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MODELLING THE MULTIFUNCTIONALITY OF CZECH AGRICULTURE

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TOMÁŠ DOUCHA AND IVAN FOLTÝN*

Abstract

The transformation of Czech agriculture since 1990 under the different stages of agricultural policy has resulted in the emergence of a strong, dual farm structure with a high share of leased land and profit-maximising (vs. family) farms. This working paper assesses the current situation concerning the multifunctional aspects of Czech farms. Applying a non-linear optimising model (FARMA 4), this study simulates the effects of different policy scenarios up to 2010 on the selected set of indicators of multifunctionality for eight farm categories (differentiated into three regions and by profit/income orientation). Under all the scenarios, there is a tendency towards a more extensive level of production with lower labour input, particularly by the profit-oriented farms that prevail in Czech agriculture.

Key words: Czech Republic, agriculture, agricultural policy, multifunctionality, land use, structure of production

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Introduction

The transformation of the Czech agricultural sector and its adjustment to new social and economic conditions has been ongoing since 1990, after the velvet revolution. The substance of the transformation consists of the restitution of ownership rights and titles for agricultural assets (property transformation) and of the restructuring of farms, their production and land use. Since the latter half of the 1990s, the restructuring has also been linked with the development of the multifunctionality of Czech agriculture. This orientation has gained importance since the accession of the Czech Republic to the EU in 2004, the entry of Czech farms into the EU Single Market under the conditions of the common agricultural policy (CAP) and the European model of agriculture.

In part 1 this paper summarises the actual state of Czech agriculture after 15 years of transformation, with the stress placed on its multifunctional characteristics and on the conditions influencing multifunctionality. Applying a non-linear optimising model and using data from the Farm Accountancy Data Network (FADN) and other parameters (in part 2), the impacts are simulated of defined policy scenarios up to 2010 (in part 3) on production structure and the multifunctionality of Czech agriculture (in part 4). The effects on individual farm categories are projected, defined according to regional aspects and their expected behavioural formulas and responses to policy stimuli. The most important policy issues derived from the simulations are presented in the conclusions.

The multifunctionality of agriculture – its positive externalities as public goods related to the environment and to rural development – is defined according to the methodology presented in Guyomard (2006) and in Dwyer et al. (2005). The indicators of multifunctionality are also derived from the referenced ENARPRI Working Papers, which can be adjusted to the possibilities of the applied mathematical model. The same point applies to the definitions of the policy scenarios.

1. The multifunctionality of Czech agriculture – State of the art

1.1 Czech agricultural policy

The multifunctionality of the Czech agricultural sector has been developing under the conditions determined by agricultural and other policies and the general institutional framework of society. Up to the mid-1990s, Czech agricultural policy was prevailingly oriented towards property transformation in the sector and income support for the emerging new farm structures. After 1994, the following stages of Czech agricultural policy can be observed, as outlined below (see Table 1).

Table 1. Annual budgetary supports for Czech agriculture 1995-2005, by policy goals

Goals	1995–97 CZK (millions)	%	1998–2003 CZK (millions)	%	2004–05 CZK (millions	%
Restructuring	4,635	41.38	5,457	30.27	4,878	16.13
Incomes	2,208	19.72	6,780	37.61	16,756	55.42
Environment	2,469	22.04	5,518	30.61	7,993	26.44
Consumers	1,888	16.86	271	1.50	609	2.01
Total	*11,199*	*100.00*	*18,025*	*100.00*	*30,235*	*100.00*
Of which environment						
Landscape, LFA	1,742	70.54	3,087	55.94	4,595	57.49
Water, soil	20	0.82	137	2.48	714	8.93
Biodiversity	232	9.40	337	6.10	1,057	13.22
Ecological farming	0	0.00	141	2.55	240	3.01
Forestry, rural[1)]	24	0.96	72	1.31	746	9.33
Non-food use	451	18.28	1,745	31.62	642	8.03
Total	*2,469*	*100.00*	*5,518*	*100.00*	*7,993*	*100.00*

[1)] The only support available under the agricultural policy.

Source: Database of agricultural policy, VUZE, Prague.

1995–97: Restructuring

Agricultural policy in the period 1995–97 was characterised by the following main features:

- continuing support for restructuring and stabilising the new emerging farm structure (41% of all budgetary support);
- introduction of new support for grassland in 'less favoured areas' (LFAs) in order to maintain the landscape;
- support for the environment and multifunctionality was mainly through LFA payments, but also through new support given for non-food use of agricultural production (mainly for biofuel);
- a higher level of protection for domestic consumers through administrative barriers for exports (cereals, oilseeds, etc.); and
- protection for domestic producers at the general level agreed in the Uruguay Round of the GATT (approximately 2-2.5 times lower than EU protection), which was only slightly eroded by bilateral and multilateral trade agreements (e.g. Central European Trade Agreement).

1998–2003: CAP-like policy

Agricultural policy in the period 1998–2003 was oriented towards a gradual adjustment to the CAP and future EU accession, and was characterised by these key features:

- a growing total level of support (by more than 60% in nominal terms compared with the previous period), particularly in the category of income support (38% of all budgetary support), based on CAP-like marketing organisations and measures;

- a growing share of support for the environment and multifunctionality (31% of all budgetary support), with the implementation of less favoured area (LFA) payments and the continuing high level of support for non-food uses of agricultural production (biofuel); and
- a decrease in the actual tariff protection through the implementation of new trade agreements with the EU ('double-profit' and 'double-zero' agreements), but with the protection levels still remaining on a higher level than in the EU.

2004–05: CAP

Czech agricultural policy in the first years after EU accession (2004–05) has been characterised by the main features below:

- a sharp increase in the total level of budgetary support (by 68% compared with the previous period);
- a prevailing share of income support in the total package of budgetary support (more than 55%). Income support in the form of direct payments has consisted of decoupled SAPS[1] payments and coupled national, complementary, direct payments (the so-called 'top-up payments'). Yet with a high share of coupled top-up payments, all the direct payments have functioned as coupled support during this start-up period;
- direct payments have been conditioned on 'good farming practices', but with reduced enforcement;
- an increase of support for the environment and multifunctionality, with a prevailing share of LFA payments and a growing share of other support (biodiversity and rural development), but with a sharp decrease of the budgetary support for biofuel (as a consequence of EU regulations in this sector). Owing to relatively weak payment conditions and other factors, however, LFA payments and some other environmental support have been functioning in reality as additional direct payments; and
- entry into the EU Single Market with 'zero' protection for the sector, but with a higher average level of protection against the rest of the world compared with the pre-accession period.

1.2 Farm structure – Land use and ownership

During the entire transformation period, besides the legislation for property transformation, the quality of the land market has been one of the most important factors shaping the Czech farm structure and farm multifunctionality. Owing to path dependencies from Czech 'land history' and to ineffective reform instruments (particularly the instruments and financial sources for land consolidation and re-parcelling in cadastres – the elementary official territorial unit in the Czech Republic), the land market has remained undeveloped. The privatisation of state land has proven to be the most significant driving force for its development. Nevertheless, those land users originating from the pre-reform period still maintain real power and advantages in the land market.

Thus, actual land use and ownership continues to strongly influence the present and future situation in Czech agriculture and its multifunctional roles. The main conclusions derived from Table 2 are as follows:

[1] SAPS refers to the Simplified Administrative Payment Scheme.

Table 2. Land users and owners of the Czech utilised agricultural area (2004)

Farms/ Owners	State	Muni-cipal	PE[1)] Farms	LE Farms	PP-LE	Other PP	Total (000 ha)	Total (%)	No.	Avg. size (ha)
Subsistence	–	–	40	–	–	–	**40**	**1.11**	19,189	0.2
Family	30	5	205	–	–	185	**425**	**11.81**	30,231	14.1
Ind.	320	10	65	60	–	1150	**1605**	**44.58**	3,704	433.3
CF-M	125	5	–	40	75	395	**640**	**17.78**	668	958.1
CF-O	110	5	–	20	180	540	**855**	**23.75**	667	1,281.9
Other	35	–	–	–	–	–	**35**	**0.97**	180	194.4
Total (000 ha)	**620**	**25**	**310**	**120**	**255**	**2,270**	**3,600**	**100.00**	**54,639**	**65.9**
Total (%)	**17.22**	**0.69**	**8.61**	**3.33**	**7.08**	**63.06**	**100.00**	**–**	**–**	**–**
Number	**1**	**6,000**	**2,000**	**28,000**	**50,000**	**3,000,000**	**3,086,001**	**–**	**–**	**–**
Average size (ha)	**620,000**	**4.17**	**155.00**	**4.29**	**5.10**	**0.76**	**1.17**	**–**	**–**	**–**

PE/LE = physical/legal entities; PP = physical persons; CF-M/O = coops and joint stock companies (M = with a power of management; O = with a power of owners); other companies included in the category of individual farms; PP-LE = PP as members/shareholders of farms

[1)] Land leased by PE to other categories of farms is included in OPP

Sources: Czech Statistical Office – Agrocensus 2000, the Czech Land Fund and authors' estimations.

- There is an extreme concentration of land use (around 5% of the largest farms occupy almost 75% of the utilised agricultural area or UAA[2]). The dual structure of land use stands against an extreme fragmentation in the land ownership (millions of small owners).
- Czech farms own only about 12–13% of the land, with the remaining agricultural land being leased.
- Family farms occupy only about 13% of the UAA.
- Large individual farms (including partnership farms and limited liability companies) are the most dynamic farm category, occupying nearly half of the UAA at present. Their share in the UAA (also supported by the land privatisation) has been growing. This has occurred through the enlargement of family farms and also through formal or informal changes of those collective farms (coops and joint stock companies) in which a concentration of property or economic power in the hands of its managers has been underway.
- From another point of view, about two-thirds of the UAA is occupied by 'profit-oriented' farms; the remaining one-third is utilised by 'income-oriented' farms, with a stronger self-employment focus.
- Concerning land ownership and use, non-agricultural and foreign capital has been penetrating the sector on an increasing rate in the last few years (as an obvious consequence of the present and expected profitability of the Czech farming/land sector).

[2] UAA approximately represents the area of Czech agricultural land that is eligible for direct payments. The acreage of the UAA (about 3.5-3.6 million ha) differs from the total acreage of Czech agricultural land (4.3 million ha) based on the registration of ownership plots. Some of the difference (about 300,000 ha) can be considered as abandoned land.

Such land use and ownership structures have some implications for the development of multifunctionality in agriculture:

- In principle, there are high transaction costs accompanying any changes in land use or in land ownership. These costs result in passive behaviour on the part of landowners concerning the land market or in serious barriers for land users, e.g. in needed (and therefore supported) conversions of arable land into grassland (landowners block the conversion).
- There is a risk of an extremely high level of diversion of direct payments away from agriculture and from rural areas through land ownership and leased land (today a reasonable number of landowners are living in towns). At present, in the Czech Republic the diversion of support is hampered by the low degree of flexibility in the land market, so this is more of a future risk.
- The prevailing profit orientation of farms represents another risk for multifunctionality. The continuing investment support for farm modernisation will evidently lead to a further reduction of labour, without a proper motivation for the establishment of new job opportunities on those farms, if new non-agricultural activities are not sufficiently profitable.

1.3 Farm categories and their characteristics

The effects of different policy scenarios on multifunctionality are modelled below for individual farm categories. The farm categories are defined through the application of two main criteria:

- the regional location of farms, reflecting also the share of LFA in their area. Each Czech farm can be identified by its location in the so-called 'production regions', reflecting soil productivity, i.e. in
  - the hilly region (H), which also simulates 100% of the LFAs in the area of a farm;
  - the potato region (P), which also simulates 50% of the LFAs in the area of a farm;
  - the maize and sugar beet regions (M), which also simulates 0% of the LFAs in the area of a farm;
- the behaviour of farms and their expected reflection of policy measures/stimuli, i.e.
  - profit-oriented farms (P), optimising the rate of profit from inputs/assets;[3] and
  - income-oriented farms (I), optimising the level of gross margin or the maximum profit generated by farming.[4]

Combining these two criteria, six categories of farms are recognised for modelling: HP, HI, PP, PI, MP and MI. Based on FADN data and with the conversion of land use and production structures for farms with 100 ha of agricultural land, the main indicators for all selected farm categories are presented in Table 3.

[3] For modelling, this farm category is represented by large individual farms with more than 300 ha of agricultural land.

[4] For modelling, this farm category is represented by family farms with 50–100 ha of agricultural land.

*Table 3. Economic and structural indicators for selected farm categories 2004**

Indicator	Unit	Hilly (H)		Potato (P)		Maize & sugar beet (M)	
		Profit	Income	Profit	Income	Profit	Income
Arable land	ha	12.4	19.6	54.6	71.3	96.7	94.0
– cereals	ha	3.0	14.5	36.9	50.0	66.2	61.9
– oilseeds	ha	1.7	0.0	9.0	7.2	8.9	8.3
– forage	ha	7.6	4.4	4.6	10.9	1.6	5.7
– other	ha	0.1	0.7	4.1	3.2	20.0	18.1
Permanent crops	ha	0.0	0.0	0.0	0.2	0.2	2.9
Grassland	ha	87.6	80.4	45.4	28.5	3.1	3.1
Total UAA	ha	100.0	100.0	100.0	100.0	100.0	100.0
Dairy cows	heads	10.4	8.9	7.0	14.6	1.0	3.8
Suckler cows	heads	7.5	7.2	5.1	5.4	0.3	0.5
Ewes/goats	heads	5.9	0.0	1.6	1.5	0.1	0.9
Pigs	000 CZK	4	8	26	206	74	132
Poultry	000 CZK	0	0	0	3	0	0
Eggs	000 CZK	0	0	0	0	0	1799
Livestock units	LU	32.1	48.7	21.5	43.7	6.1	15.0
Labour	AWU	1.40	2.26	1.40	2.97	1.85	3.02
Production	000 CZK	753	1,247	1,497	2,399	2,362	2,982
– crops	000 CZK	363	484	980	1,202	2,138	2,533
– livestock	000 CZK	375	717	487	1,126	155	381
– other	000 CZK	15	46	30	71	69	68
Interim consumption	000 CZK	691	1164	1077	1644	1549	1915
Depreciation	000 CZK	84	192	125	317	266	349
Operational subsidies[1)]	000 CZK	529	657	406	388	329	365
Net value added (NVA)	000 CZK	507	548	826	701	912	1047
Labour costs (hired)	000 CZK	251	40	190	40	294	109
Capital costs	000 CZK	7	35	10	15	22	28
Rents for land	000 CZK	25	38	55	48	122	104
Operational surplus	000 CZK	224	442	446	756	475	838
NVA/AWU	000 CZK	362	242	590	236	493	347
Profitability [2)]	CZK/CZK	1.16	1.07	1.24	1.12	1.15	1.20
Production intensity	000 CZK/ha	7.38	12.01	14.67	23.28	22.93	29.14
Production/AWU	000 CZK	538	552	1,069	808	1,277	987
Share of non-agric. production	%	2.0	3.7	2.0	3.0	2.9	2.3
Interim consumption/ production	%	91.8	93.3	71.9	68.5	65.6	64.2
Depreciation/ production	%	11.2	15.4	8.4	13.2	11.3	11.7

* Calculated for 100 ha

[1)] Without production taxes

[2)] (Production+operational subsidies)/(interim consumption + depreciation+labour costs including FWU+capital costs+rents for land)

Source: FADN CZ (2004), VUZE, Prague.

1.4 The multifunctionality of Czech agriculture

The development of multifunctionality in the Czech agricultural sector during the reform, applying selected proxy indicators, is shown in Table 4.

Czech agriculture under the socialist regime was characterised by extremely large collective and state farms and by industrial methods of farming, with heavy negative consequences for the environment and landscape. Even though about two-thirds of the Czech agricultural area now finds itself in regions with worse soil and climatic conditions, the share of arable land in the total area reached about 75%. It was a typical side effect of the socialist policy of full food self-sufficiency at any cost. The approach towards water in the countryside was the most seriously damaging aspect.

Table 4. Indicators of multifunctionality – Czech agriculture

Indicator	Unit	1989	1995	2004	Index 2004/1989
Land abandonment	000 ha	300	300	300	100.00
Share of arable land in agricultural land	%	75.00	73.00	71.70	95.60
Share of land threatened by erosion	%	35.00	33.00	33.00	94.29
Share of ecological farming in agricultural land	%	0.00	1.00	5.97	–
Of which on arable land and permanent crops	%	0.00	0.50	7.70	–
Number of cows (dairy and suckler)	000 heads	1248	768	574	45.99
Number of sheep	000 heads	399	80	140	35.09
Number of workers in agriculture	000 pers.	533	222	141	26.45
Share of non-agricultural incomes in total farm incomes	%	30.00	20.00	16.00	53.33

Source: Authors' estimations.

During the last 15 years of the transformation of Czech agriculture, its relations to the environment and landscape have not changed in principle, despite the large financial resources spent on this purpose. Any improvements that have occurred have been enforced by the poor economic conditions affecting farms, leading to a reduction in the consumption of fertilisers, pesticides, etc. The main causes of this situation are:

- inappropriate agricultural policy (with opportunity costs fostering the continuation of industrial farming and overweighing stimuli for change);
- ineffective environmental legislation accompanied by weak enforcement of laws;
- the above-mentioned relations between land users and landowners, generating high transaction costs for needed changes; and
- very slow progress in land consolidation/re-parcelling.

Meanwhile, major changes have occurred in the social functions of farms and in their relations to rural areas. Since 1989, nearly 75% of workers have left farms, being largely absorbed in other sectors. Further, the quality of human capital in the agricultural sector has deteriorated, because mainly younger and more educated workers have exited. Agriculture has stopped representing the main source of rural employment and now the risk of growth in rural unemployment – considering a further inevitable reduction of labour in primary agricultural production – has been increasing. The risk is all the more serious today, because of a relatively

low willingness of farms to create new job opportunities in non-agricultural activities for the released workers. Likewise, other social functions previously provided by farms (nursery schools, canteens, health centres, etc.) have been abolished (with some exceptions). Above all, Czech agriculture, with its prevailing industrial character, still has a tendency to reduce the recreational potential in rural areas, functioning against the needed development of rural tourism.

2. Methodology

2.1 Model FARMA 4

Optimal farm behaviour in the system of sustainable development

Definition 1

Farm behaviour under the given natural conditions is *economically optimal,* if the farm maximises its profit in the framework of all its possible production directions. Indeed, the economically optimal farm behaviour can provoke negative effects in the sustainable development of agriculture (e.g. soil fertility) and in the environment.

For modelling the influences of farming on the environment, some indicators that can be quantified and used for 'measuring' effects on the environment have been chosen, as below.

Ratio of grassland: This indicator generally characterises exposure to soil erosion and the capacity for water retention.

Risk of plants: Broadly-seeded crops in crop rotation represent a risk of soil erosion.

Ratio of organic fertilisers: This indicator is able to predict both the losses of soil diversity in ecosystems and soil erosion, the washing-off of nitrogen and phosphorus from the surface and underground waters, etc. If there is not a proper circulation of organic mass, then an increased share of industrial fertilisers can be supposed, which causes negative ecological effects.

Number of breeding cattle (per head) and other farm animals: This indicator gives basic information about the production of greenhouse gasses in agriculture.

Inputs of energy: This indicator calculates the consumption of fossil energy by the agricultural sector, compared with the production of renewable energy.

Definition 2

Farm behaviour in the given natural conditions is *ecologically optimal,* if the farm maximises its profit respecting one or more sustainability indicators.

Mathematical model of farm ecological behaviour

To simulate the sustainability of Czech agriculture, a mathematical optimisation model of farm economic behaviour – FARMA 4 – is applied, with the implementation of the above-mentioned ecological criteria in the sense of definition 2.

The adjusted mathematical model FARMA 4 includes the following segments:

- marketed and feeding commodities of the crop production on the arable land and on grassland;
- commodities of the livestock production connected with meat and milk outputs;
- feeding balance on the basis of self-supply in feeding stuffs;

- calculations of production and income activities with respect to agricultural producer prices (farm gate prices);
- calculations of commodity support (per hectare, per head or per production unit) on the basis of the CAP rules or of the defined policy scenarios;
- cost calculations for all commodities on the basis of unit costs;
- calculations of two optimisation criteria: 1) farm profit = total sales + total subsidies – total cost; and 2) farm profitability = (total sales + total subsidies) / total cost;
- calculations of the production of organic fertilisers (manure, etc.);
- calculations of the nutrient balance NPK based on the circulation of fertilisers on the farm (industrial, organic (crop or animal in origin) and air-deposition) measured in pure nutrients N, P and K;
- calculations of the total heads of animals measured by livestock units (LU) and LU/ha;
- yield calculations depending on the applied level of industrial fertilisers; and
- calculations of labour inputs depending on the production structure and measured by the total number of working hours or AWU (AWU = 2,200 hours/year).

According to the optimisation criterion (1 or 2) it is possible to compute farm profit maximisation in relation to additional conditions as follows:

- positive nutrient balance N, P, K;
- maximum or minimum LU on the agricultural land/forage land/grassland; and
- implementation of some agro-environmental programmes such as the maintenance of grassland, etc.

For simulations of farm behaviour under the different production conditions of the Czech Republic, three farm categories were constructed for three regions (M – area fully in a non-LFA, P – area combining a non-LFA and an LFA and H – area fully in an LFA) and the two orientations/behaviour (P – profit with the criterion 2 and I – income with the criterion 1). All farm categories are represented as 100 ha farms where the structure of agricultural commodities and intensity parameters (hectare yields, milk yield) and cost parameters (unit costs per hectare or 'feeding days') are derived from the Czech farm surveys (FADN, CZ).

2.2 The multifunctionality indicators used

For modelling multifunctionality with the application of the model FARMA 4, the following indicators are used for the selected farm categories:

- structure of land use – arable land, grassland and set-aside (unused) land;
- number of dairy/suckler cows;
- livestock (ruminants) density (livestock units/ha);
- labour – employment; and
- balance of elements (N, P, K).

2.3 Data

To simulate the impact of various policy scenarios, the following exogenous variables/parameters are applied:

- For the situation in 2004,
  - structure of production (FADN 2004);
  - production costs for individual commodities (VUZE survey 2004),
  - farm gate prices for individual commodities (report on the situation in Czech agriculture, 1994-2004).
  - direct payments and LFA payments (database of policy measures 2004, VUZE).
- For simulations – predictions related to the horizon of 2010,
  - direct payments (decoupled Single Payment Scheme) and LFA payments according to the Accession Treaty between the EU and the Czech Republic and according the last known policy decisions/expectations;
  - farm gate prices in the EU (OECD, 2005), reflecting the reform in the sugar sector;
  - exchange rates CZK/EUR (VUZE predictions) and EUR/USD (OECD, 2005);
  - input prices – labour, land and other inputs (VUZE predictions); and
  - yields (VUZE predictions, based on AG-MEMOD simulations).

3. Policy scenarios

The policy scenarios below are applied for modelling the effects of policy measures on the multifunctionality of Czech agriculture.

- S1: status quo 2004–06, with decoupled SAPS payments, coupled top-up payments and LFA payments as in the period 2004–06;
- S2: full decoupling, with the decoupled Single Payment Scheme at the maximum possible level and LFA payments, based on the suppositions/conditions from the last draft of the Czech EAFRD (European Agricultural Fund for Rural Development) programmes;[5] sugar beet, milk and permanent crop productions ≤ the reference period 2004–06; and sugar beet production without compensation payments resulting from the reform;
- S3: reduced full decoupling – the same as the S2 scenario, but with a 20% reduction in direct payments
- S4: reduced full decoupling and increased agro-environmental support (the transfer of the financial sources from Pillar I to Pillar II) – the same as the S3 scenario, but with a 20% increase in payments for the agro-environmental scheme 'maintenance of pastures'.[6]

[5] For 2010 this is held to be a maximum of 24% of arable land on a farm in the H category, or 64% of arable land on a farm in the P category, and the ruminant density 0.36–1.8 LU/ha of forage land. The level of LFA payments is set at CZK 4,650/ha of grassland on a farm in the H category and CZK 3,410 of grassland on a farm in the P category. Investment support for the establishment of grassland is CZK 8,000 for all farm categories.

[6] In 2010 this is held to be a maximum of 23% of arable land on a farm in the H category, or 58% of arable land on a farm in the P category, and the ruminant density 0.36–1.0 LU/ha of forage land; a

4. Results of modelling multifunctionality

Results of the simulations related to 2005 (scenario 1) and to 2010 (scenarios 2–4) for the selected farm categories and the defined policy scenarios are presented in Table 5.

Table 5. Simulation results

Indicator/farm category	Unit	MI	MP	PI	PP	HI	HP
Scenario S1 (2005)							
Arable land	ha	99.5	84.0	71.4	12.9	52.6	8.2
– cereals & oilseeds	ha	76.7	63.6	64.9	6.0	47.0	3.1
– fodder	ha	2.7	2.3	4.5	6.8	5.6	5.0
– other arable land	ha	20.1	18.1	2.0	0.1	0.0	0.1
Grassland	ha	0.5	16.0	28.6	87.1	47.4	91.8
Unused land	ha	0.0	0.0	0.0	0.0	0.0	0.0
Dairy cows	heads	1.0	3.8	7.0	14.6	10.4	8.9
Suckler cows	heads	3.0	3.0	16.9	8.2	13.2	14.8
Livestock units/ha of fodder land	LU	2.55	0.81	1.50	0.53	0.94	0.52
Labour	AWU	1.47	1.50	1.78	1.55	1.70	1.34
Balance of N	kg	-11,580	-8,918	7,259	8,980	8,095	8,473
Balance of P	kg	-2,738	-2,478	73	200	-145	-56
Balance of K	kg	-4,165	-3,385	1,717	571	1,382	160
Operational surplus (profit)	000 CZK	1,239	1,281	1,220	1,122	1,236	1,036
Scenario S2 (2010)							
Arable land	ha	95.5	4.2	65.1	12.8	8.7	8.3
– cereals & oilseeds	ha	73.4	1.9	58.5	6.1	3.2	3.2
– fodder	ha	2.0	2.2	4.4	6.6	5.4	5.0
– other arable land	ha	20.1	0.1	2.2	0.1	0.1	0.1
Grassland	ha	4.5	31.0	34.9	87.2	91.3	91.7
Unused land	ha	0.0	64.8	0.0	0.0	0.0	0.0
Dairy cows	heads	1.0	3.8	7.0	14.6	10.4	8.9
Suckler cows	heads	3.0	3.0	16.9	8.2	13.2	14.8
Livestock units/ha of fodder land	LU	1.29	0.45	1.27	0.53	0.52	0.52
Labour	AWU	1.44	0.67	1.63	1.55	1.39	1.34
Balance of N	kg	-11,780	3,193	6,401	8,855	8,231	8,348
Balance of P	kg	-2,817	92	-233	177	-70	-79
Balance of K	kg	-4,206	195	1,358	486	17	72
Operational surplus (profit)	000 CZK	751	436	1,219	1,424	1,410	1,352
Scenario S3 (2010)							
Arable land	ha	95.5	69.0	65.1	12.8	8.7	8.3
– cereals & oilseeds	ha	73.4	66.7	58.5	6.1	3.2	3.2
– fodder	ha	2.0	2.2	4.4	6.6	5.4	5.0

maximum of 170 kg N/ha on arable land and 40 kg N/ha of grassland. Compensation is set at CZK 3,100/ha of grassland for farms in the H category and CZK 2,800/ha for farms in the P and M categories.

The same conditions apply for investment support for the establishment of grassland and for the livestock density in the LFA payments, but the maximum share of arable land in farm acreage is 0.23% for the H farm category and 0.58% for the P farm category.

Table 5.Continued

– other arable land	ha	20.1	0.1	2.2	0.1	0.1	0.1
Grassland	ha	4.5	31.0	34.9	87.2	91.3	91.7
Unused land	ha	0.0	0.0	0.0	0.0	0.0	0.0
Dairy cows	heads	1.0	3.8	7.0	14.6	10.4	8.9
Suckler cows	heads	3.0	3.0	16.9	8.2	13.2	14.8
Livestock units/ha of fodder land	LU	1.29	0.45	1.27	0.53	0.52	0.52
Labour	AWU	1.44	1.13	1.63	1.55	1.39	1.34
Balance of N	kg	-11,780	5,295	6,401	8,855	8,231	8,348
Balance of P	kg	-2,817	149	-233	177	-70	-79
Balance of K	kg	-4,206	-196	1358	486	17	72
Operational surplus (profit)	000 CZK	611	604	1,079	1,284	1,270	1,212
Scenario S4 (2010)+B23							
Arable land	ha	86.9	4.2	9.1	12.6	8.6	8.2
– cereals & oilseeds	ha	65.9	1.8	2.6	5.9	3.0	3.1
– fodder	ha	0.9	2.2	4.4	6.6	5.5	5.0
– other arable land	ha	20.1	0.2	2.1	0.1	0.1	0.1
Grassland	ha	13.1	31.0	90.9	87.4	91.4	91.8
Unused land	ha	0.0	64.8	0.0	0.0	0.0	0.0
Dairy cows	heads	1.0	3.8	7.0	14.6	10.4	8.9
Suckler cows	heads	3.0	3.0	16.9	8.2	13.2	14.8
Livestock units/ha of fodder land	LU	0.60	1.45	0.52	0.53	0.52	0.52
Labour	AWU	1.38	0.67	1.31	0.25	1.39	1.33
Balance of N	kg	-11,680	2,406	4,476	6,704	5,983	6,088
Balance of P	kg	-2,921	-64	-896	-267	-532	-540
Balance of K	kg	-4,180	115	-439	302	-171	-117
Operational surplus (profit)	000 CZK	640	382	1,276	1,522	1,555	1,499

Source: Authors' estimations.

The interpretation of the results can be summarised as below.

- Scenario 1 (status quo 2005) represents the optimisation of the current production structures under the 2004–06 policy conditions (not considering permanent crops). The optimum structures compared with the current ones show an increase in the acreage of arable land in all income-oriented farms and vice versa in all profit-oriented farms. Grassland can generate higher profitability; arable land can generate a higher amount of profit. Leaving the land unused is not an optimum solution for any of the farm categories.
- The results of scenarios 2–4 related to 2010 are very similar, substantiating the hypotheses on land use, labour inputs, etc.:
  - Profit-oriented farms could be more attracted by the conversion of arable land into grassland (even in non-LFA regions) and by the introduction of relatively very extensive cattle breeding, resulting in lower labour inputs. Only in non-LFA regions could it be profitable to enlarge (extremely) the area of unused land.

  - Income-oriented farms can preserve a higher share of arable land combined with relatively intensive cattle breeding, resulting in higher labour inputs. The introduction of unused land can be very limited.
  - The decrease of direct payments by 20% (scenario 3) can only have an impact on the level of profitability and profits, without affecting land use or production structures.

- The implementation of higher payments for the maintenance of grassland (scenario 4) can compensate the decrease of direct payments in the profitability and profits in all farm categories, but can be especially attractive for income-oriented farms in the potato regions.

Conclusions – Policy issues and recommendations

Around 75% of the utilised agricultural area in the Czech Republic is occupied by profit-oriented farms. Because of a combination of expectations about the slow progress in land consolidation (re-parcelling), a zero-level of degressivity by the size of farm in direct payments until 2010, a low level of degressivity by the size of farm in LFA payments and other factors, the share of profit-oriented farms in the Czech agricultural sector may even increase.

Considering this Czech farm structure, the total decoupling of direct payments combined with a possibility that land will not have to be used for the production of a commodity (but to maintain the land according to good farming practices/cross-compliance) can lead to an extreme level of extensive farming with a large share of unused land in the most productive regions.

These trends, however, can be counter-balanced by the conditions for LFA payments, which contribute significantly to the finances of farms in the LFAs. On the one hand, the maximum limits for the share of arable land and on the other hand the minimum limits for livestock density can lead to an enlargement of the grassland acreage accompanied by a shift of cattle breeding on the LFA land.

Under these conditions, the tendency towards the extensiveness of production combined with a reduction in labour costs and in employment by farms can be smoothed. This point applies to all regions and farm categories. Nevertheless, there may be a perpetual risk that the expected positive externalities from farming related to the environment (water, soil) may be eliminated by the negative externalities related to rural employment or to rural social and human capital.

Taking into account all aspects of multifunctionality, the main policy issues and recommendations deduced from the model simulations to be addressed by policy-makers are:

- Implementation of a graduated scale for degressivity in the direct payments and particularly in the LFA payments could create stimuli for the development of small and medium-sized farms, generating better conditions for job opportunities and an increase in the quality of human and social capital in (marginal) rural areas.
- Higher support is needed for the development of non-agricultural activities on farms or for the development of micro-firms in rural areas.
- Agro-environmental schemes need to be implemented, based on more stringent conditions for compensation payments, or schemes to compensate non-commodity outputs in accordance with real environmental effects (to reduce the risk that agro-environmental payments, owing to low transaction costs in the required changes in farm practices, are considered as a prolongation of direct payments).
- In any case, decoupling can lead to a decrease in the volume of production by the Czech agricultural sector and contribute to a reduction of surpluses under the EU-25 framework.

Bibliography

Doucha, T. and E. Divila (2004), "Possible impacts of the Czech agricultural policy after the EU accession on the land market and land usage", *Agricultural Economics*, Vol. 51, No. 5, pp. 185-93.

Doucha, T., E. Divila and M. Fischer (2005), "Land use and ownership and the Czech farm development, 3rd ERDN", in "Rural Development in Carpathian Europe"*, Rural Areas and Development,* Vol. 3, European Rural Development Network, Institute of Agricultural and Food Economics, Institute of Geography and Spatial Organization, Polish Academy of Sciences, Warsaw.

Dwyer, J., D. Baldock, J. Wilkin and D. Klepacka (2005), *Scenarios for modelling trade impacts upon multifunctionality in European agriculture*, ENARPRI Working Paper No. 10, January.

Foltýn, I., T. Zídek and I. Zedníčková (2004), "Impacts of accession of the Czech Republic to the EU on the sustainable development of the Czech agriculture", presentation for the conference of the Lithuanian Institute of Agricultural Economics, Vilnius, November.

Foltýn, I., I. Zedníčková and L. Grega (2002), "Efficiency of agricultural policy as a factor of sustainability of protected areas", in I. Camarda et al., *Global Challenges of Parks and Protected Area Management*. *Proceedings of the 9th ISSRM*, La Maddalena, Sardinia, Italy, ISBN 88-7138-318-4.

Guyomard, H. (2006), *Review of methodological challenges: Multifunctionality and trade*, ENARPRI Working Paper No. 7, CEPS, Brussels.

Ministerstvo zemědělství ČR (The Czech Ministry of Agriculture) (1994-2004) *Zprávy o stavu zemědělství ČR, 1994–2004* [Reports on the situation in the Czech agriculture, 1994-2004], Ministerstvo zemědělství ČR, VÚZE, Prague.

OECD (2002), *Multifunctionality: Towards an Analytical Framework*, OECD, Paris, ISBN 9264186255.

OECD (2005), *OECD-FAO Agricultural Outlook 2005-2014*, OECD, Paris, ISBN 92-64-010 18-1.

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