Modelling direct payments to agriculture in a CGE Framework – analysis of the Czech Republic

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Abstract: The paper deals with modelling of the direct payments subsidies to agriculture and their impact on the economy of the Czech Republic. With the use of the general equilibrium model, scenarios concerning an increase of subsidies reaching 100% of the national envelope and a complete removal of both SAPS and Top-Up payments are applied. The results show that if the full amount of subsidies is granted, the value added in agriculture and the connected sectors is stimulated, with a positive effect on the total GDP. However, if the direct payments are completely removed, negative effects on employment can be expected, suggesting that the direct payments play a positive role in the economy. The paper further points out that the effects of direct payments on the incomes of farmer households are limited, suggesting that the farmers' living standard should be supported by other policy instruments than the direct payments

Key words: direct payments, general equilibrium model, farmer households, Czech Republic.

Governmental support to the agricultural sector in the European Union, formulated in the Common Agricultural Policy (CAP), is firmly embedded in the functioning of the European common market. Yet, the volume and the structure of the support to agriculture are constantly revised as a result of the international pressures linked to the WTO negotiations and the internal member state debates among the net-payers and net-contributors. The discussions on reforming the CAP are oriented on reducing the distortion effect on the world commodity markets. In view of this, the instruments previously linked to the volume of agricultural production were translated into the decoupled support that is granted to farmers (agricultural producers) conditionally to the specific agro-environmental criteria but with no link to the amount of agricultural production. These decoupled instruments are provided to farmers in the form of the direct payments per unit of agricultural land, defined according to the historical reference period in the EU-15 member states (distributed in the Single Payment Scheme – SPS). For the newly accessed EU member states, where the historical level could not be applied, the direct payment represents a uniform amount per hectare of agricultural land up to the national ceiling resulting from the accession agreements (distributed in the Single Area Payment Scheme – SAPS).

By accessing the European Union in 2004, the Czech Republic adopted the EU Common Agricultural Policy which resulted in a significant increase of agricultural income, most of which proceeds from the governmental support in the form of direct payments.

In the light of the outstanding role of the decoupled subsidies in supporting the agricultural sector, the question of the efficiency of this support instrument arises, moreover, it becomes still more important in relation to the discussion on the future shape of the CAP after the 2013 programming period.

The paper aims at providing an insight into the role of direct payments in the economy with the focus on the specific case of the Czech Republic. At first, the theoretical assumptions on the economic impact of direct payments and the different modelling approaches in incorporating these support instruments are reviewed. Secondly, the construction of a general equilibrium model used for the simulations of the direct payments scenarios is described. The third chapter provides an analysis of the impact of direct payments on the Czech economy.

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THEORETICAL BACKGROUND

Theoretical review of the economic impact of direct payments

A comprehensive review of the economic impact of the government support is provided in the work of Latrouffe and Mouel (2007). From the theoretical point of view, direct payments granted on the basis of the agricultural area represent a form of a land subsidy, which directly affects the market of production factors. Based on the agricultural production theory, Latrouffe and Mouel (2007) derive some general insights as regards the impacts of various policy instruments on the rental price of farmland. First of all, any agricultural support policy instruments contribute to increasing the rental price of farmland as they stimulate the agricultural activity and hence the demand for production factors that are used in agriculture. In concrete, the direct payments, representing a certain form of a land subsidy, act in the way that they decrease the costs of using the subsidized production factor and hence they shift the producer's supply function to the right. In consequence of that, the price of the production factor which is subsidized goes up, causing a capitalization of the government support. As Latrouffe and Mouel point out, the final extent of this increase depends on the supply price elasticity of farmland relative to other factors and the possibility of substitution of the production factors used in the agricultural production process. In comparing two types of measures– the output price support instrument and the factor subsidy, the former instrument affects directly the volume of agricultural production and consequently the demand for production factors, where with a higher level of substitution, the land can be partially replaced by other production factor and the resulting capitalization of land price is not significant, rather the effect is diluted in the market of other production factors. On the other hand, with a factor subsidy, namely the area payment, the main incentive for the farmer is to substitute other production factors for land which reduces the farmer's costs of production. In doing this, the pressure on the land market is stronger, resulting in a substantial land price capitalization. Moreover, the market of other production factors goes down as the interest is shifted to the land market and hence the owners of the other production factors are negatively affected.

In summarizing the economic affect of land subsidy, the main concern is the resulting land price capitalization which normally brings the benefit to the land owners. However, in cases when agricultural producers do not own the land that they farm, the final benefit of the subsidy is ambiguous.

An empirical analysis of the land price capitalization can be found in the works of various authors. The results of Just and Miranowski (1993) show that the support accounts for 15–30% of the land prices. Alarming is the finding that the land prices are more responsive to the government-based returns than to the market-based returns (Duvivier et al. 2005).

The results of the Latrouffe et al. (2006) study of the impact of subsidies on land prices in the Czech Republic based on the panel data econometric estimation show that the support in the form of the direct payments and the plot size are significant variables in explaining the changes in land prices.

Shown both theoretically and empirically, the land subsidies such as direct payments have their repercussions on the land markets. However, with the decoupling of direct payments in the CAP reform of 2003, the economic concept of direct payment is reformed as well. This is to say, it can be discussed whether the direct payments still perform the role of a factor subsidy, or whether they rather represent a direct monetary transfer to farmers.

Modelling approaches to direct payments

In reviewing the methodological tools dealing with modelling direct payments, both partial and general equilibrium models are applied in the economic studies. There are various sources of literature concerning the impact of decoupling of the direct payments in the European Union, most of the sources, however, refer to the use of the models discussed in the paper of Balkhausen et al. (2007). Currently, eight European[1] agricultural models are largely applied in economic simulations, of which six are the partial equilibrium models[2]. The remaining two models are the general equilibrium models GTAP and GOAL. Balkhausen and Banse provide a classification of the models according to their approach to the direct payment decoupling on the basis of selected aspects. One aspect of decoupling is the attribution of direct payments to the agricultural products. Both mentioned general equilibrium models enable to model the impact of direct payments on the individual products while some of the partial equilibrium models assume an aggregate impact on the product group. Another modelling is-

[1]Or broader multinational models where the EU is a part.

[2]The partial equilibrium models are: AGLINK, AG-MEMOD, CAPRI, CAPSIM, ESIM and FAPRI.

sue is the incorporation of the decoupling level that affects the extent of the possible land capitalization. In some partial equilibrium models, the coupling factors that are multiplied with the direct payments in the area allocation functions are applied. Other models tackle the decoupling character of direct payments by a differentiation in market returns, in which the crops previously excluded from the coupled direct payments, such as fodder and pasture, are better off after the decoupling. In the GOAL model, the issue of decoupling is tackled by the assumptions of the limited capitalisation of direct payments in land prices.

Jensen and Frandsen (2003) use the GTAP model to estimate the impact of the 2003 CAP in view of the Eastern European Integration. In the similar way, Phillipidis et al. (2006) in their impact study of the Harbinson proposal of the Doha Round Liberalization treat decoupled payments as the land subsidy that is converted into a uniform hectare payment given to all utilised agricultural area.

A new approach to the direct payments modelling can be found in the work of Balamou et al. (2008) that analyse the effects of a change in agricultural support on two selected case study regions. Balamou et al. (2008) consider direct payments as the transfers from government to the agricultural households that consequently influence the income balance between the rural and urban population.

METHODOLOGY AND DATA SOURCES

The Computable General Equilibrium (CGE) models represent a relatively new category of modelling methods which translate the concept of Walrasian general equilibrium into the realistic representation of specific economies. In practice, the multiple equilibria are formulated by the means of a set of nonlinear simultaneous equations which are derived from the microeconomic theory of producer and consumer optimization with the aim of recording all possible transactions among the agents of the economy.

In order to describe the present economy in the structure of the CGE model, the data should be arranged into the form of a Social Accounting Matrix (SAM).

Construction of the Social Accounting Matrix for the Czech Republic

The Social Accounting Matrix contains information about the economy recorded in the System of National Accounts. At present, after a pause in the field of economic modelling caused by rebuilding of the statistical surveys and methods, the Czech System of National Accounts (SNA) is fully compatible with the other countries of the European Union (Janovskij and Rojíček 2004)[3].

The Social Accounting Matrix used in the paper is based on the national accounts data provided by the Czech Statistical Office (CSO) for the year 2006. An aggregated form of the matrix which is used in the analysis is presented in Table 1.

Because of the intended focus of the model on agriculture and the impact of agricultural policies, the agricultural production and commodities are further disaggregated in 8 accounts, while the non-agricultural production accounts have been aggregated

Table 1. Aggregated SAM for the CR (2006) in mln. CZK

SAM CR 2006	Commodities	Activities	Production factors	Institutions	Taxes	Capital account	Rest of the World	Total
Commodities		5 406 196		2 249 549		852 931	2 464 716	10 973 393
Activities	8 306 529							8 306 529
Prod. factors		2 355 125					23 789	2 378 914
Institutions			2 342 133	1 907 231	284 669		154 566	4 688 599
Taxes	315 625	–30 956						284 669
Capital account		576 164		204 660		285 783	77 151	1 143 758
ROW	2 351 238		36 781	327 159		5 044		2 720 222
Total	10 973 393	8 306 529	2 378 914	4 688 599	284 669	1 143 758	2 720 222	

Source: Czech Statistical Office, author's elaboration

[3]Input-output tables (supply and use tables) of the Czech Republic covering the years 1995–2007 are available at the EUROSTAT (http://epp.eurostat.ec.europa.eu).

into two accounts only, i.e. Industry and Services. The aggregated sector of manufacturing comprises the sectors C–I in the standard NACE classification and the aggregated sector of services includes NACE sectors J–P (Czech Statistical Office 2008).

The disaggregation of the respective agricultural accounts was possible with the use of the production surveys and commodity balances, provided by the Institute of Agricultural Economics and Information.

A further modification to the general form of the SAM concerned the disaggregation of households account into the farming and non-farming households. In this paper, the "*farmer households*" represent the households whose factor income originates exclusively from agriculture, distinguishing from the concept of "*rural households*", in which the households may participate in other economic activities.

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. The final arrangement of the data represents a square matrix of the range 43 × 43[4]. The data structure adopted in the SAM provides, on one hand, a comprehensive overview of the economy, and on the other hand, it contains all the elements of importance for formulating a CGE model.

Description of the static CGE model

The CGE methodology provides a valuable framework for modelling the interaction between the agents and their interdependences on endogenous changes and exogenous shocks. In order to define the relationships that exist between the various elements of the model, choices need to be made on how to represent the behaviour of the agents. Besides, the equilibrium in all markets needs to be defined by the means of market clearing equations, and assumptions on the market structure leading to zero profit conditions. These elements of the CGE model will be elicited in this section.

Production structure and technology

The CGE model does not consider individual firms, but rather groups of similar firms aggregated into sectors. The various sectors are characterized by their production structure describing the relation between inputs into the production process and the output resulting from the economic activity. In this context, it is assumed that the total domestic supply is a fixed factor Leontief combination of the intermediate consumption and the value added under perfect competition and constant returns to scale. The producers minimize the costs of employing production factors of capital, land and labour subject to their production technologies.

For modelling of the value added, two groups of production sectors are distinguished: the sectors that use land as a production factor (*secland*), and the sectors that use only labour and capital (*secnland*).

In the first stage, the 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) based on which the demand functions of labour and capital-land are derived.

$$VA_i = aF_i \times \left(\chi F_i \times KD_i^{-\rho Fi} + (1-\chi F_i) \times L^{-\rho Fi}\right)^{-1/\iota} \qquad (1)$$

where: aF_i is the efficiency coefficient and χF_i and $(1 - \chi F_i)$ are 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.

Analogically in the second stage, the optimal combination of capital and land is modelled with the use of the CES II production function.

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

Households' behaviour

The behaviour of households in the Czech economy is simulated by introducing two representative households – farmer households and other households that optimise their utility subject to a budget constraint. Whereas the microeconomic theory provides numerous suggestions, a standard choice in the field of the CGE models is the Stone-Geary Linear Expenditure System (LES) (Equation 2).

$$U = \prod_j \left(C_j - \mu Hj\right)^{\alpha} \quad \text{where} \quad \sum_j \alpha HLES_j = 1 \qquad (2)$$

where: U is the consumer's utility, C_j is the amount of consumption of the j-th commodity, μH_i represents the subsistence level of consumption of each j-th commodity[5] and $\alpha HLES_i$ is a preferential parameter of the respective j-th commodity in the consumer basket.

[4]The full version of the SAM is available from the author upon request.

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

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

Government behaviour

The government maximizes the 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:

$$U = \prod_j CG_j^{\alpha CG_j} \qquad \text{where } \sum_j \alpha CG_j = 1 \tag{3}$$

where: CG_j is the governmental consumption of a commodity j and αCG_j represents the preferential parameter in the government consumption basket.

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

Modelling foreign sector

The total supply in the market is represented by a *composite commodity* consisting of the bundle of the 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 the foreign and domestic markets, expressed by a Constant Elasticity of Transformation (CET) function, and the intension of consumer to find the optimal combination of the imported and domestically produced commodity in the market, expressed in the CES Armington function. The functional form of the CET function is given in Equation 4.

CET I:

$$XC_j = aT_j\left(\chi T_j \cdot E_j^{-\rho Ti} + \left(1-\chi T_j\right)XDD^{-\rho Tj}\right)^{-1/\rho Tj} \tag{4}$$

where: XC_j is the amount of domestic production of the j-th commodity, E_j is the amount of exports of j-th commodity to the Rest of the World and XDD_j is the amount of domestic production of j-th commodity supplied to domestic market. Analogically to the CES function, aT_j, γT_j and $-\rho T$ are the parameters of the CET function.

The CES function with the Armington assumption is used to determine the extent of substitutability of the components of the composite commodity where it is assumed, that there is no perfect substitution between the domestically produced and imported commodity. The functional form of the Armington CES function is provided in Equation 5.

CES Armington (I):

$$X_j = aA_j\left(\chi A_j \cdot M_j^{-\rho Ai} + \left(1-\chi A_j\right)XDD_j^{-\rho Aj}\right)^{-1/\rho Aj} \tag{5}$$

where: X_j is the amount of the total supply of the j-th commodity in the domestic market, M_j is the amount of imports of jth commodity from the Rest of the World, XDD_j is the amount of domestic production of j-th commodity supplied to domestic market. Analogically to the CES function, aA, γA_j and $-\rho A$ are the parameters of the CES function.

An extension of the foreign market equations has been carried out in order to disaggregate the foreign sector in the EU and the Rest of the World (the scheme of flows is displayed in Figure 1). The following assumptions have been made to address the issue:

– It is assumed that there is an aggregated CET function that distributes the total domestic production between the domestic and foreign markets (CET I).
– Exports defined in the CET I are further disaggregated in the second nested level between exports to the EU and the Rest of the World (RoW) based on the CET II function.
– The equilibrium between the export supply and the export demand determines the export prices in both foreign markets.
– An aggregated CES function that combines the domestic production delivered to domestic markets and imports in one bundle is applied.
– Imports defined in the CES I function are disaggregated on the second nest level to imports from the EU and the ROW with the use of the CES II function.

In addition to the behavioural characteristics, the proposed model is based on the following assumptions:

– Fixed supply of production factors capital, labour and land.
– 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.
– Governmental consumption is modelled as a fixed proportion of the GDP.
– Following the assumption of a small country, both world export and import prices are fixed.
– Model closure consists in the endogenous exchange rate adjusting to the exogenous foreign savings.

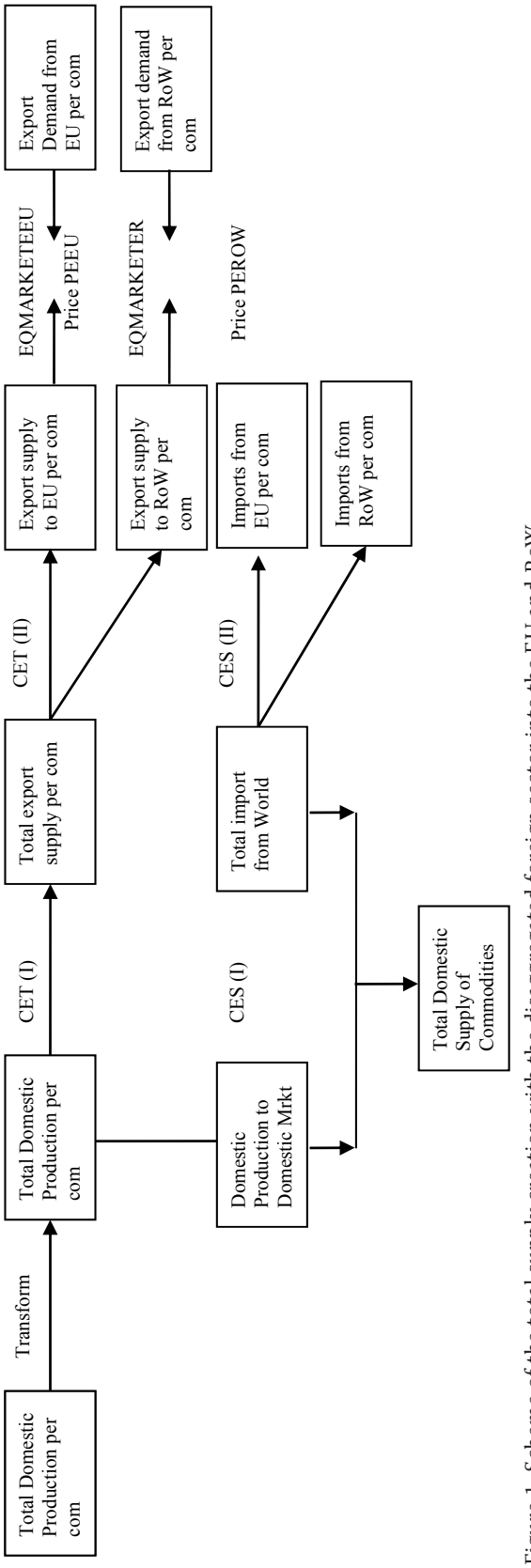

Figure 1. Scheme of the total supply creation with the disaggregated foreign sector into the EU and RoW
Source: Author's elaboration

Incorporation of direct payments into the CGE model

Selecting the proper way of modelling the direct payments should be based on the assumptions of their effect on the farmers' production decisions. Given that in the Czech Republic the agricultural sector is dominated by larger scale enterprises rather than family farms typical for the EU-15 countries, it is plausible to assume that direct payments act as production subsidies that enable to partially cover the costs resulting from the production process and thus have direct effects on the production decisions of the farmers.

With respect to the fact that in the Czech Republic the direct payment rate per hectare highly exceeds the rent[6], modelling direct payments solely as land subsidies would cause computational problems, which is also alerted by other CGE modellers (Gohin and Bureau 2006). In order to eliminate this problem, a part of the direct payment subsidy is allocated to land and the rest is modelled as a production subsidy. Thus, the total amount of direct payments allocated to each individual agricultural sector is a negative sum of production and land subsidies[7], as displayed in formula 6:

$$DP = -\left(\sum_i td_i \times PLDZ \times D_i + \sum_i tp_i \times PDZ \times XDZ_i\right) \quad (6)$$

where DP are direct payments, td_i and tp_i are land and production subsidy rates in the respective i^{th} sector, $PLDZ$ and PDZ_i are the initial land and producer price indexes, D_i represents land used in each respective sector and XDZ_i is the initial gross production per the respective agricultural sector.

The sources of direct payments are recorded in the equation 7, where *SAPS* are the Single Area Payments from the European Union and *TOPUP* is the contribution of the Czech government to complement the direct payments. Since both variables are exogenous, they must be multiplied by price indexes – the exchange rate with the European Union (*EREU)* and the consumer price index (*PCINDEX),* in order to reflect the changes of price level in the external and domestic market.

$$DP = SAPS \times EREU + TOPUP \times PCINDEX \quad (7)$$

Furthermore, modelling direct payments also requires a modification in the equation of the balance of payments, as displayed in Equation 8.

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

[7]Since the subsidies are treated as negative taxes, a negative sign is added to convert the sum to a positive value.

$$NetSFEU = \sum M_j \times PM_j - \sum E_j \times PE_j + \\ + NetTRtEU_k \times PCINDEX - SAPS \times EREU \quad (8)$$

where: the net savings from the EU represent a fixed balance of payments of the European Union with the Czech Republic, modelled as a sum of the inverse foreign trade balance (as the foreign trade balance deteriorates, the exchange rate acts to maintain the balance) and the net flows to the non-residents (represented by transfers from the institutions and net wages paid to the EU). Since the SAPS represent an income item of the balance of payments, it is subtracted on the right side of the equation.

Another modification is performed with the governmental expenditure equation, where the exogenous variable TOPUP is included. Finally, the farmer households' income equation is extended to include the flows of the direct payments.

MODEL ANALYSIS

Governmental support of agriculture in the Czech Republic

The Accession of the Czech Republic to the European Union has brought about a considerable growth of the financial support to agriculture. When analysing the dynamics of support to agriculture before the EU accession it can be found out that within the years 1995–2001, the support to agriculture grew by approximately 22% annually. After the year 2000, the expenditures from the national budget stabilized, seen as a sign of the possible end of the transformation period of the Czech agriculture. The breaking point in the development of support to agriculture is the year 2004, when the CAP was adopted with considerably larger funds available than before.

As seen from Table 2, the share of direct payments in the total support concerning the period of 2005–2008 reached approximately 50%. Funds granted for the rural development programs were the second most important category of the financial support to agriculture, representing almost 30% of the total agricultural budget.

The direct payments had two components: the payment from the EU provided in the framework of the Simplified Area Payment Scheme (SAPS) and the Complementary National Direct Payments (Top-Ups) by which the national government could partially cover the gap between the level of the EU subsidies granted to Czech and the EU 15 farmers. In the accession year, Czech farmers obtained only 25% of the national envelope granted to the Czech Republic by the Agenda 2000[8], but additional 30% as the Top-up payments.

Definition of scenarios

In connection to the increasing role of direct payments in the total support to agriculture, two scenarios were defined:

– Scenario 1: This scenario aims at simulating the impact of increasing total direct payments granted to Czech agriculture to the 100% level of the national envelope with no additional Top-up payments. In this scenario, it is assumed that the direct payment rate would reach 256 EUR/ha, which is a 186% increase with respect to the baseline level of 89 EUR/ha in 2006.
– Scenario 2: This scenario models a situation of a complete removal of direct payments concerning both SAPS and Top-up.

The impact of both scenarios is assessed in the static framework, that is, it is compared to the benchmark equilibrium in the year 2006.

Table 2. Structure of the expenditures on agricultural policy 2005–2008 (in %)

	2005	2006	2007	2008
Direct Payments Support	46	47	51	51
Regional Development and Agroenvi Support	28	29	27	28
National Support	21	20	19	19
Common Market Organization Support	5	4	3	2
Total	100	100	100	100

Source: Green Reports 2005–2008

[8]Under which the accession agreement was negotiated. The amount from the EU gradually increased reaching 100% in 2013.

Table 3. Gross Value Added and Price level (comparison to the baseline) in %

	Agriculture	Manufacturing	Services	Total
Gross Value Added in constant prices 2006				
Scenario 1	1.76	–0.21	0.13	0.02
Scenario 2	–9.82	0.11	0.03	–0.11
Composite commodity price index				
Scenario 1	–2.78	–0.27	0.03	–1.76
Scenario 2	18.59	1.26	–0.24	11.58

Results of the simulation

In analysing the impact of different direct payments levels on the equilibrium in the economy, plenty of economic variables might be taken into account. In order to provide the results in a structured way, five groups of variables serving as indicators were formed and the impact of different scenarios concerning the chosen areas was evaluated:

– Impact on the production activity in agriculture and other sectors;
– Impact on the production factor market;
– Impact on income of farmers' households;
– Impact on the foreign trade;
– Impact on the macro level.

Impact on the production activity in agriculture and other sectors

Table 3 shows the resulting impact of the considered scenarios on the value added generated in the sectors of agriculture, manufacturing and services. Concerning the first scenario, in which the direct payments are simulated to reach a 100% level, **the value added in agriculture increases by almost 2%** with respect to the baseline. Such a positive reaction is attributed to the increased amount of direct payments that cover the production costs and decrease producer prices. Given that in the short-term period, both capital and labour supply is limited, the increase of the production of the agricultural sector occurs at the expense of the other sectors which compete for the same resources. The position of the manufacturing sector becomes disadvantaged due to the decrease of exports reacting negatively to the exchange rate appreciation (as explained further). Contrary to the manufacturing sector, the sector of services can slightly benefit from the new situation through the increase in the consumer demand. Concerning the effect of direct payments on the price level in the economy, it can be concluded that **the growth of direct payment subsidies to agriculture leads to lower producer prices both in agriculture and in the manufacturing sector and contribute to a total decline of price level**. An exceptional case is the sector of services, in which the prices slightly increase as a result of higher wages and the stimulated consumer demand.

Concerning the complete removal of direct payments in the Scenario 2, **the sector of agriculture would face a considerable decrease of the value added (almost 10%)**. Even though the sectors of manufacturing and services would benefit by this decline, the overall impact on the economy would be negative. With respect to the changes in the price level, removing direct payment subsidies would cause a considerable growth of the agricultural producer prices, which would be transmitted to the connecting industries and would cause an overall price inflation, except for the price level of services, which would benefit from the lower wages.

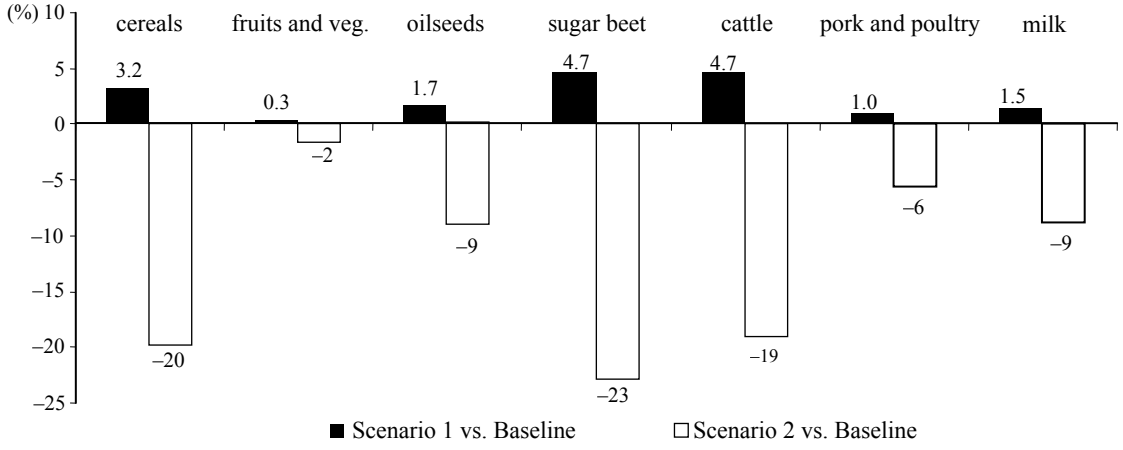

Figure 2. Changes of the gross agricultural production in constant prices 2006 (vs. baseline)

When interpreting the impacts of the agrarian policy instruments, it is also important to analyze the changes on the disaggregated level concerning the particular agricultural activities. Given that each agricultural activity is characterized by its specific cost structure and a different level of protection, the impact of direct payments varies per each activity.

Figure 2 reports the changes in the gross agricultural production caused by the two alternative policy options. Scenario 1 provides an overview of the situation in case of the full level of direct payment subsidies. As seen from the Figure 2, all sectors would benefit under this situation, however, the **sectors of cereals, sugar beet and cattle would benefit the most,** as these are the sectors with the highest level of protection. Contrary to that, if the direct payments were removed under the Scenario 2, the mentioned sectors would face the strongest decline of agricultural production (up to 20%), whilst **the sectors of fruits-vegetables, pigs-poultry, oilseeds and milk** would face the comparatively lowest decline, suggesting their **higher competitiveness in the absence of the subsidized production**.

Impact of direct payments on the market of production factors

The changes occurring in the market of production factors are interesting as they provide two insights. Firstly, they explain the changes occurring in the market of goods and services based on the shifts in demand of production factors and their resulting equilibrium prices. Secondly, they provide information on the distribution of income to the owners of production factors. In connection to that, they also provide the information on the occurrence of the land price capitalization.

The situation in the production factor market is displayed in Table 4. The changes in capital and land are not reported, as these production factors are fixed in the short term. However, it is possible to observe structural changes of labour demand among the sectors, where **granting a higher amount of direct payments leads to an increase of labour employed in agriculture at the expense of the labour employed in the manufacturing sectors**.

As regards the prices of production factors, shifts associated with the increased demand for production factors in agriculture are observed. Firstly, **the return to capital increases substantially** in the sector of agriculture and slightly in the other sectors, which reflects an increased demand for capital in the conditions of inelastic capital supply. Secondly, an increase in wages is observed, which is mainly stimulated by an increased demand for labour in agriculture and services. With respect to the land market, **a significant growth of the land price index is observed** (more than 200%). This is explained by the fact that direct payments, granted per hectare of agricultural land, stimulate the producers to lower production costs by substituting the relatively more expensive capital and labour for the subsidized land. In the conditions of the fixed land supply, the land price index increases sharply, causing thus a strong capitalization of the land rent.

Concerning the Scenario 2, a complete removal of direct payments would cause a sharp decline of employment in agriculture in favour of the employment in manufacturing and services. The decreased demand for production factors in agriculture would consequently reduce returns to capital in all sectors and also cause a reduction of wages. As Table 4 also shows, a complete removal of direct payments would lead to a significant decrease of the land price index, which would negatively affect the owners of land.

Impact of direct payments on farmer households

Any change in the direct payment subsidies is translated into the incomes of households through the production factors market. First of all, raising **the direct payments to a 100% level produces a moderate increase of the farmer households' income** (Table 5). This finding clearly shows that the direct payments, as the CAP policy instrument, are less suitable for pursuing the goal of increasing the farmer households' income and maintaining their living standard, as they provide only a small redistribution of the subsidy income to the farmer household. Secondly, **with the increasing level of direct payments, the non-farming households are also better-off, as their**

Table 4. Impact of simulations on the market of production factors (in % change)

	L agri	L manuf	L serv	PK agri	PK manuf	PK serv	PL	PD
Scenario 1	3.19	–0.38	0.20	14.96	0.42	0.09	0.11	203
Scenario 2	–14.33	0.21	0.05	–44.07	–3.29	–0.18	–0.43	–89

L agri = employed labour, PK agri = return to capital in agriculture (analogically for other sectors), PL = wage index, PD = land price index

Table 5. Impact of simulations on the households' income and utility level (in % change)

	Farmers' income*	Other households' income	Farmers' utility**	Other households' utility
Scenario 1	1.2	0.1	1.4	0.2
Scenario 2	–3.5	–0.2	–4.2	–0.5

*Gross income of household after redistribution of transfers among firms, government and other households

**Utility level as obtained from the Stone-Geary LES utility function

income slightly increases. Considering the fact that land is only partially owned by the farmer households in the Czech Republic, the effect of the direct payments is channelled to the income of non-farming households. This finding is in line with the empirical analysis of Ciaian and Kancs (2009) who estimated that the leakages of the direct payment rental effects to non-farming land owners reach up to 18% of the SAPS value in the Czech Republic, and similarly in the other newly accessed EU-member states.

The situation of a complete removal of direct payments suggests that the income of both types of households would deteriorate, with a stronger reaction regarding the farmer households. In line with the changes in income, the consumer utility is affected. Whereas the increase of direct payments is translated into higher utility levels for both types of households, a complete removal of direct payments produces a deterioration of the consumer welfare, due to the resulting fall of incomes and the increased price level of commodities in the domestic market.

Impact on the foreign trade

All changes produced in the markets of goods and services must be understood in the context of the opened economy. Since the direct payments in the form of SAPS represent a source of income from abroad, it is recorded in the balance of payments. With the increasing level of direct payments granted from the EU, the supply of foreign currency in the domestic market increases, leading to the exchange rate appreciation and vice versa.

Table 6 displays the impact of direct payments on the balance of trade in agriculture, manufacturing and services. Based on these results, it can be found out that **with the increasing volume of direct payments, the position of agricultural producers on the external markets improves as the balance of trade increases** by CZK 820 mln. compared to the baseline. However, the overall impact of the direct payment policy on the external competitiveness is negative. As seen in the table, **the trade balance in manufacturing and services declines, as a result of the Czech Crown appreciation**. Contrary to that, a complete removal of direct payments can produce negative effects in the trade balance of agricultural commodities, but through the currency depreciation, it can positively stimulate the overall foreign trade.

Impact on the macroeconomic level

The last step of the scenario evaluation concerns the macroeconomic level, which gives an aggregate picture of the behaviour of the whole economy. Table 7 provides an overview of the impact of the considered scenarios on the selected macroeconomic indicators. At first, the resulting change in GDP is evaluated. As seen from the table, even though the increase of direct payments has an almost negligible effect on the GDP level, a moderate positive change can be recorded. **Positive effects on the GDP are mainly attributed to the growth of the household consumption**, which is stimulated by the increased incomes, stemming from a higher employment and higher factor rents. Governmental consumption is slightly reduced due to the lower price level. Regarding investments, their value increases slightly as a result of higher savings generated in the economy. The strongest reaction produced by the increase of direct payments is recorded

Table 6. Changes in the trade balance and exchange rate (vs. the baseline)

Scenario	Balance Agri	Balance Manuf	Balance Services	Total Balance	ER EU
Scenario 1	0.82	–14.59	–1.77	–15.54	–0.32%
Scenario 2	–5.75	26.10	4.08	24.44	0.21%

Note: Changes in balance of trade are calculated in absolute differences from baselin

ER EU= exchange rate CZK/EUR

Table 7. Impact on the GDP components (vs. baseline) (in % change)

Scenario	GDP	Consumption Hous	Consumption Gov	Investments	Net Exports
Scenario 1	0.002	0.194	–0.039	1.449	–13.256
Scenario 2	–0.054	–0.437	0.103	–0.476	7.443

Table 8. Impact on the macroeconomic indicators (vs. the baseline) (in % change)

	Total savings	Unemployment*	Consumer Price Index
Scenario 1	4.58	–0.026	–0.04
Scenario 2	–1.39	0.099	0.16

*Expressed in percentage points difference against the baseline

in the case of net exports, which face a considerable decline (mainly as a result of the currency appreciation, as mentioned previously).

Contrary to the Scenario 1, the results of the Scenario 2 show that **in the case of a complete removal of direct payments, GDP would see a moderate decline**, mainly caused by the reduction of private consumption and investments, which would be compensated by the increase of net exports.

Changes in the GDP level are connected to other macroeconomic indicators, such as the unemployment level and inflation. Table 8 displays the impact of direct payments on these macroeconomic indicators. Concerning the Scenario 1, the total savings are stimulated, mainly due to the growth of the household savings. This is positively transmitted into higher investments, which contribute to the growth of GDP, as seen in Table 7. Contrary to that, **the removal of direct payment subsidies would produce a decline of the total savings compared to the baseline, which would be negatively translated into the formation of investments and the dynamics of the economic growth.**

With respect to the unemployment, with the increasing level of direct payments, unemployment is slightly reduced, as the demand for labour increases in both the agricultural and services sector. Furthermore, the consumer price index decreases as well, as a result of the price transmission effect induced by the subsidies.

Concerning the Scenario 2, the removal of direct payments has unfavourable impacts on both unemployment and the inflation.

DISCUSSION AND CONCLUSION

This paper assessed the impact of direct payments granted to agriculture on the economy of the Czech Republic. For this purpose, two contrasting scenarios were defined regarding the direct payments that the farmers receive: direct payments at the 100% level of the national envelope vs. the complete removal of subsidies. These scenarios were analysed using a general equilibrium model, as it takes into account the complexity of economic relations and is suitable for the analysis of efficiency of the selected governmental support instruments, as are the direct payments to agriculture.

In relation to the obtained results commented in the previous chapter, several reflexions can be made. First, all results should be interpreted in the context of the assumptions that were made in the model construction. The main concern here is the character of the direct payment subsidies. Contrary to most of the EU-15 member states, in which the direct payments perform the role of monetary transfers to farmer households, in the Czech Republic, most of the direct payment subsidies are received by the large scale agricultural enterprises and are directly utilized in farming activities. In order to reflect these country specifics, the direct payments are modelled partially as land and partially as production subsidies, providing thus a positive stimulus for farming.

According to the results, increasing direct payments to a 100% level produces an increase of the value added in agriculture and through the sector interlinks, it stimulates the overall GDP. The impact of the direct payments on the disaggregated agricultural level is not homogenous, but certain production activities, such as cereals, sugar beet and cattle would face major changes in production if the level of the direct payments is altered.

The paper also reveals the impact of direct payments on the situation of the farmer and non-farming households. It is pointed out that increasing the direct payments to a 100% level does not provide any major improvement of the farmer households' income, suggesting that other CAP instruments are more efficient to pursue the goal of raising the farmers' incomes. Furthermore, due to the unusual ownership structure that prevails in the Czech Republic, a leakage of the land rental effects produced by the direct payments policy to the non-farming households might occur.

With respect to the land market, it has been found out that the direct payments might produce a strong capitalization of land rent. However, in reality, there has been a very low dynamics of land rents in the Czech land market, which can be attributed to the existence of the transaction costs (Ciaian and Swinnen 2006). This evidence suggests that the following studies on the impact of direct payments should consider the incorporation of the land market transaction costs into the CGE modelling framework.

The role of direct payments has been also analysed from the macroeconomic perspective, where the countervailing effects were identified. First of all, increasing the amount of direct payments stimulate private consumption, where a considerable part is consumed in services. On the other hand, the balance

of foreign trade deteriorates through the currency appreciation, which can be seen as a crowd-out effect of the private consumption with respect to the net exports. Finally, the direct payments contribute to increasing the level of investments through higher domestic savings, stimulating thus the economic growth.

In the situation of a complete removal of the direct payments, the economy would face structural adjustments produced by a dramatic decline of the agricultural production. As the absorption capacity of manufacturing and services sector is limited, the reduction of employment in agriculture would cause an increase in the overall unemployment. This evidence implies that the instruments of the Common Agricultural Policy, namely the direct payments, have overarching effects on the whole economy, confirming thus the suitability of the general equilibrium framework in the impact assessment studies.

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