIONS

The attempt to apply INRA model on FADN database was a very valuable exercise, which allowed mastering the application of a different method on one and the same database. A large quantity of interesting information was obtained, which allows to be analysed in different aspects. The present small study was an attempt to provide a data analysis and a comparison with the already existing cost breakdown by production activity for Latvia.

The analysis of the information generated the following considerations:

1) In future the use of FADN data base for the purpose of breaking down the costs by Agricultural Activity could be a good solution, because FADN data base contains information on farms which do accounting, thus, actual costs are available. The currently used data sources are more built on normative acts and rule of thumb rather than actual average costs in Latvian farms per Agricultural Activity unit.
2) we believe that, for the time being, the application of INRA model for cost breakdown by production activity is quite a problem. The reason is the very situation in Latvian agriculture, and, consequently, in the FADN database. The typical features of Latvian agriculture are:
   - a significant level self-consumption at farms, which is not taken into account by the INRA model;
   - a considerable weight of farms with multiple activities;
   - a rather significant weight of non-agricultural activities, where the costs have not been segregated from agricultural production costs;
   - a large diversity of farms as to their size and technologies used (there exist small family farms, large private farms and companies);
3) INRA model might serve as a good tool for data analysis and for designing a cost breakdown methodology, which would suit the Latvian situation the best. The model offers a cost breakdown and income in different cross-sections – per output value, per output volume, per ha or per animal. It would be valuable to analyse data obtained from different FADN data sets, selecting farms by type of activity or size, or any other criteria. We have a part of these data already available. It is also possible to do some experimenting with cost and activity type detail level. More likely than not, one will not succeed in obtaining a cost breakdown for small-scope (a low output value), or specific (fungus production, individual activities in animal farming) activities;
4) For the time being, it is not possible to name one “best approach”, since none of the applied methods seems fully satisfactory to us. Each of them has its own advantages and drawbacks. The above described features typical to Latvian agriculture (presumably, these might be common for all Eastern Europe countries) put some limitations to the INRA model as it is applied in the EU. The “Latvian approach” to break down costs is not a finalised methodology. Regression analysis technology should be improved – documentation of analysis scenario, building an interface, result export etc. Presently, to obtain a cost

breakdown by production activity in Latvia, also alternative data sources and calculation methods have to be used. Definitely, the work on using FADN data will be continued. It is complicated to apply the same method in Latvia, which is applied on the EU member states, because the situation in agriculture is very different.

5) Prior to be able to use FADN data, there is much work to be done which might take a couple of years, and the first steps could be:
   - Improvement of FADN data set - data quality and representation- as the prerequisite for this is a new farm sample designed on the basis of agricultural census data.
   - A thorough input data preparation for the purpose of each cost item breakdown by Agricultural Activity;
6) Our wish would be to work simultaneously with several methods, which would make the comparison of the obtained results possible. In the long run, thus we could identify the data obtaining approach, which is the best and most convenient for our needs. This is the first year when we are working so seriously to arrive at cost breakdown by production activity. These are the first attempts to use FADN data as a data source and the model as a tool for breaking down these costs.

ANNEX

Table 4. Production costs of cereals (LVL per ha)

	Cost breakdown variants									
	1	**2**	**3**	**4**	**5**	**6**	**9**	**10**	**13**	**14**
Number of fram in data set	520	518	520	518	61	459	165	165	73	186
Feedstuffs	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,0	0,0
Veterinary	0,0	0,0	0,1	0,1	0,0	0,1	0,1	0,1	0,0	0,0
Seed	10,7	10,0	10,3	10,1	7,9	9,3	10,0	9,0	22,2	5,3
Fertilizer	34,3	32,3	31,1	31,0	26,6	23,8	30,1	25,6	53,6	19,5
Crop protection	9,1	9,7	7,8	7,5	-1,9	12,1	14,8	12,7	15,0	-2,6
Petrol	33,7	32,5	31,0	29,9	33,3	30,2	34,0	30,4	45,9	29,5
Other energy	1,1	0,5	1,0	1,4	3,7	0,8	0,9	0,9	-3,2	3,4
Upkeep building	1,2	1,4	1,2	1,4	0,7	1,5	1,2	1,2	4,1	4,8
Upkeep machinery	7,7	7,5	7,5	7,1	25,4	8,7	9,2	9,2	68,2	-22,8
Other goods and services	9,3	25,7	11,3	29,1	-177,8	19,6	25,8	25,0	33,1	10,9
Rent paid	1,9	2,2	1,9	2,0	-3,4	3,0	3,5	3,5	15,4	-1,0
Interest	15,5	18,4	15,9	17,1	-9,3	21,6	22,1	22,1	-4,6	8,0
Taxes (excluding land)	2,1	2,3	2,1	2,4	-2,5	2,5	2,4	2,4	-3,4	-3,2
Depreciation	37,5	37,3	38,0	38,4	23,9	36,8	39,4	39,4	-126,7	21,1
Other subsidies	-36,1	-34,2	-37,4	-37,9	-38,8	-26,9	-21,8	-21,8	0,0	-10,1
Income	2,9	-14,9	8,9	-8,7	232,1	-4,7	-22,5	-10,5	-16,5	46,0
TOTAL	130,9	130,9	130,9	130,9	119,8	138,4	149,2	149,2	103,1	108,9
Paid work	16,2	13,7	17,0	17,3	53,9	4,3	8,4	8,9	3,0	31,8
Family wage	17,5	24792,0	19,6	20,1	0,0	26,5	15,8	16,5	1,0	69,6
Net income excluding family wage	-30,8	-24821,0	-27,7	-46,2	178,3	-35,4	-46,7	-35,9	-20,5	-55,5

Table 5. Production costs of wheat and barley (LVL per ha)

	Cost breakdown variants											
	wheat				barley				other cereals			
	7	**8**	**11**	**12**	**7**	**8**	**11**	**12**	**7**	**8**	**11**	**12**
Number of fram in data set	165	165	165	165	165	165	165	165	165	165	165	165
Feedstuffs	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1
Veterinary	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,2	0,2	0,2
Seed	8,3	5,6	10,4	7,7	26,3	30,7	32,4	36,8	-19,6	-20,5	-19,4	-20,1
Fertilizer	41,2	32,6	41,4	32,7	8,0	16,9	10,1	18,8	-18,4	-20,5	-10,9	-13,3
Crop protection	15,9	12,8	16,1	13,0	14,7	15,4	15,1	15,7	-0,4	-1,6	0,1	-1,2
Petrol	33,0	27,9	33,7	28,5	32,3	33,6	35,6	36,8	46,8	41,6	49,2	43,8
Other energy	1,0	1,0	1,0	1,0	-1,6	-1,6	-1,4	-1,4	7,2	7,2	7,3	7,3
Upkeep building	1,1	1,1	1,0	1,0	2,7	2,7	2,4	2,4	4,6	4,6	4,4	4,4
Upkeep machinery	9,6	9,6	10,1	10,1	6,6	6,6	8,1	8,1	18,9	18,9	18,0	18,0
Other goods and services	37,0	36,1	36,5	35,6	-2,7	-4,8	-3,4	-5,5	14,1	14,6	16,9	17,5
Rent paid	6,7	6,7	6,6	6,6	-3,3	-3,3	-3,6	-3,6	-1,1	-1,1	-1,0	-1,0
Interest	24,7	24,7	25,4	25,4	36,4	36,4	37,3	37,3	-6,5	-6,5	-9,1	-9,1
Taxes (excluding land)	1,9	1,9	2,2	2,2	6,4	6,4	7,0	7,0	2,1	2,1	2,4	2,4
Depreciation	34,4	34,4	36,5	36,5	64,5	64,5	71,4	71,4	18,5	18,5	19,0	19,0
Other subsidies	-9,1	-9,1	-20,6	-20,6	-37,3	-37,3	-59,3	-59,3	-26,2	-26,2	-30,8	-30,8
Income	-21,2	-0,8	-15,7	4,8	-58,9	-72,2	-57,5	-70,4	63,8	72,6	57,7	66,7
TOTAL	184,5	184,5	184,5	184,5	94,1	94,1	94,1	94,1	104,0	104,0	104,0	104,0
Paid work	9,0	9,9	9,2	10,1	5,1	4,2	6,0	5,1	23,6	23,8	22,8	23,0
Family wage	15,5	16,7	16,5	17,8	15,2	12,3	18,1	15,1	28,4	29,2	27,8	28,7
Net income excluding family wage	-45,7	-27,5	-41,4	-23,0	-79,2	-88,7	-81,7	-90,6	11,8	19,6	7,0	15,0

Table 6. Production costs of potatoes (LVL per ha)

	Cost breakdown variants													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Number of farm in data set	520	518	520	518	61	459	165	165	165	165	165	165	73	186
Feedstuffs	0,1	0,1	0,1	0,1	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,0
Veterinary	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Seed	168,7	168,5	157,0	159,5	96,7	138,9	182,9	180,5	187,7	184,6	163,3	160,1	119,2	188,2
Fertilizer	95,3	96,5	87,4	87,7	119,7	95,0	138,7	121,6	146,2	127,9	106,8	91,3	193,2	-505,1
Crop protection	81,2	79,6	72,7	73,1	-21,5	67,0	84,6	82,0	84,4	81,7	79,8	77,8	55,5	-80,4
Petrol	109,3	128,8	99,8	110,8	344,9	68,1	89,3	76,0	90,8	77,3	77,1	65,5	749,0	-441,7
Other energy	-20,9	-25,4	-21,9	-25,4	-124,0	5,2	2,5	2,5	2,7	2,7	1,9	1,9	-37,9	-393,3
Upkeep building	19,3	18,3	18,8	18,2	18,8	10,4	4,0	4,0	3,0	3,0	5,3	5,3	49,7	-56,7
Upkeep machinery	38,9	47,6	40,2	47,5	70,5	13,8	38,0	38,0	37,1	37,1	37,8	37,8	87,2	-224,6
Other goods and services	163,9	23,0	125,6	16,2	207,6	65,3	68,7	68,9	73,3	73,6	63,3	63,1	-273,3	253,3
Rent paid	10,9	9,0	9,7	8,2	26,2	4,7	3,8	3,8	4,7	4,7	4,9	4,9	-130,5	87,1
Interest	85,0	74,1	88,8	81,4	107,9	33,8	43,2	43,2	42,4	42,4	45,5	45,5	198,8	44,4
Taxes (excluding land)	5,8	3,6	4,2	2,7	-16,5	2,4	5,6	5,6	5,5	5,5	2,4	2,4	88,0	-26,1
Depreciation	127,5	114,2	124,5	116,1	316,7	85,0	102,2	102,2	108,7	108,7	84,4	84,4	386,1	1053,5
Other subsidies	-29,5	-38,1	-18,2	-19,4	-275,9	-0,9	-3,2	-3,2	-16,4	-16,4	41,1	41,1	-497,1	-697,6
Income	-1,9	153,8	65,0	177,0	14,5	256,6	182,3	217,5	172,4	209,7	229,0	261,4	-289,9	1546,3
TOTAL	853,7	853,7	853,7	853,7	885,8	845,4	942,6	942,6	942,6	942,6	942,6	942,6	697,9	747,3
Paid work	49,3	43,2	50,7	50,2	333,7	25,7	32,4	33,4	29,5	31,1	32,9	33,8	47,9	338,4
Family wage	146,5	148,3	149,2	149,3	0,0	190,2	74,3	78,4	69,2	73,4	79,9	83,5	579,5	876,1
Net income excluding family wage	-197,7	-37,6	-134,9	-22,6	-319,2	40,8	75,6	105,7	73,7	105,1	116,2	144,2	-917,3	331,8

Table 7. Production costs of milk (LVL per head)

	Cost breakdown variants													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Number of farm in data set	520	518	520	518	61	459	165	165	165	165	165	165	73	186
Feedstuffs	10,2	21,6	10,0	21,6	-6,4	44,8	31,8	31,8	31,8	31,8	31,8	31,8	50,6	38,9
Veterinary	41,8	34,1	41,9	34,1	45,7	34,6	32,8	32,8	32,8	32,8	32,8	32,8	31,7	31,5
Seed	12,2	10,9	10,6	11,0	12,7	5,5	60,5	73,5	33,0	43,7	36,4	50,0	6,7	9,8
Fertilizer	12,8	8,7	11,8	11,7	14,3	4,4	233,4	255,8	244,4	262,0	240,5	263,3	6,6	7,1
Crop protection	8,6	10,0	7,5	7,1	15,1	2,0	-99,6	-84,5	-104,9	-90,3	-101,9	-86,2	2,8	7,9
Petrol	57,6	61,1	55,6	57,4	52,3	53,2	160,6	173,5	150,0	161,0	157,6	170,8	46,9	40,6
Other energy	28,9	25,4	29,2	28,5	40,5	22,8	45,3	45,3	45,6	45,6	45,4	45,4	24,3	20,0
Upkeep building	2,6	2,5	2,5	2,5	1,9	2,3	-2,9	-2,9	-2,7	-2,7	-2,2	-2,2	0,5	0,6
Upkeep machinery	4,9	7,7	4,8	6,9	-9,0	16,2	-15,5	-15,5	-22,8	-22,8	-22,4	-22,4	10,7	0,7
Other goods and services	43,4	30,2	40,8	37,6	103,3	27,7	464,7	466,3	480,8	482,7	474,7	476,8	22,4	28,1
Rent paid	4,5	4,4	4,4	3,9	9,0	2,2	-21,2	-21,2	-16,6	-16,6	-19,9	-19,9	2,1	4,6
Interest	14,3	17,1	13,9	13,7	1,8	28,0	-65,6	-65,6	-79,4	-79,4	-77,8	-77,8	25,5	16,7
Taxes (excluding land)	5,6	5,4	5,6	5,6	8,2	3,8	15,9	15,9	12,2	12,2	13,7	13,7	2,9	5,4
Depreciation	54,2	47,9	53,6	50,8	25,0	67,5	177,5	177,5	137,5	137,5	155,2	155,2	70,4	50,0
Other subsidies	-37,5	-31,1	-37,1	-38,7	-46,8	-26,8	-380,7	-380,7	-323,5	-323,5	-334,5	-334,5	-20,5	-22,1
Income	72,3	80,4	81,2	82,7	62,2	55,3	-331,9	-397,2	-313,4	-369,3	-324,6	-391,9	61,1	97,8
Total	336,5	336,5	336,5	336,5	329,8	343,5	304,7	304,7	304,7	304,7	304,7	304,7	344,8	337,6
Paid work	91,8	87,3	92,1	91,7	145,7	37,2	79,0	70,0	72,4	34,7	70,8	61,6	73,3	80,2
Family wage	45,6	-16828,0	45,5	45,7	0,0	86,6	87,0	77,7	77,7	69,4	80,0	69,8	29,8	40,7
Net income excluding family wage	-65,2	16822,0	-56,4	-54,7	-83,4	-68,5	-497,9	-544,9	-463,6	-503,4	-475,4	-523,3	-42,0	-23,1

Table 8. Production costs of pigs (LVL per head)

	Cost breakdown variants													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Number of farm in data set	520	518	520	518	61	459	165	165	165	165	165	165	73	186
Feedstuffs	152,5	84,5	152,5	84,5	272,7	31,2	10,5	10,5	10,5	10,5	10,5	10,5	-0,8	2,2
Veterinary	10,6	9,7	10,6	9,7	17,4	3,3	4,5	4,5	4,5	4,5	4,5	4,5	0,1	0,4
Seed	1,4	2,4	1,6	2,5	0,7	2,9	-6,1	-6,5	-9,9	-10,2	-8,3	-8,7	0,3	1,3
Fertilizer	0,8	1,4	0,9	1,7	0,5	2,8	-12,2	-9,3	-10,4	-7,6	-10,7	-7,7	0,5	6,3
Crop protection	0,5	0,9	0,5	0,8	0,6	0,8	-1,8	-0,8	-1,4	-0,4	-2,0	-0,9	0,5	0,5
Petrol	6,8	8,2	6,9	7,9	7,7	6,9	2,1	2,8	1,6	2,4	2,2	2,9	1,9	16,3
Other energy	12,7	4,5	12,6	4,5	22,7	2,1	0,4	0,4	0,3	0,3	0,4	0,4	0,2	3,7
Upkeep building	1,1	0,2	1,1	0,2	1,7	0,4	1,5	1,5	1,5	1,5	1,6	1,6	0,4	1,9
Upkeep machinery	4,4	4,0	4,3	4,0	6,6	1,4	3,0	3,0	2,1	2,1	2,2	2,2	1,0	2,2
Other goods and services	118,0	6,4	118,9	6,6	228,0	4,4	-19,9	-19,9	-19,8	-19,9	-18,6	-18,6	-0,4	7,4
Rent paid	0,2	0,0	0,2	0,0	0,7	0,1	-0,8	-0,8	-0,7	-0,7	-0,7	-0,7	0,1	-1,0
Interest	9,9	3,7	10,0	3,7	18,0	1,9	5,2	5,2	4,0	4,0	3,7	3,7	-0,1	2,5
Taxes (excluding land)	2,2	0,4	2,2	0,4	4,1	0,3	-0,2	-0,2	-0,6	-0,6	-0,3	-0,3	0,0	-0,1
Depreciation	12,4	8,0	12,7	7,9	17,2	8,6	-5,3	-5,3	-10,1	-10,1	-7,2	-7,2	-1,1	2,8
Other subsidies	-26,9	-14,3	-27,3	-14,5	-44,7	-12,9	0,0	0,0	0,0	0,0	0,0	0,0	-0,7	-2,4
Income	-114,8	-6,1	-115,8	-5,7	-228,3	2,5	49,5	45,3	58,8	54,7	53,2	48,8	-1,2	-37,1
Total	192,0	114,0	192,0	114,0	325,4	56,7	30,4	30,4	30,4	30,4	30,4	30,4	0,6	7,0
Paid work	22,5	-183,5	22,8	7,6	41,9	3,4	1,3	1,1	1,3	1,2	1,3	1,1	0,1	-1,8
Family wage	6,6	-23067,0	6,3	6,4	0,0	12,8	14,8	13,6	15,9	14,6	15,3	14,0	0,4	-10,7
Net income excluding family wage	-143,8	23245,0	-144,9	-19,8	-270,2	-13,7	33,5	30,6	41,5	38,9	36,6	33,7	-1,7	-24,6