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Modelling of Impacts of the Agricultural Sector on the National Economy of the Czech Republic

Abstract: *Continuous efforts to predict what is the most likely development and importance of the agricultural sector are being made in the long-term perspective. To this end, EAA prediction models (SZU-P1 and SZU-P2) were constructed, and coupled with a model that describes the importance and linkages of the agricultural sector to other sectors within the national economy of the Czech Republic (HDP-1 model). The models described below can be used for measuring and simulation of impacts of the agricultural sector with downstream and upstream industries on the Czech GDP, but also monitoring flows and linkages of the total agri-food industry complex on the national economy.*

Keywords: *Economic Accounts for Agriculture (EAA), national economy, intersectional balances, GDP, HDP-1 model, Leontieff's matrix, Input-Output matrix, predictions*

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Introduction

Economic Accounts for Agriculture (EAA) are compiled on the basis of the Regulation (EC) no. 138/2004 of the European Parliament and Council in all the EU countries. It is an essential instrument to measure the size and economic effectiveness of the agricultural sector. EAA are used to compare effectiveness of agriculture of Member States. In the Czech Republic, EAA are compiled annually by the Czech Statistical Office (CZSO) and published on its website (EAA-CZSO).

EAA can be divided into 4 parts: production account, income account, entrepreneurial income account and capital account. The last account is created only in the final EAA version (see further).

The following terms for sending EAA to Eurostat are obligatory for all the EU Member States:

– the first EAA estimate for year n in November of the n year;
– the second EAA estimate for year n in January of the n+1 year;
– the semi-final EAA version for year n in September of the n+1 year;
– the final EAA version for year n in September of the n+2 year.

From these regulations, it is clear that the delivery date of EEA (the final EAA version has a two-year delay) is very late from the point of view of using the results of agriculture in the form of EAA-CZSO by decision-makers (Ministry of Agriculture of the Czech Republic) and it can be considered rather as conceptual work for the future of the branch (following year and longer period).

For these reasons, the IAEI implemented into its research activities development of mathematical forecasting models of EAA (SZU-P1, SZU-P2), which enable to obtain EAA estimates in advance during the actual year.

Moreover, there was created a new model of national economy balances (HDP-1 model), which draws results for the SZU-P1 and SZU-P2 models and allows to simulate impacts of the agricultural sector on the Czech national economy, including upstream and downstream sectors.

Modelling of EAA

EAA models are mathematical tools for predicting the results of EAA for a given year in advance of the official results of the EAA presented by the CZSO (see above). It is the best and most reliable quantification method of the EAA which will be shown for the needs of decision-makers (during the current year, for a certain time horizon in the context of processing concepts and strategies for the development of the resort, etc.). Modelling of EAA is, therefore, used for projections of the probable agricultural branch development and it is usually based on alternative assumptions (possible scenarios).

Development scenarios are usually formulated in the form of a framework by the Ministry of Agriculture and clarified for modelling needs by the IAEI management in collaboration with the model authors.

Two mathematical models were proposed in the IAEI for predicting the EAA (SZU-P1 and SZU-P2 models), which are based on FADN-CZ data, on the RENT-4 model (see below) and on a combination of empirical and mathematic-statistic procedures.

SZU-P1 and SZU-P2 models

The SZU-P1 model (prediction for the current year) consists of accounts of individual agricultural commodities and draws on data from an existing RENT-4 model and part of STR-1 sub-model (SZU-P2).

The SZU-P2 model (for 3 years in advance) is formed by the regression calculation of seasonal trends based on the IAEI Baseline database.

These models have their own apparatus for predicting prices (CEN-1 and CEN-2 models) based on the CZSO database (Foltýn et al., 2015). Both models were created in Microsoft Excel and use the following sources:

- Mathematical RENT-4 model for economic predictions of profitability of 37 major commodities of the Czech agriculture (Foltýn, Zedníčková, 2012).
- CZSO time series of prices (month periodicity) of agricultural producers (CZV), and yearly price averages.
- CZSO time series of selected indicators of EAA.
- Internal IAEI Baseline database (time series of natural and economic indicators of agriculture).

EAA predictions for the current year

The SZU-P1 model described in the previous sections can be used to predict future EAA for the current year. For this prediction the following input information are needed:

- Anticipated revenues and expenses for each commodity: prediction RENT-4 model.
- Projections of CZV: for this purpose there was created a predictive CEN-1 model, on the basis of monthly time series from 2000 to 2014, which predicts average annual prices of agricultural commodities for 2014.
- Projections of areas and head numbers of individual agricultural commodities: for this purpose there was developed a predictive STR-1 model (which is based on annual time series for all commodities of the RENT-4 model) which provides forecasts for the current year.

– Projections of agricultural subsidies: The prediction of the expected support of individual agricultural commodities under the rules and objectives of the Common Agricultural Policy for the period after 2013.

Model projections of EAA for 2015 by the SZU-P1 model is presented in table 1.

Table 1. The SZU-P1 model – Prediction of Economic Account for Agriculture for 2015

EAA Code	Indicator	Model SZU-P1: S-Reality, P-Prediction				EAA by CZSO - reality		
		2012-S	2013-S	2014-S	2015-P	2012	2013	2014
01	CEREALS INCLUDING SEEDS	35 645	33 827	38 764	31 770	32 362	32 549	33 857
02	INDUSTRIAL CROPS	18 491	19 966	22 024	21 092	19 039	20 628	21 482
03	FODDER CROPS	11 348	12 591	13 079	13 449	10 291	11 751	12 853
04	VEGETABLES AND HORTICULTURAL PRODUCTS	5 331	5 647	5 868	5 723	5 170	5 383	5 670
05	POTATOES INCLUDING SEEDS	3 251	4 450	4 908	2 025	1 924	2 562	2 723
06	FRUIT	1 351	1 560	1 485	1 449	1 281	1 373	1 293
07	WINE	774	935	935	935	774	935	804
08	OLIVE OIL	0	0	0	0	0	0	0
09	OTHER VEGETABLE PRODUCTS	830	777	777	777	830	777	861
10	VEGETABLE PRODUCTION (01….09)	77 021	79 754	87 840	77 220	71 671	75 957	79 544
11	ANIMALS	21 017	22 207	20 702	20 755	21 901	22 284	22 612
12	ANIMAL PRODUCTS	23 831	25 453	29 284	24 035	23 117	24 612	28 957
13	ANIMAL PRODUCTION (11+12)	44 848	47 661	49 985	44 790	45 017	46 895	51 569
14	AGRICULTURAL PRODUCTS OUTPUT (10+13)	121 868	127 415	137 825	122 010	116 688	122 853	131 113
15	AGRICULTURAL PRODUCTS SERVICES	3 082	2 774	2 832	2 832	3 082	2 774	2 832
16	AGRICULTURAL PRODUCTION (14+15)	124 951	130 189	140 658	124 842	119 770	125 627	133 945
17	NON-AGRICULTURAL SECONDARY ACTIVITIES (INSEPARABLE)	2 468	2 597	2 630	2 630	2 468	2 597	2 630
18	AGRICULTURAL SECTOR PRODUCTION (16+17)	121 868	127 415	137 825	122 010	122 239	128 223	136 575
19	INTERMEDIATE CONSUMPTION	79 162	87 769	91 129	95 224	88 247	90 767	94 776
20	GROSS VALUE ADDED IN BASIC PRICES (18-19)	37 426	34 147	41 163	21 312	33 991	37 456	41 799
21	FIXED ASSETS CONSUMPTION	17 076	16 096	15 081	15 267	15 023	15 584	16 051
22	NET VALUE ADDED IN BASIC PRICES (20-21)	20 350	18 051	26 083	6 045	18 968	21 872	25 748
23	RENUMERATIONS TO EMPLOYEES	25 297	24 125	25 064	25 695	24 828	25 550	26 163
24	OTHER TAXES ON PRODUCTION	0	0	0	0	1 219	1 146	1 197
25	OTHER SUBSIDIES ON PRODUCTION	26 030	26 390	26 791	25 223	29 283	27 504	30 896
26	INCOME FACTOR (22-24+25)	46 380	44 441	52 874	31 269	47 032	48 230	55 447
27	NET OPERATING SURPLUS/MIXED INCOME (26-23)	21 083	20 315	27 810	5 574	22 204	22 680	29 284
28	OBLIGATORY RENT AND OTHER REAL ESTATE RENTS	0	0	0	0	4 511	5 037	5 541
29	INTEREST PAYABLE	0	0	0	0	1 787	1 816	1 366
30	INTEREST RECEIVABLE	0	0	0	0	423	420	494
31	BUSINESS INCOME (26-23-28-29+30)	21 083	20 315	27 810	5 573	16 329	16 248	22 871

Source: own calculations.

EAA predictions for a longer period

While the SZU-P1 model is based on commodity accounts, the SZU-P2 model is based on projections of all 31 indicators of EAA-CZSO. The RV and ZV accounts of the SZU-P2 model use the commodity structure from the RENT-4 model. The intermediate consumption and final account indicators (19-31) in the SZU-P2 model are based on the time series (table 2).

The SZU-P2 model is based on the regression of seasonal trends (see below) in prices, crop areas hectare yields, animal intensity and animal units from which the values of the total output indicators for agriculture are calculated. Furthermore, with the help of seasonal trends cost items and other indicators of EAA are calculated. Predictions of subsidies are taken from the rules of Agrarian Policy of the EU CAP for the period up to 2020.

The basic input source into the SZU-P2 model is the IAEI Baseline database that collects long-time series of natural and economic data for all important agricultural commodities.

The aim of the SZU-P2 model is to create a complex predictive model of EAA. This model consists of sub-models that predict separately harvest area and the animal units (STR-1), yields and animal intensities (INT-1), producer prices (CEN-2) and the cost and other items of EAA (NAK-1).

Projections take place in each sub-model individually for the monitored commodities (RENT-4 model) and for the cost and other items of EAA, for which the time series since 2000 are used.

Table 2. The SZU-P2 model – Prediction of Economic Account for Agriculture for 2015-2017

EAA Code	Indicator	Model SZU-P2: S-reality, P-prediction						EAA by CZSO - reality		
		2012-S	2013-S	2014-S	2015-P	2016-P	2017-P	2012	2013	2014
01	CEREALS INCLUDING SEEDS	35 505	33 738	32 202	36 519	39 186	39 475	32 362	32 549	33 857
02	INDUSTRIAL CROPS	19 722	21 548	20 554	22 326	23 041	25 586	19 039	20 628	21 482
03	FODDER CROPS	10 291	11 751	10 498	10 960	11 340	11 719	10 291	11 751	12 853
04	VEGETABLES AND HORTICULTURAL PRODUCTS	5 170	5 383	6 152	6 395	6 600	6 797	5 170	5 383	5 670
05	POTATOES INCLUDING SEEDS	4 054	3 333	3 245	3 008	2 505	2 395	1 924	2 562	2 723
06	FRUIT	1 291	1 330	1 392	1 434	1 396	1 363	1 281	1 373	1 293
07	WINE	774	935	1 081	1 158	1 173	1 257	774	935	804
08	OLIVE OIL	0	0	0	0	0	0	0	0	0
09	OTHER VEGETABLE PRODUCTS	830	777	782	746	682	629	830	777	861
10	VEGETABLE PRODUCTION (01….09)	77 637	78 795	75 905	82 546	85 924	89 221	71 671	75 957	79 544
11	ANIMALS	23 704	23 708	25 526	22 545	22 385	22 071	21 901	22 284	22 612
12	ANIMAL PRODUCTS	26 443	27 682	28 486	24 938	24 836	24 780	23 117	24 612	28 957
13	ANIMAL PRODUCTION (11+12)	50 147	51 391	54 012	47 483	47 221	46 850	45 017	46 895	51 569
14	AGRICULTURAL PRODUCTS OUTPUT (10+13)	127 784	130 185	129 917	130 029	133 144	136 071	116 688	122 853	131 113
15	AGRICULTURAL PRODUCTS SERVICES	3 082	2 774	2 787	2 589	2 310	2 048	3 082	2 774	2 832
16	AGRICULTURAL PRODUCTION (14+15)	121 749	123 843	132 704	132 617	135 454	138 120	119 770	125 627	133 945
17	NON-AGRICULTURAL SECONDARY ACTIVITIES (INSEPARABLE)	0	0	0	0	0	0	2 468	2 597	2 630
18	AGRICULTURAL SECTOR PRODUCTION (16+17)	121 749	123 843	121 216	121 137	123 728	126 163	122 239	128 223	136 575
19	INTERMEDIATE CONSUMPTION	88 247	90 767	88 168	86 757	88 032	89 477	88 247	90 767	94 776
20	GROSS VALUE ADDED IN BASIC PRICES (18-19)	33 502	33 075	33 048	34 380	35 696	36 685	33 991	37 456	41 799
21	FIXED ASSETS CONSUMPTION	15 023	15 584	15 584	15 861	16 128	16 312	15 023	15 584	16 051
22	NET VALUE ADDED IN BASIC PRICES (20-21)	18 479	17 492	17 463	18 519	19 568	20 373	18 968	21 872	25 748
23	RENUMERATIONS TO EMPLOYEES	24 828	25 550	25 797	25 846	25 964	26 163	24 828	25 550	26 163
24	OTHER TAXES ON PRODUCTION	1 219	1 146	1 121	1 106	1 063	1 013	1 219	1 146	1 197
25	OTHER SUBSIDIES ON PRODUCTION	29 283	27 504	31 354	32 520	33 085	33 449	29 283	27 504	30 896
26	INCOME FACTOR (22-24+25)	46 543	43 850	47 696	49 933	51 591	52 809	47 032	48 230	55 447
27	NET OPERATING SURPLUS/MIXED INCOME (26-23)	28 064	26 358	30 233	31 414	32 023	32 436	22 204	22 680	29 284
28	OBLIGATORY RENT AND OTHER REAL ESTATE RENTS	4 511	5 037	4 927	5 118	5 363	5 509	4 511	5 037	5 541
29	INTEREST PAYABLE	1 787	1 816	1 313	1 358	1 296	1 259	1 787	1 816	1 366
30	INTEREST RECEIVABLE	423	420	461	412	396	371	423	420	494
31	BUSINESS INCOME (26-23-28-29+30)	15 839	11 867	16 120	18 024	19 364	20 250	16 329	16 248	22 871

Source: own calculations.

Modelling of the national economy balances (HDP-1 model)

Based on the requirements of the Ministry of Agriculture, Agrarian and Food Chamber this year the question appeared of how to measure the size of agriculture, including the upstream and downstream sector, in the whole range and how to measure impact on the national economy (NE). To this end, the HDP-1 model was designed based on the Input-Output method (I/O method) inter-sectoral and interdisciplinary relations in the NE (Leontieff 1941, 1986; Korda, 1967).

Agriculture sector on a large-scale can be defined by the sectors of the national economy, such as the agricultural sector, which is 01 (agriculture), 02 (forestry and logging) and 03 (fisheries and aquaculture). For full expression of linkages between agriculture affecting food production the paper uses the term agro complex, which is defined by sectors of the agrarian sector (01, 02, 03) and sector 10 (manufacture of food products) and sector 11 (beverages).

The size of agriculture can be measured by two approaches in the national economy. In the first approach, the size of agriculture is measured by production of all enterprises, which have predominant agricultural activity. In the second approach, the size of agriculture is measured by the sum of all agricultural activities of all enterprises in the Czech Republic (which is contained in the EAA). It is an agricultural activity in both businesses, dominated by agricultural activity, as well as in other companies, which have agricultural activity within their production activities.

The Czech Statistical Office monitors the national economy (NE), divided into sectors (sum for all companies of the sector with predominant activities in this sector). The agricultural sector is thus defined in the NE-balances of the CZSO as the sum of companies with predominant agricultural activities.

For this reason, the HDP-1 model uses the clean agricultural production of the EAA results. Due to the results of the SZU-P1 and SZU-P2 models it is possible to simulate the impact of the agrarian sector in the NE for several years ahead, or perform pre-defined simulation.

Leontieff's matrix of Inter-sectoral relationships (Input-Output matrix)

The basic economic instrument for measuring the importance of agriculture on the scale of the national economy is the Leontieff's matrix of inter-sectoral relations. The matrix model has the following structure:

Let us denote 1, 2, ..., n sectors of the national economy and Xi total output of the sector in terms of value. Thereafter, for the sector i = 1, 2, ..., n there can be formulated an equation system (I/O matrix):

$$D1 + X1 = Z1,1 + Z1,2 + ... + Z1,n + Y1$$
$$D2 + X2 = Z2,1 + Z2,2 + ... + Z2,n + Y2$$
$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$
$$Dn + Xn = Zn,1 + Zn,2 + ... + Zn, n + Yn,$$

where:
Di is the value of imports and production of the sector i,
Zi,j is intermediate consumption, i.e. the part of sector i and production (taking into account imports), which delivers the sector i and the manufacturing industry j = 1,2, ..., n,
Yi is the final production, i.e. the total volume of production in the sector which leaves the production sector (accounting for exports).

Rows of the matrix represent deliveries of the production of one sector (line) to all branches (columns) the matrix columns. Columns of the matrix represent deliveries of supplies from all sectors (lines) to one sector (column). I/O matrix is a square matrix (nxn) and includes the so-called inter-sectoral deliveries (diagonal elements Zi,i), where production of the industry was partially consumed in the same industry.

I/O matrix – static approach

The CZSO monitors the national economy annually using the Leontieff's matrix.

The individual sectors include production of all enterprises with predominant activity, which is given the name of the sector. For example, the sector 01 includes all production activities of farms in the CR (including hunting), which represent both a purely agricultural activities (crop and livestock production) and non-agricultural activities (construction production, transport, etc.). In a broader definition of agriculture it contains agriculture (01), forestry (02) and fisheries (03) which usually occur in the statistical sources of the Czech Statistical Office.

Supply sources include the most important items of domestic production, imports and other items (fig. 1). Final consumption includes expenditure of households, government and non-profit organisations and export.

For the purpose of measuring the significance of the agricultural sector, the study used the latest available data from the CZSO I/O matrix for 2012.

CZ-NACE	X	D							Interdisciplinary matrix of consumption for manufacturing Z						Y							Y+Z
		SOURCES OF SUPPLY							CZ-NACE sector						Final consumption expenditure							
	Production of basic commodities prices	Import	VAT	Taxes on products without VAT	Subsidies on products	Trading range	Transport margins	Total supply purchase price							Household	Government	Non-profit inst.	Gross fixed capital formation, Incl. Valuable	Changes in inventories	Export (FOB)	Final uses in total	Used sources total
	P.1	P.7	D.211	D.212+D.214	D.319				01	02	.	.	.	99	P.3			P.51+P.52	P.52	P.6		
01 Agriculture	x1	d1,1	d1,2	.	.	.	d1,6	x1+∑d1,j	z1,1	z1,2	.	.	.	z1,99	y1,1	y1,2	.	.	.	y1,6	∑y1,j	∑z1,j+∑y1,j
02 Forestery	x2	d1,2	d2,2	.	.	.	d2,6	x2+∑d2,j	z2,1	z2,2	.	.	.	z2,99	y2,1	y2,2	.	.	.	y2,6	∑y2,j	∑z2,j+∑y2,j
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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99 Services	x99	d1,99	d2,99	.	.	.	d99,6	x99+∑d99,j	z99,1	z99,2	.	.	.	z99,99	y99,1	y99,2	.	.	.	y99,6	∑y99,j	∑z99,j+∑y99,j

Figure 1. Scheme of I/O matrix by the Czech Statistical Office

Source: own calculations.

Table 3 shows how to participate in the agriculture and forestry production use in other sectors of the NE. In the rows 01-03 of I/O matrix it selects only significant flows into other sectors. Table 4 shows other sectors of production through the NE industries involved in the production of agricultural and forestry sectors and selects significant flows of I/O matrix from different sectors in columns from 1 to 3.

Table 3. Matrix of supply and use – Agricultural sector – customer relationships in 2012 (CZK million)

Commodity production [1]	Import	CZ-NACE	Commodity name	CZ-NACE Sectors															
				Agriculture	Forestery and logging	Fishing and aquaculture	Food products	Beverages	Tobacco products	Textiles products	Wood and corc products	Paper products	Chemicals products	Electricity, gas and heat products	Wholesale trade, except of motor vehicles	Retail, except of motor vehicles	Accommodations	Catering	Activities related to construction.
				01	02	03	10	11	12	13	16	17	20	35	46	47	55	56	81
182 149	50 024	01	Agricultural and hunting products	20 778	899	0	77 968	13 741	4 786	4 218	12	3	1 476	1 019	4 524	1 311	1 737	13 254	1 860
42 438	4 454	02	Forestry and logging products	28	8 892	0	6	83	0	20	19 689	2 553	0	148	2	0	0	0	0
1 951	904	03	Fish, aquaculture	0	3	15	850	0	0	0	0	0	0	0	0	0	0	0	5
184 100	50 928	01+03	Agriculture [2]	20 778	902	15	78 818	13 741	4 786	4 218	12	3	1 476	1 019	4 524	1 311	1 737	13 254	1 865
226 538	55 382	01+02+03	Agrarian sector [3]	20 806	9 794	15	78 824	13 824	4 786	4 238	19 701	2 556	1 476	1 167	4 526	1 311	1 737	13 254	1 865

1) In basic prices.

2) Agriculture – specific term = 01 agricultural +03 fish, aquaculture.

3) Agricultural sector = 01 agricultural and hunting products +03 fish, aquaculture +02 forest products, timber production.

Source: ČSÚ (http://apl.czso.cz/pll/rocenka/rocenkaout.dod_uziti?mylang=CZ); own calculations.

When limited to agricultural production, tables 3 and 4 show that the focus should be only on the sectors 01 and 03. This demonstrates the I/O matrix in the column 10 (manufacture of food products), which shows production delivered from the sector 01 in total value of CZK 78.0 billion, then it shows production from the sector 03 in the value of CZK 0.9 billion and, finally – production from the sector 02 in value of only CZK 0.006 billion.

Table 4. Matrix of supply and use – Agricultural sector – supply relationships in 2012 (CZK million)

Commodity production 1)	Import	CZ-NACE	Commodity name	Agriculture	Forestery and logging	Fishing and aquaculture	Agriculture 2)	Agrarian sector
				01	02	03	01+03	01+02+03
182 149	50 024	01	Agricultural and hunting products	20 778	899	0	20 778	21 677
42 438	4 454	02	Forestry and logging products	28	8 892	0	28	8 920
1 951	904	03	Fish, aquaculture	0	3	15	15	18
249 114	121 223	10	Food products	40 895	21	2	40 897	40 918
26 186	41 747	14	Clothing	1 025	1 301	10	1 035	2 336
82 703	15 757	16	Wood and cork products	247	1 505	1	248	1 753
147 529	64 810	19	Coke and refined oil products	10 252	2 317	23	10 275	12 592
153 316	215 696	20	Chemicals and chemical products	14 849	199	53	14 902	15 101
298 883	127 542	28	Machines and equipment	2 777	693	207	2 984	3 677
121 833	4 650	33	Repair, maintenance and installation of mach. Equipment	3 274	501	60	3 334	3 835
439 068	31 129	35	Electricity, gas, heat and air conditioning	2 598	145	15	2 613	2 758
4 386	20 640	43	Specialised construction works	555	1 336	12	567	1 903
306	4 725	45	Wholesale and retail with motor vehicles	943	1 198	2	945	2 143
208 698	17 666	52	Storage and supporting sevices in transport	1 276	1 092	1	1 277	2 369
209 496	4 240	64	Financial services	2 586	631	10	2 596	3 227
3 694	0	75	Veterinary services	2 362	1	0	2 362	2 363

1) In basic prices.
2) Agriculture – specific term = 01 agricultural +03 fish, aquaculture.
3) Agricultural sector = 01 agricultural and hunting products +03 fish, aquaculture +02 forest products, timber production.

Source: ČSÚ (http://apl.czso.cz/pll/rocenka/rocenkaout.dod_uziti?mylang=CZ); own calculations.

The I/O matrix – dynamic approach

The I/O matrix shows a list of all sectors in rows and columns and relations between them determine production to other sectors. From the intersection of the row and column of the I/O matrix it can be seen how much of the sector A enters into an intermediate consumption of sector B, and vice versa. It can be calculated what volume of agricultural production goes not only to food, but also to the whole economy (rows of the I/O matrix). In the opposite direction, it can be calculated how much production goes into agriculture economy, and it is so "invoked" (column of the I/O matrix).

Leontieff's table should only be based on inter-sectoral flows of production, regardless of who is the producer in the domestic economy. Unfortunately, this is not available, and there are only data on the production of enterprises of the sector. This may in some cases lead to distorted results. For this reason, all countries construct the Economic Accounts for Agriculture (Economic Account of Agriculture, EAA), whose structure is defined by Eurostat annually. For the Czech Republic, for the past year, it was compiled by the CZSO and, therefore, it is the best available source of the data on agricultural production in the Czech Republic.

Cleaning of imports

Particular attention should be paid to imports. Leontieff's table allocates overall "source of supply" to individual sectors for their use, i.e. for intermediate consumption. Among these, in addition to domestic production (which we are

interested in and we will have decrease variants), are counted as imports (and other small sources have a rather accounting character). Recognized production of agriculture is entering into other sectors and includes the imports of agricultural products, and these need to be deducted, because of our varieties dynamic effect. We will consider only the decrease in domestic agricultural production, not humiliation category "production + imports" (in fact, on the contrary, increased imports decline in domestic production). Here, it was necessary to apply a presumption of proportionality. In each sector we know each other share of imports and its own production, so the impact of agriculture on other sectors (and the whole economy) has been adjusted for imputed volume of imports under the "sources of supply" of the sector.

Simulations of importance and size of agriculture in the national economy

Assumptions of model simulations
Initial state: data for 2012.
Variants of simulations: decrease in production by 5, 10 and 30%.

Data Sources:

- CZSO 2012;
- Report on the State of Agriculture 2013;
- IAEI Baseline Database.

Used modelling tools:

- HDP-1 model based on the I/O matrix of the CZSO for 2012 and its implementation in Excel,
- SZU-P2 model in GAMS optimization system,
- Statistical regression functions.

In table 5, there are interpreted results of impact simulations of size of the agricultural sector in the Czech Republic, by HDP-1 model. Significant agricultural GDP was measured as a share of GDP of individual sectors (01, 02, 03, 10 and 11), which consists of agribusiness in the Czech Republic in the Czech GDP.

The ratio of agro complex to GDP (last column) does not match the simple sum of shares of individual sectors in the GDP due to the fact that there are very strong links between sectors of the agro complex (between agriculture and food production of the sectors and vendors). These ties were considered and eliminated in the calculations.

Table 5. Model simulations – share of agriculture in specific term on GDP of the Czech Republic

CZ-NACE	Agriculture 01	Forestry and logging 02	Fisheries and aquaculture 03	Food products 10	Beverages 11	Agrarian sector 01+02+03	Agrocomplex 01+02+03+10+11
	Status of year 2012						
The share of industry in GDP in National Economy (incl. taxes and grants)	2,26%	0,80%	0,02%	1,52%	0,76%	3,09%	
The share of domestic suppliers inputs to industry	0,91%	0,22%	0,01%	1,56%	0,20%	1,13%	
The share of GDP generated by other industries by delivering industry	1,57%	0,33%	0,01%	1,56%	0,10%	1,91%	
The share of exports in the production sector in the national economy	0,37%	0,08%	0,01%	0,97%	0,16%	0,47%	
TOTAL industry share in GDP sectors, including upstream and downstream sectors	**5,11%**	**1,43%**	**0,05%**	**5,61%**	**1,22%**	**6,60%**	12,20%
	Reduced production by 5 %						
The share of industry in GDP in National Economy (incl. taxes and grants)	2,15%	0,80%	0,02%	1,52%	0,76%	**2,97%**	
The share of domestic suppliers inputs to industry	0,90%	0,21%	0,01%	1,56%	0,20%	**1,13%**	
The share of GDP generated by other industries by delivering industry	1,52%	0,32%	0,01%	1,56%	0,10%	**1,85%**	
The share of exports in the production sector in the national economy	0,38%	0,08%	0,01%	0,97%	0,16%	**0,47%**	
TOTAL industry share in GDP sectors, including upstream and downstream sectors	**4,95%**	**1,42%**	**0,05%**	5,61%	1,22%	**6,42%**	12,04%
	Reduced production by 10 %						
The share of industry in GDP in National Economy (incl. taxes and grants)	2,04%	0,80%	0,02%	1,52%	0,76%	**2,86%**	
The share of domestic suppliers inputs to industry	0,90%	0,21%	0,01%	1,56%	0,20%	**1,12%**	
The share of GDP generated by other industries by delivering industry	1,49%	0,30%	0,01%	1,56%	0,10%	**1,80%**	
The share of exports in the production sector in the national economy	0,38%	0,08%	0,01%	0,97%	0,16%	**0,47%**	
TOTAL industry share in GDP sectors, including upstream and downstream sectors	**4,80%**	**1,40%**	**0,05%**	5,61%	1,22%	**6,25%**	11,89%
	Reduced production by 30 %						
The share of industry in GDP in National Economy (incl. taxes and grants)	1,58%	0,80%	0,02%	1,52%	0,76%	**2,41%**	
The share of domestic suppliers inputs to industry	0,88%	0,20%	0,01%	1,56%	0,20%	**1,09%**	
The share of GDP generated by other industries by delivering industry	1,34%	0,24%	0,01%	1,56%	0,10%	**1,59%**	
The share of exports in the production sector in the national economy	0,38%	0,08%	0,01%	0,97%	0,16%	**0,47%**	
TOTAL industry share in GDP sectors, including upstream and downstream sectors	**4,18%**	**1,33%**	**0,05%**	5,61%	1,22%	**5,56%**	11,27%

Source: own calculations.

1) From the static modelling approach (reality 2012) the following values of GDP were obtained:
   - share of agriculture (sector 01) = 2.26% of GDP,
   - share of the agricultural sector (sectors 01, 02, 03) = 3.09% of GDP,
   - share of agro complex (sectors 01, 02, 03, 10, 11) = 12.19% of GDP,

2) From the dynamic modelling approach (simulation of decreasing agricultural production by 5, 10 and 30%) the following GDP value changes were obtained:
   - share of agriculture (sector 01) = GDP decrease to 2.15%, 2.04%, 1.58% , respectively;
   - share of the agricultural sector (sectors 01, 02, 03) = GDP decrease to 2.97%, 2.86%, 2.41%, respectively.
   - share of agro complex (sectors 01 to 03, 10, 11) = GDP decrease to 12.04%, 11.89%, 11.27%, respectively.

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