Macroeconomic Consequences of a Common Agricultural Policy Budget Reduction for the Czech Economy – a General Equilibrium Approach[1]

*Zuzana KŘÍSTKOVÁ**

Abstract

The objective of this paper is to quantify the impact of selected scenarios of a Common Agricultural Policy (CAP) budget reduction on the macroeconomic equilibrium of the Czech economy with the use of a dynamic general equilibrium model.

The findings show that in the short term, a reduction in direct payments (1st pillar) is more harmful for the economy than the removal of investment subsidies (2nd pillar); this is completely reversed in the long term, in which the removal of investment subsidies leads to a considerably stronger decline in economic growth.

Keywords: *CGE model, CAP, EU budget, scenario, GDP, the Czech Republic*

JEL Classification: D50, Q10

1. Introduction

Common Agricultural Policy (CAP) is one of the core policies which, since its establishment in the 1950s, has contributed significantly to the process of integration of the European Union (EU). Since the reform carried out in the *Agenda 2000*, CAP has been implemented in two pillars, pursuing different policy goals. Whereas the first pillar of CAP is concentrated on production support mostly via

* Zuzana KŘÍSTKOVÁ, Czech University of Life Sciences in Prague, Faculty of Economics and Management, Department of Economics, Kamýcká 129, 165 21 Prague 6; Czech Republic; e-mail: kristkova@pef.czu.cz

[1] Research presented in this paper is the result of a research grant MSM 6046070906 *Economics of Czech agricultural resources and their efficient usage within the framework of multifunctional agri-food systems*.

***Acknowledgments*:** An important contribution in the elaboration of this paper has been made by the Institute of Agricultural Economics and Information (UZEI), which has provided valuable inputs for the construction of the Social Accounting Matrix.

decoupled direct payments, the second pillar, with a gradually increasing yet considerably smaller share, aims at supporting the competitiveness of farmers and the socio-environmental functions of agriculture.

The CAP scheme in its current form ends in 2013. In connection with the approaching end, a debate on the reform of CAP has been opened. The need to reshape CAP raises questions regarding the possible impacts of CAP reform on the economies of EU member states. The Czech Republic belongs to the group of countries that acceded to the European Union in 2004 and thus fully adopted the principles of CAP. Unlike in some other Central and Eastern European (CEE) member states, the agricultural sector has only a small role in the economy, as it contributes to the total GDP by only 2% and employs less than 4% of workers. Even so, the volume of subsidies granted from both the EU and the national budget, as well as the inter-sectoral linkages with other sectors of the national economy, suggest that the policy options of future CAP can play a role in the whole macroeconomic balance of the Czech economy. In connection with the ongoing pressures to reduce the CAP budget, three scenarios (a reduction in direct payments in the 1st pillar, the removal of investment subsidies in the 2nd pillar, and the combination of both alternatives) are applied with the aim of quantifying the impact of these scenarios on macroeconomic equilibrium.

In order to fully address the effects of these scenarios on the whole economy, a general equilibrium approach is applied. The Computable General Equilibrium (CGE) model is calibrated on the economy of the Czech Republic in 2006, including a detailed disaggregation of the agricultural sector.

The paper is organized as follows: in the second chapter, the main characteristics of the Czech agrarian sector with respect to the EU accession are presented. In the third chapter, the debate on future CAP is outlined, followed by the introduction of the scenarios which are applied in the analysis. Subsequent chapters include a description of the CGE model and the process of constructing the Social Accounting Matrix (SAM). The results chapter analyzes the impact of the scenarios on the structure of the economy, GDP components and other macroeconomic variables. The paper concludes with a confrontation of the results with those of other authors.

2. Czech Agricultural Sector in the Context of the EU Accession

By acceding to the European Union in 2004, the Czech Republic adopted the EU Common Agricultural Policy, which resulted in a significant increase in agricultural income, most of which comes from governmental support in the form of direct payments. The structure of the direct payments granted to agriculture

consists of *SAPS*[2] payments from the EU and *Top-Up* payments from the Czech government that partially cover the gap between the levels of subsidies granted to Czech and EU 15 farmers. In the accession year, Czech farmers obtained 25% of the national envelope, with an additional 30% covered from the Top-Up payments. Despite the asymmetry in the distribution of European subsidies, Czech farmers were able to profit from a considerable increase in support. Compared to the pre-accession level, the total amount of subsidies granted to agriculture in 2008 was 66% higher (Table 1). It can also be observed that the structure of total subsidies to the agricultural sector changed. This is especially visible in the case of direct payments, which increased their share of total support from 19% in 2003 to 50% in 2008. In the same way, agro-environmental support and support for regional development doubled in comparison to the pre-accession period, showing the increasing orientation of policy to the non-productive functions of agriculture.

T a b l e 1

Structure of Support for Agriculture (in mil. CZK)

	2003	**2004**	**2005**	**2006**	**2007**	**2008**
Direct Payments Support	4.262	12.487	14.287	16.781	17.738	18.786
Regional Development and Agro-Envi Support	3.307	5.657	8.678	10.547	9.191	10.295
National Support	10.221	7.309	6.443	7.283	6.720	6.814
Common Market Organization Support	4.106	2.500	1.403	1.282	882	591
Total	*21.896*	*27.953*	*30.811*	*35.893*	*34.531*	*36.487*

Source: MZE ČR (2005 – 2008).

According to the report of Institute for Agricultural Economics and Information (UZEI, 2009), the effect of the EU accession on Czech agriculture has been ambiguous. On one hand, the amount of subsidies increased considerably. This has brought several benefits, such as improved income for farmers, greater investments in modern technologies, and improved access to bank credit connected with the higher financial credibility of agricultural enterprises. On the other hand, the efficiency of agricultural companies has remained low; most companies would operate at a loss in the absence of subsidies. Thus, the subsidies have not capitalized on the increase in competitiveness.

3. CAP Reform and the Construction of Scenarios

The development of the agricultural sector in upcoming periods could be significantly influenced by the prepared CAP reform. The debates on future CAP are usually structured into three areas: market support instruments, direct payments,

[2] *Single Area Payment Scheme* (SAPS) is the national envelope redistribution option which the newly-acceded EU member states (EU 12) have opted for, as opposed to the Single Payment Scheme (SPS), applied in the EU 15 countries.

and rural development. Most of the criticisms of current CAP are focused on the lack of transparency and equality in the distribution of direct payments and the insufficient support for environmental services and standards.

Besides the instruments of CAP, the size of the budget is also an important issue. Opinions on the level of support to agriculture vary across member states. Whereas Great Britain, Ireland and Sweden would like to carry out a crucial reform of CAP with a significant budget reduction, Bulgaria, Greece and Poland would prefer to maintain the status quo. Another group of countries, including the Czech Republic, agrees on the importance of CAP but acknowledges the need to modernize it.

In connection with the increasing voices in some European countries for reform of CAP and a substantial decrease in the burden of agriculture on the European budget, the first scenario, *Scenario A*, applies a reduction in subsidies to agriculture for both the 1st and 2nd pillars of CAP. Since the subsidies granted in the 1st pillar are predominantly distributed in the form of direct payments, which are the primary CAP instruments, it is not plausible to expect a complete removal of 1st pillar support. Therefore, only a 50% reduction in the national envelope for the Czech Republic at the end of the current programming period (2013) is being considered. In order to achieve a comparable reduction in financial support for both pillars, second pillar payments (concerning axis 1 and 3) are removed completely in Scenario A.

The second scenario, *Scenario B,* models a situation of concentrated support for 2nd pillar payments, in line with the "greening" tendencies of CAP. In this scenario, the reform of CAP is carried out only for the 1st pillar, in which subsidies are reduced by 50%, with the 2nd pillar remaining unchanged.

Finally, to analyze the effect of the removal of 2nd pillar subsidies on the economy, *Scenario C* models a situation of CAP support dominated by direct payments, with no 2nd pillar subsidies.

Reducing subsidies to agriculture opens an additional debate on the proportions of national contributions relative to the total EU budget. Given that the share of direct payments in total national contributions to the EU budget is not negligible,[3] it might be plausible in the case of a CAP budget reduction to expect that this reduction would be reflected in a decrease in national payments to the EU budget. Therefore, all the scenarios incorporate an alternative setting, where a reduction in subsidies is accompanied by a 20% reduction in contributions to the EU budget. As CAP reform is targeted for the period after 2013, the scenario shocks are performed in 2014 and the effects are calculated till 2020. All scenarios

[3] It is possible to estimate that the share of direct payments in total contributions to the EU budget from the national government reaches approximately 40%.

are reported with respect to the baseline, in which the 1st and 2nd pillar payments are fixed at the 2013 level in the new programming period (2014 – 2020). It should be pointed out that since Top-Up payments will be phased out in 2013, the 1st pillar after this period only involves subsidies from the EU. An overview of the scenarios and the main instruments used in the simulations are displayed in Table 2.

T a b l e 2

Overview of Scenarios

Scenario	Variant	Contributions to EU budget	1st pillar instruments (production subsidies)	2nd pillar instruments* (investment subsidies)
Scenario A	A 1 A 2	Reduction by 20% No change	Reduction in production and land subsidy rates by 50%	Investment subsidies from EU and the CR = 0
Scenario B	B 1 B 2	Reduction by 20% No change	Reduction in production and land subsidy rates by 50%	Baseline level (no change)
Scenario C	C 1 C 2	Reduction by 20% No change	Baseline level (no change)	Investment subsidies from EU and the CR = 0

Note: *Axis 1 and 3, all shocks are carried out in 2014; CR – Czech Republic.

Source: Author's elaboration.

As Table 2 shows, the simulations are carried out with the use of several CAP instruments, which must be translated into the CGE model. The 1st pillar instruments are represented by land and production subsidy rates, which directly affect the cost structure of the subsidized sectors. Therefore, a reduction in 1st pillar subsidies, carried out in Scenarios A and B, will have direct repercussions on agricultural producer costs and thus on their prices as well. In view of this, the considered scenarios are presumed to have inflationary effects on the economy. Furthermore, a reduction in land and production subsidies will negatively influence factor rents, where land would be the most affected as its supply is fixed, and there is a limited substitution between land and other production factors, especially in crop production sectors. This could be further translated into a decline in institutional incomes, thus weakening final consumption. With respect to unemployment, the outcome is not so straightforward, since the expected contraction of the agricultural sector could be counterbalanced by an increase in production in other sectors, thereby avoiding negative employment effects.

Contrary to the 1st pillar instruments, the 2nd pillar instruments are modelled as subsidies which stimulate investment, predominantly in agricultural sectors, but partially also in industrial sectors (concerning projects of solar-energy plants in rural areas) and services (regarding tourism and other service-oriented projects in rural areas). Thus, the effects of the removal of 2nd pillar subsidies will be translated into non-agricultural sectors as well. Therefore, it can be expected that Scenarios A and C will lead to a decrease in investment, which will consequently

slow down capital stock formation and economic growth. Whereas 1st pillar subsidies would have an immediate impact on the economy, second pillar subsidies would have major repercussions in the longer run.

4. Description of the Applied CGE Model

In order to assess the effects of agrarian policy instruments on the economy, a general equilibrium approach was applied. The choice of this approach is supported by various arguments. According to Piermartini (2006), the general equilibrium models provide a consistent, rigorous and quantitative way of assessing economic policies, and they serve as supporting tools in the decision-making process. Decreaux and Valin (2007) further emphasize that the CGE models are based on robust and generally accepted behavioral patterns of the economic agents. Based on Elbehri, Umstaetter and Kelch (2008), the explicit modelling of the production factors market, which connects production with the household economy, makes the CGE models preferable to the partial equilibrium models. According to Gelan, Ayel and Schwarz (2006), the CGE models are suitable for quantification of the spill-over effects, which comprise all effects in the economy.

One of the earliest CGE applications in the geographical region of the Czech Republic can be found in a study on the impact of the EU accession on agricultural markets (Tangermann and Banse, 2000); further contributions in this area were provided by Ratinger and Toušek (2004). Most of the currently developed CGE models for the Czech Republic focus on natural resources and the environment. These models include the Czech National Bank's CGE model dealing with the impact of the oil price shocks on the Czech economy (Dybczak, Voňka and Van der Windt, 2008), and a dynamic CGE model for the quantification of environmental policy impacts on macroeconomic aggregates, developed for the Czech Ministry of the Environment (Pavel, 2008). Experiences with CGE model applications can be found in the Slovak literature as well, for instance in Miťková (2009), who applies a static CGE model to analyze the role of the automotive industry in the Slovak economy.

Apart from a regional CGE model applied for scenarios concerning rural areas of the Czech Republic (Bednaříková and Doucha, 2009), there is very scant evidence from agriculture-oriented CGE applications with a specific focus on the economy of the Czech Republic. Most of the research on the impact of agrarian policy is performed by widely-dispersed, multi-country CGE models focused on

agriculture,[4] in which the Czech Republic is usually aggregated into a group of CEE countries, or is not included at all. Furthermore, the nature of the multi-country models implies that the model closures are defined on a global scale, allowing for macroeconomic disequilibrium on the individual country level.

The presented CGE model is thus the only currently existing CGE model with agricultural policy extensions, built for the economy of the Czech Republic. The national economy is modelled in a disaggregation into 13 production sectors, of which 8 represent specific agricultural sectors and the others represent the sectors of industry and services.

In the model, it is assumed that total gross production is a fixed-factor Leontief combination of intermediate consumption and value added under perfect competition and constant returns to scale, which can be expressed by a nested production structure (for the schematic production structure as well as more details on the model description see Křístková, 2010 b).

Two groups of production sectors are distinguished for the modelling of added value: sectors that use land as a production factor ("*secland"*) and sectors that use only labour and capital ("*secnland"*). In the first stage, value added is formed by the combination of labour (L_i) and capital-land bundle (KD_i) based on the *CES I* production function (Equation 1):

$$CES\ I:\ VA_i = aF_i \cdot \left(\chi F_i \cdot KD_i^{-\rho Fi} + \left(1-\chi F_i\right) \cdot L^{-\rho Fi}\right)^{-1/\rho Fi} \qquad (1)$$

where

aF_i – the efficiency coefficient,

χF_i and $(1 - \chi F_i)$ – the distribution parameters of the production function.

Parameter ρFi in the exponent is derived from the elasticity of substitution σFi between the production factors KD_i and L_i.

In the second stage, the optimal combination of capital K_i and land D_i is modelled analogously with the use of the *CES II* production function (Equation 2):

$$CES\ II: KD_i = aG_i \cdot \left(\chi G_i \cdot K_i^{-\rho Gi} + \left(1-\chi G_i\right) \cdot D^{-\rho Gi}\right)^{-1/\rho Gi} \qquad (2)$$

where

aG_i – the efficiency coefficient of the second nest production function,

χG_i and $(1 - \chi G_i)$ – the distribution parameters of the second nest production function.

The production structure further incorporates the depreciation of capital, which is modelled as a fixed proportion from the current level of capital stock.

[4] For instance, GTAP (Global Trade Analysis Project), LEITAP (an extension of GTAP on European agriculture), GOAL and MIRAGE.

The behaviour of households in the Czech economy is simulated by introducing two representative households – farmer households and other households, which optimise their utility subject to a budget constraint. Whereas microeconomic theory provides numerous suggestions, a standard choice in the field of CGE models is the Stone-Geary Linear Expenditure System (*LES*) (Equation 3).

$$U = \prod_j \left(C_j - \mu Hj\right)^{\alpha HLESj} \quad \sum_j \alpha HLES_j = 1 \tag{3}$$

where

U – the consumer's utility,
C_j – the amount of consumption of the j-th commodity,
μH_j – the subsistence level of consumption of each j-th commodity,[5]
$\alpha HLES_j$ – a preferential parameter of the respective j-th commodity in the consumer basket.

The households' consumption budget is determined by the net value of its income after taxation and transfers, reduced by its savings.

The government maximizes utility modelled by the Cobb-Douglas utility function subject to the disposable budget, which is derived from incomes received on the basis of tax collections:

$$U = \prod_j CG_j^{\alpha CG_j} \quad \text{where} \quad \sum_j \alpha CG_j = 1 \tag{4}$$

where

CG_j – governmental consumption of a commodity j,
αCG_j – a preferential parameter in the government´s consumption basket.

The closure of the governmental account is arranged by fixing a ratio of governmental consumption to GDP. Governmental savings are thus adjusted to the difference between governmental incomes and expenditures.

Total supply in the market is represented by a composite commodity consisting of the bundle of domestically produced goods supplied to domestic markets, and imports. The composite commodity is a result of two simultaneous forces in the model: first, the intention of the producer to find the most profitable combination of supply between foreign and domestic markets, modelled with a Constant Elasticity of Transformation *(CET)* function, and secondly the intension of the consumer to find an optimal combination of an imported and domestically produced commodity, modelled with a *CES Armington* function. An extension to the foreign market equations has been carried out in order to model trade and

[5] If μH = 0, the *LES* utility function is reduced to the Cobb-Douglas utility function.

financial flows on a disaggregated level comprising the EU foreign sector and the Rest of the World (RoW).

Furthermore, the model is based on the following closure options and factor market assumptions:

- Supply of labour and land is fixed; capital stock grows at the rate of net investments.
- Capital is fully employed in all sectors, whereas land is employed only in sub-sectors of agriculture.
- Certain amounts of labour are not employed, modelled by a Phillips curve determining the level of unemployment.
- The model follows a standard macroeconomic balance of savings and investment.
- Based on the assumption of a small country, both world export and import prices are fixed.
- Two foreign sector closures (for the EU and the RoW) consist of an endogenous exchange rate adjusting to the exogenously-set foreign savings.

The CGE model follows a recursive form of dynamization with a Tobin's Q investment function, which allocates investments to the sectors according to their ratio of profitability to user costs (for a detailed description, see Křístková, 2010a). In the dynamic part, the expected growth rates of the exogenous variables were taken from the following official sources: the prediction of EU GDP is based on the Economic Forecasts of the European Commission (EC, 2010), world prices and world GDP are taken from the IMF predictions (IMF, 2010), and the growth rates of the domestic exogenous variables, such as transfers and the GDP deflator, are taken from the Czech Ministry of Finance (MF of CR, 2010).

The instruments of CAP included in the CGE model concern direct payments (1st pillar) and investment subsidies (2nd pillar). Given the fact that in the Czech Republic the direct payment rate per hectare greatly exceeds the land's rent,[6] modelling direct payments solely as land subsidies would cause computational problems, which is also alerted by other CGE modellers (see Gohin and Bureau, 2006). In order to eliminate this problem, part of the direct payment subsidy is allocated to land and the rest is modelled as a production subsidy. Furthermore, the sources of financing the direct payments are recorded in the balance of payment equation of the EU (for the *SAPS* payments from the EU) and in the governmental expenditures equation (for the *Top-Up* payments). The investment subsidies in the 2nd pillar are incorporated into the investment allocation function for the recipient sectors.

[6] For instance, in 2007, the direct payment rate (approx. 100 EUR/ha) was almost 3 times higher than the land's rent (approx. 40 EUR/ha).

5. Construction of the Social Accounting Matrix

The general form of the SAM is based on data provided by the Czech Statistical Office (CSO) in their published version of the SAM for the year 2006. Given that the purpose of the CGE model is to provide agriculturally oriented policy simulations, the general SAM does not provide a sufficiently detailed view of the agricultural account. This refers in particular to the proper disaggregation of the production account, representing key agricultural activities, the commodity accounts, representing flows of domestically produced, imported and exported key agricultural commodities, the production factors account with a specific treatment of land, and finally, the institutional account with farmer households treated independently. Most authors solve the problem of unavailable data on their local agricultural accounts by adopting the GTAP database,[7] which contains all necessary accounts in great agricultural detail, but neglects local specifics stemming from the different commodity and cost structure of the agricultural sector.

In light of these facts, the SAM that was used in this CGE model was built on the basis of data provided by the Institute of Agricultural Economics and Information (UZEI). Two major sources of information were used – commodity balances and cost surveys of agricultural enterprises. The disaggregation of the household account into farmer and other households was carried out with the use of the Statistics of Household Accounts, where the groups of incomes and expenditures are recorded individually for each type of household.[8]

6. Results of the Simulations

All results of the scenarios are reported with respect to the baseline. First of all, the impact on the aggregated sector of agriculture and the sectors of industry and services is analysed with the aim of identifying possible structural changes produced by the simulations. Subsequently, the results of the scenarios with respect to GDP are interpreted. Finally, the effect of the analysed scenarios on further macroeconomic variables such as unemployment, inflation and exchange rate are reported.

6.1. Impact of a CAP Budget Reduction on the Value added in Agriculture, Industry and Services

According to the assumptions, a reduction in subsidies in agriculture has negative effects on the agricultural sector, measured by the gross value added. As displayed in Table 3, as a result of a reduction in governmental support, value

[7] *Global Trade Analysis Project* (GTAP) is a database containing data in the form of Social Accounting Matrices for 83 countries of the world (Dinamaran, 2006).

[8] The final SAM, representing a matrix of size 43 x 43, is available upon request.

added in agriculture declines by 8% against the baseline. Comparing across the scenarios, the most negative effect is observed in Scenario A2, which combines a reduction in subsidies in both pillars of CAP and does not compensate for the decrease in governmental payments to the EU budget. With regard to Scenario C, the value added in agriculture declines by only 1%, which is in line with the fact that 2nd pillar subsidies are not coupled to production, and therefore do not directly influence the competitiveness of the sector. In addition, 2nd pillar support is considerably lower, leading to less negative distortions in case of its removal.

The effect of the analysed scenarios on the industrial sector is predominantly positive, most noticeably under Scenario B1. In general, the industrial sector can benefit from a reduction in agricultural support due to reallocation of resources. Scenario C is less favourable for the industrial sector, since a reduction in second pillar subsidies negatively affects investment activity in industry. Under the C2 variant, the value added in industry would even decrease, compared to the baseline.

The sector of services shows the highest sensitivity to the budget payments to the EU. The option of reduced governmental contributions to the EU budget clearly triggers value added in services. When comparing the CAP instruments, it can be seen that a reduction in direct payments can be beneficial for the sector of services, whereas the removal of investment subsidies in the 2nd pillar can be harmful, if not compensated for by decreased payments to the EU.

T a b l e 3

Gross Value Added in Current Prices (average deviation from the baseline, in %)

	Scenario A		***Scenario B***		***Scenario C***	
	A1	A2	B1	B2	C1	C2
Agriculture	–8.79	–8.82	–7.83	–7.86	–0.98	–1.02
Industry	0.14	0.10	0.16	0.12	0.03	–0.02
Services	0.11	–0.02	0.17	0.05	0.06	–0.06

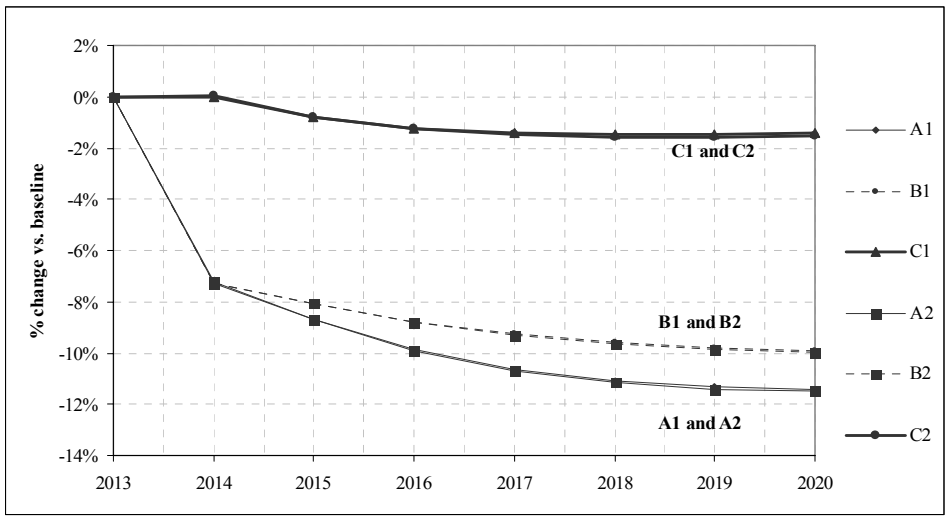
Note: Calculated for the period 2013 – 2020.

Source: Author's calculations.

A dynamic view of the development of value added per sector under each scenario is provided by Figures 1, 2 and 3. Figure 1 shows the disparity between value added under a reduction in the 1st and removal of the 2nd pillar payments in agriculture. Scenarios A1 and A2 combine the effects of both the B and C scenarios. The figure clearly shows that the decline in Scenario A is predominantly caused by a reduction in direct payments (Scenario B), whereas the removal of second pillar payments (Scenario C) produces only a minor decline in value added.

F i g u r e 1

Value Added in Agriculture (% deviation from the baseline)

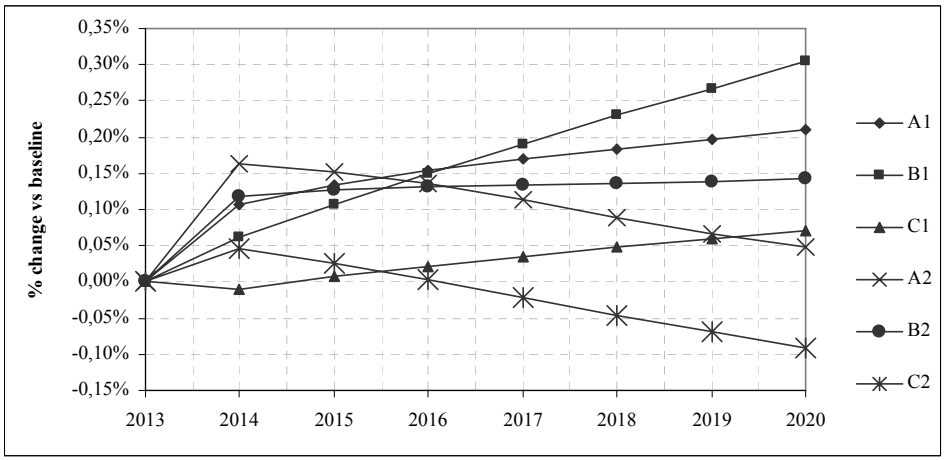


Source: Author's calculations.

The value added in the aggregated sector of industry shows a very diverse development (Figure 2).

F i g u r e 2

Value Added in Industry (% deviation from the baseline)



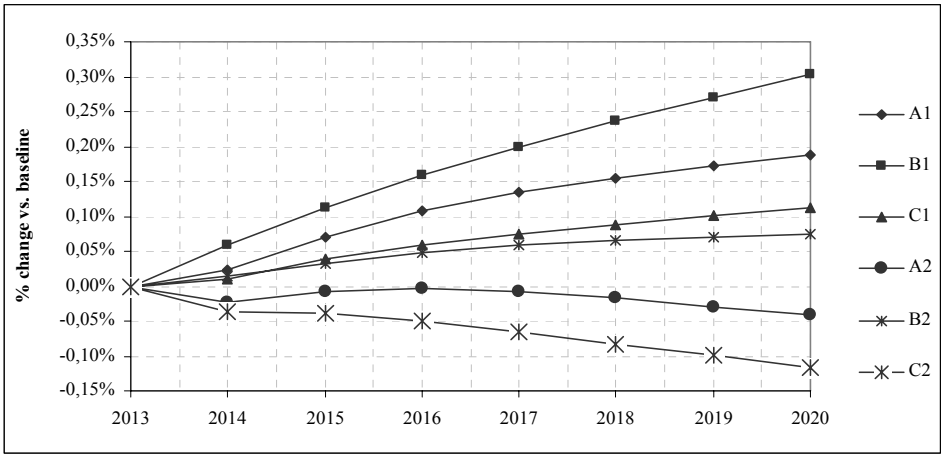
Source: Author's calculations.

At the end of the analysed period, the scenarios can produce changes ranging from –0.15% to +0.30% against the baseline. In the first period of the removal of subsidies, the highest increase of the value added in industry is noticed for Scenario A2. In the other periods, the value added in the industrial sector declines,

suggesting that this positive effect has only a short-term duration. The sharpest increase in the value added in industry is observed under Scenario B1, in which industry grows steadily above the baseline up to 0.30%, whereas in Scenario B2, value added stagnates in the longer run. This suggests that positive effects from the resource reallocation produced by the subsidy reduction in agriculture can be triggered if subsidy reduction is accompanied by the growth of governmental savings.

Diverse effects of a reduction in agricultural support are also produced in the aggregated sector of services. The range of value added deviations is similar to industry (–0.10%, +0.3%). The budgetary effects are most visible in the case of services. If direct payments granted under the 1st CAP pillar are reduced, services can benefit by an increase in value added of about 0.05%. If, parallel to that, payments to the EU budget decrease, the effects can jump up to 0.30% at the end of the observed period. Therefore, the budgetary effects produce an additional 0.25% increase in services. Contrary to that, if the subsidies granted in the 2nd pillar, devoted to the support of rural development, are removed, services can face a relative decline in value added, if this reduction is not supported by additional budgetary savings.

F i g u r e 3
Value Added in Services (% deviation from the baseline)



Source: Author's calculations.

6.2. Impact of a CAP Budget Reduction on GDP

The CGE model allows one to analyze the impact of the selected scenarios on individual components of GDP, as well as on the total GDP level (Table 4). With regard to *household consumption*, Scenarios B produce stronger shocks compared

to Scenarios C. Given that a reduction in direct payments, modelled in Scenario B, is directly linked to costs and production results, in a general equilibrium setting this is further translated into the production factors market, which provides the sources of income to households and firms. Contrary to Scenario B, shocks produced in Scenario C, linked to the removal of investment subsidies in agriculture, do not produce a major decline in household consumption, since they act through the investment channel. If all forms of subsidies are reduced, as modelled in Scenarios A, total household consumption can be contracted by 0.28% compared to the baseline. Assessing the two alternative budget variants suggests that with an additional reduction in payment contributions to the EU budget, the decline in household consumption produced by restrictive agrarian policy could be diverted by about 0.2 – 0.3%.

T a b l e 4

GDP and its Components (average deviation from the baseline, in %)

	Scenario A		***Scenario B***		***Scenario C***	
	A1	A2	B1	B2	C1	C2
Household consumption	–0.25	–0.28	–0.24	–0.26	0.01	–0.02
Gov. consumption	0.15	0.09	0.17	0.11	0.04	–0.02
Investments	–0.02	–0.72	0.48	–0.22	0.21	–0.49
Net exports	2.31	4.96	0.44	3.08	–0.77	1.87
Total GDP	0.02	–0.05	0.07	0.00	0.03	–0.04

Note: Calculated for the period 2013 – 2020.

Source: Author's calculations.

According to the closure setting, the *consumption of government* is determined as a fixed share of GDP. In light of this fact, the scenarios which produce an increase in GDP also stimulate governmental consumption. Therefore, the highest increase in governmental consumption is observed in Scenario B1, which also provides the highest GDP growth against the baseline.

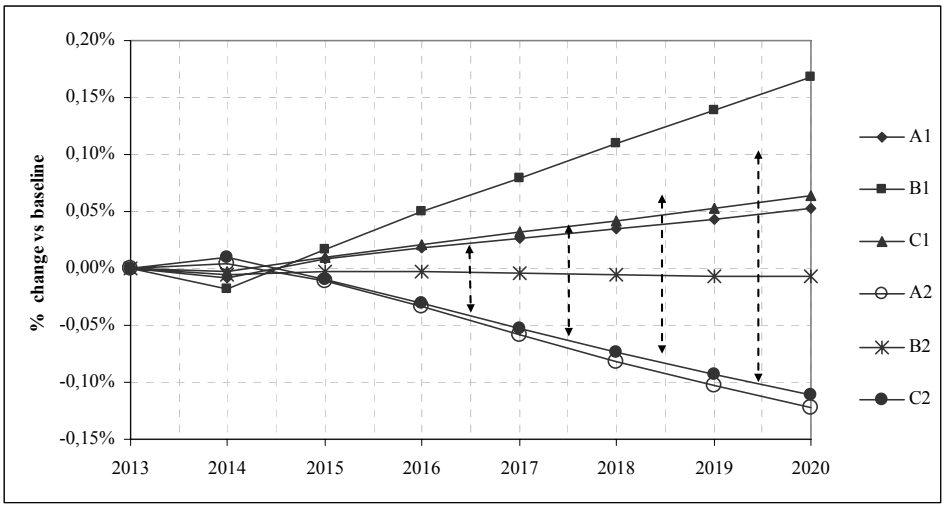
The evolution of *investments* varies with each scenario. According to the assumptions, the strongest decline occurs in Scenario C, in which the investments granted in the Rural Development Programme are removed. A reduction in direct payments produces, on the contrary, a smaller decline in investments, since the direct payments do not directly affect investment behaviour. If a reduction in direct payments and the removal of investment subsidies are combined, investments may decline by 0.72% compared to the baseline. Table 4 also shows that the possible reduction in national contributions to the EU budget would reduce the negative effect on investments. With regard to Scenario A1, up to 0.7% of the investment decline would be avoided as a result of increased governmental savings.

Net exports are the most variable GDP component. The reaction produced by the selected scenarios ranges from –0.77% to 4.96%. Comparing Scenarios B2 and C2, the increase in net exports against the baseline is stronger in the case of B2. This can be explained by the fact that a reduction in direct payments decreases the share of agriculture in total value added and produces a reallocation of resources to industry, which is more export-oriented. As Table 4 shows, the option of reducing budgetary payments may significantly change these results. As these alternatives have stimulating effects on investments, a strong increase in demand for investment goods is produced, which creates pressure on the market for industrial investment goods. This pressure occurs due to the fact that the industrial sector produces almost 70% of all investment goods in the Czech Republic. However, the market for manufactured goods is characterized by a high share of imports in the total domestic supply. Therefore, the effect of the stimulated investments results in an increase in imports, producing a deterioration of the foreign trade balance. This finding leads to the conclusion that the positive investment effect is outweighed by the decline in net exports.

The resulting effect of the GDP components on the aggregate indicator of GDP varies greatly with each scenario; at the end of the analyzed period, deviations from the baseline range from –0.12% to 0.17% (see Figure 4).

F i g u r e 4

Gross Domestic Product in Current Prices (% deviation from the baseline)



Source: Author's calculations.

The evolution of GDP clearly demonstrates that the effects of CAP policy instruments are properly evaluated only in a model that respects the dynamics of the economy. Considering the short-term effects, the removal of 2nd pillar

payments produces less harmful effects on the economy than a reduction in direct payments, which leads to the decline of GDP compared to the baseline. However, in the longer run, the results provide a completely different picture. As the resources are reallocated, a reduction in direct payments can produce a 0.15% increase in GDP against the baseline, provided that at the same time, contributions to the EU budget are reduced (in the opposite case, the effect on GDP is neutral). The harmful impact of Scenarios C, which assume the removal of investment subsidies, turns out to be much greater than could be recorded in the shorter term. This is mainly because investments impact the economy in subsequent periods, when they are capitalized in the form of the capital stock. Thus, these effects deepen over time, since they influence the dynamics of economic growth.

6.3. Impact of a CAP Budget Reduction on the other Macroeconomic Variables and Total Welfare

Changes in GDP, produced by the analyzed scenarios, have repercussions in the other macroeconomic variables. The results of the simulations indicate that distortions occur in all production factor markets (Table 5). Regarding the *labour market*, a reduction in agricultural support leads to an increase in unemployment, accompanied by a decline in wages. This finding is not very consistent with GDP growth, produced particularly in Scenarios B1 and C1. As Table 5 displays, the unemployment rate rises by 0.07 percentage points in Scenario B1, while the GDP in the respective scenario grows by 0.07% compared to the baseline. This discrepancy can be explained by the fact that the economic growth, induced by restrictive agrarian policy, is driven by the increasing capital stock, which replaces the labour used in the production process. As a result of this process, the economy becomes more capital-intensive, compared to the status quo scenario. Figure 5 clearly indicates that the highest capital-labour ratio is achieved under Scenario B1, where it exceeds the baseline by 0.26%. On the other hand, a decline in the capital intensity of the economy is observed in Scenario C2, which is negatively influenced by the decrease in capital stock formation, resulting from the removal of investment subsidies.

With respect to the *land market*, due to the inelastic supply of land, land price indices react very sensitively to a change in the demand for land. Whereas in Scenarios B, the land price index can see a significant decline, reaching 64%, Scenarios C1 and C2 report even a slight increase. Such a strong fall of the land price index in Scenarios B is caused by a considerable decline in agricultural production, which leads to a significant reduction in the demand for land. As concerns Scenarios C1 and C2, the demand for land remains high, since the sector's production does not predominantly decrease. Furthermore, with respect to the

increasing prices of capital in the C1 and C2 Scenarios, capital can be partially substituted for land, thereby avoiding strong downward pressure on land demand.

The evolution of the capital price index is consistent with capital stock formation. Capital becomes relatively cheaper in the presence of higher capital endowments and vice versa.

According to the assumptions, a reduction in agricultural support results in an increase in *consumer prices*. As expected, consumer prices grow faster in the case of a reduction in 1st pillar subsidies, as a result of the direct effect of these subsidies on producer prices, which is translated into food prices for consumers. On the other hand, the removal of investment subsidies contributes only moderately to price inflation.

T a b l e 5

Unemployment and Price Indices (average deviation from the baseline, in %)

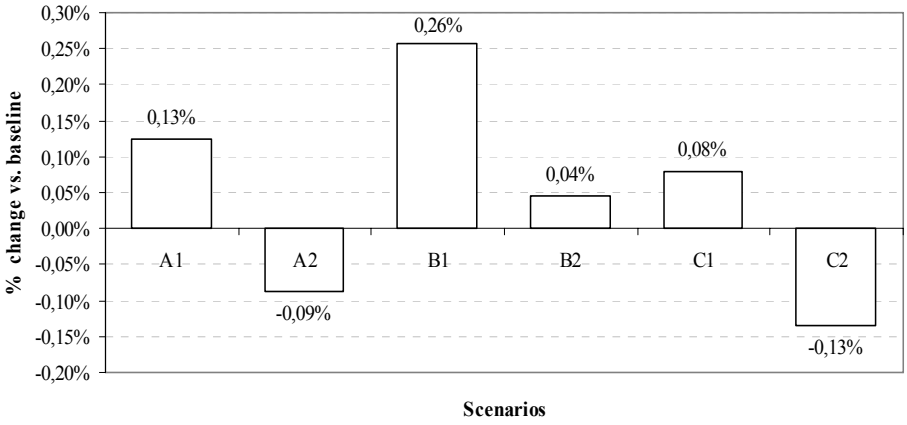
	Scenario A		***Scenario B***		***Scenario C***	
	A1	A2	B1	B2	C1	C2
Unemployment	0.08	0.09	0.07	0.07	0.01	0.01
Wage index	–0.27	–0.29	–0.23	–0.25	–0.02	–0.04
Land price index	–62.60	–62.55	–63.82	–63.77	2.37	2.57
Capital price index	–0.47	–0.20	–7.15	–6.93	5.85	6.15
Consumer price index	0.13	0.14	0.10	0.11	0.01	0.02
Exchange rate EU index*	0.11	0.18	0.06	0.13	–0.02	0.05

Note: * expressed in CZK/EUR; calculated for the period 2013 – 2020.

Source: Author's calculations.

F i g u r e 5

Capital-labour Ratio per Scenario (average deviation from the baseline)



Note: Calculated for the period 2013 – 2020.

Source: Author's calculations.

Finally, the impact of the scenarios on the *exchange rate* is reported. Except for Scenario C1, all scenarios report tendencies toward currency depreciation. In the case of direct payment reduction, depreciation of the Czech Crown is stronger, since the direct payments from 2013 on are fully financed from the EU budget. Concerning the C2 Scenario, the depreciation effect is lower, as the investment subsidies are co-financed from the national budget, therefore causing lower pressure on the balance of payments. Comparing the two budget payment alternatives across the scenarios, the option of reduced contributions to the EU budget mitigates the negative effects on the balance of payments and on currency depreciation. Very moderate currency appreciation may occur in the case of Scenario C1, where a reduction in balance of payment inflows due to removal of investment subsidies is compensated by a reduction in payment outflows as a result of the decrease in EU budget contributions. Finally, all considered scenarios can be assessed from the perspective of their contribution to the total welfare. The CGE model enables the measurement of welfare by alternative indicators. In this case, the equivalent variation is calculated, which estimates consumer costs that are associated with a change in market equilibrium.

Table 6 allows for a comparison of welfare changes with regard to farmers and other households. Obviously, farmer households are significantly more affected by the considered scenarios than other groups of households. It should also be noted that Scenarios A and B cause more distortions of farmers' welfare, as these scenarios negatively affect factor incomes. On the other hand, farmers could be relatively better off in Scenario C, due to rising land prices that stimulate their income. The overall effect concerning all households is negative in all cases; however, comparing individual scenarios, it can be observed that a reduction in 1st pillar subsidies brings higher costs to households, as opposed to the removal of 2nd pillar subsidies.

Confronting the welfare effects with GDP brings contradictory conclusions. Apparently, there is no unique optimal scenario, since the criterion of economic growth is in conflict with the criterion of social welfare.

T a b l e 6

Equivalent Variation and GDP (average deviation from the baseline, in %)

	Scenario A		***Scenario B***		***Scenario C***	
	A1	A2	B1	B2	C1	C2
Equivalent variation, households	–0.70	–0.91	–0.65	–0.75	–0.05	–0.15
Equivalent variation, farmers	–4.42	–4.97	–5.48	–5.46	0.43	0.45
Equivalent variation, total	–0.96	–1.18	–0.98	–1.07	–0.02	–0.11
Total GDP	0.02	–0.05	0.07	0.00	0.03	–0.04

Note: Calculated for the period 2013 – 2020.

Source: Author's calculations.

7. Discussion

The results of this research can be only partially compared with other papers, since the multi-country CGE models, such as the GTAP, have a different model structure. As opposed to the micro-level, where the effects on particular agricultural commodity markets are more comparable, macro-level comparisons can be misleading due to different macro closures in each model.

Furthermore, it should be pointed out that the presented CGE model is a single-economy model and therefore does not take into account parallel impacts of the considered scenarios on the other EU member states, which would be similarly affected in case of a CAP budget reduction. It is assumed that the final reaction of EU market prices depends on several factors, such as the role of direct payments in the competitiveness of the agricultural sector in each member state, the importance of direct payments in the total agricultural support in each country, and the price level differences between each member state. The resulting EU-wide price effect is a combination of all factors and is not predictable within this CGE model. Therefore, in this study, it is assumed that the combination of all factors leads to a neutral effect on the international EU price.

In light of these facts, when comparing studies with a similar focus, the results are not consistent with the findings of this paper. For instance, the European Commission in *Scenar 2020* reports a growth in GDP of 0.2%, and Dixon (2006) calculates a growth of 0.03% against the baseline, if the subsidies are reduced. However, the scenarios performed in this paper show that the impact of agricultural subsidy reduction is rather negative, provided that the policy restriction measures are not accompanied by a parallel decrease in national contributions to the EU budget. Even though these results do not necessarily need to be comparable, this might suggest that the role of agriculture in other models is underestimated.

Conclusions

This paper presents the results of the possible impacts of a CAP budget reduction on the Czech economy, with a specific focus on the macroeconomic level. Three scenarios were tested, which considered a reduction in direct payments, a removal of investment subsidies and a combination of both instruments. Furthermore, two different budget payment options were considered, in order to assess the sensitivity of the economy to these financing options.

The results of this paper confirm the suitability of the general equilibrium approach. First of all, it has been shown that the measures directly affecting

agriculture are translated to other sectors of the national economy. In the case of direct payment reduction, the reallocation of resources can positively affect industry and services. On the other hand, a restrictive policy regarding 2nd pillar payments can negatively affect all sectors of the economy, as the support is not exclusively granted to the agricultural sector. The results of the paper further show that CAP plays a role in macroeconomic stability. If CAP support is reduced, increasing inflation and currency depreciation can be expected (driven especially by a reduction in direct payments).

Secondly, the divergence in the static and dynamic results confirms the necessity of a dynamic approach in the CGE analysis. In this respect, a reduction in direct payments can produce harmful effects in the short-term; however, over the long-term it can stimulate economic growth, since the resources are reallocated to sectors with a higher export orientation (industry) and higher capital attractiveness (services). On the other hand, the dynamic gains are less pronounced when investment subsidies are removed, where the short-term positive effects are replaced by negative effects stemming from the lower dynamics of economic growth.

Finally, the budget contribution option shed some light on the efficiency of the actions being considered for reforming CAP. The results clearly show that the removal of subsidies in agriculture can only have positive effects if the governmental contributions to the EU budget are relaxed. In the other case, that of subsidies reduction, those included in the 2nd pillar payments in particular can produce counter-stimulating effects on the economy.

Furthermore, there are a few additional implications. First of all, restrictions on agricultural support negatively influence the level of employment, as the economy becomes more capital intensive. Therefore, the government should prevent a rise in the unemployment level by investing in requalification programs. Attention should also be paid to the decreasing welfare of households as a result of a CAP budget reduction.

References

BEDNAŘÍKOVÁ, Z. – DOUCHA, T. (2009): Impact of Agricultural Policy Scenarios on the Development of Remote Rural Areas – A Case Study of Bruntál and Ostrava Districts. Czech Journal of Agricultural Economics, *55*, No. 4, pp. 161 – 168.

DECREAUX, Y. – VALIN, H. (2007): MIRAGE, Updated Version of the Model for Trade Policy Analysis Focus on Agriculture and Dynamics. [CEPII Working Paper.] Available at: <http://www.cepii.fr/anglaisgraph/workpap/pdf/2007/wp07-15.pdf>.

DINAMARAN, B. (2006): Global Trade, Assistance and Production. The GTAP 6 Database, Software Documentation. Pardue: Centre for Global Trade Analysis, Department of Agriculture, Purdue University, December.

DIXON, J. (2006): The 2003 Mid-Term Review of Common Agricultural Policy: A Computable General Equilibrium Analysis for Ireland. [Poster paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12 – 18, 2006.] Available at: <http://ageconsearch.umn.edu/handle/25284>.

DYBCZAK, K. – VOŇKA, D. – Van der WINDT, N. (2008): The Effect of Oil Price Shocks on the Czech Economy. [Working Paper Series 5.] Prague: Czech National Bank, 40 p.

ELBEHRI, A. – UMSTAETTER, J. – KELCH, D. (2008): The EU Sugar Policy Regime and Implications of Reform. [Economic Research Report, No. 59.] Washington: Economic Research Service/USDA, July.

EC (2010): European Economic Forecast – Spring 2010. Luxembourg: European Commission. ISBN 978-92-79-14804-0.

EC (2007): Scenar 2020. Scenario Study on Agriculture and Rural World. Brussels: Directorate-General Agriculture and Rural Development. ISBN 978-92-79-05441-9.

GELAN, A. – SCHWARZ, G. (2006): Policy Impact Evaluation Model for Scotland: Decoupling Single Farm Payments. [Aberdeen Discussion Paper Series: People, Environment and Development, Scotland.] Aberdeen: The Macaulay Institute.

GOHIN, A. – BUREAU, J. C. (2006): Modelling the EU Sugar Supply to Assess Sectoral Policy Reforms. European Review of Agricultural Economics, *33*, No. 2, pp. 223 – 247.

IMF (2010): World Economic Outlook, Rebalancing the Growth. Washington, DC: International Monetary Fund, April. ISBN 978-1-58906-915-2.

KŘÍSTKOVÁ, Z. (2010a): Approaches to the Dynamization of the CGE Model Applied to the Czech Republic. Emerging Markets Finance & Trade, *46*, May – June, Supplement, No. 1, pp. 59 – 82.

KŘÍSTKOVÁ, Z. (2010b): Impact of Common Agricultural Policy Reform on the Czech Economy, a General Equilibrium Approach. [Paper presented at the International Conference on Economic Modelling, Ecomod.] Istanbul: EcoMod.

MF ČR (2010): Makroekonomická predikce České republiky. Praha: Ministerstvo financí České republiky, červenec 2010. Available at: <http://www.mfcr.cz/makropre>. Accessed in January 2011.

MIŤKOVÁ, V. (2009): Is Growth in Automotives Beneficial for Slovakia? An Applied CGE Model Study. Ekonomický časopis/Journal of Economics, *57,* No. 4, pp. 309 – 326.

MZE ČR (2005 – 2008): Publikace Zemědělství. Available at: http://eagri.cz/public/web/mze/zemedelstvi/publikace-a-dokumenty/publikace-zemedelstvi/. Accessed in January 2010.

PAVEL, J. (2006): Macroeconomic Models of the Impact of Environmental Policy Measures on the Macroeconomic Aggregates in the Czech Republic. Prague: Institute for Economic and Environmental Policy (IEEP), 186 p. ISBN 80-86684-40-7.

PIERMARTINI, R. (2006.): Modelling Methods for Trade Policy I: Simulations, Models, Economic Research and Analysis Division. Bangkok: WTO, April.

RATINGER, T. – TOUŠEK, Z. (2004): Vliv přijetí společné zemědělské politiky evropské unie na rozvoj české ekonomiky. Politická ekonomie, *LII,* No. 4, pp. 465 – 481.

TANGERMANN, S. – BANSE, M. (2000): Central and Eastern European Agriculture in an Expanding European Union. New York: CABI, 224 p. ISBN 978-0-85199-425-3.

UZEI (2009): Interní materiály. Praha: Ústav zemědělské ekonomiky a informací.