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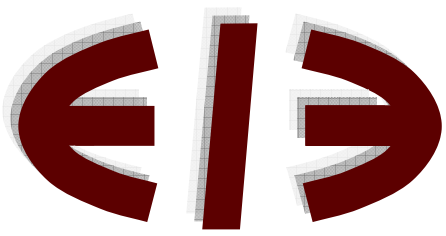

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Abstract

In this paper we develop a partial equilibrium model for agricultural sector to assess the impact of CEE integration with the EU on welfare and income distribution of agricultural factors. The modelling framework is based on the concept of market imperfections and transaction costs. We perform several policy simulations with different levels of direct payments as given in the most recent European Commission proposal. We find that even the most sceptical European Commission proposal of awarding the CEE farmers only 25% of the direct payments will increase welfare and income of farmers. However, the distribution of CAP rents are affected by the institutional structure. We find an adverse impact on allocation of incomes and welfare that are generated by the integration in Slovakia and in the Czech Republic. The major part of it - between 65% to 93% - is transferred to owners of production factors, such as hired labour, landowners and variable capital suppliers, but not as desired to support farmer incomes. In Poland the gains resulting from the integration are allocated more favourably to farmers. Factor owners retain only around 24% to 61%, depending on the level of direct payments.

Key words: Partial equilibrium, model CAP, EU enlargement.

JEL Classification: D57, Q17, Q18.

1. INTRODUCTION

EU integration of Central and Eastern European countries (CEECs) will significantly change, among others, their current agricultural policies. First, the level of support to agriculture will increase for the majority of CEECs, and secondly the composition of the policy instruments will be affected. One of the most hotly debated issues on enlargement is whether the CEECs should get access to full CAP support, in particular the direct payments. Yet, no matter what decision is taken, agricultural policy changes with accession are likely to change the income distribution and welfare in CEECs.

There is a growing literature on the impact of EU enlargement of CEECs in agriculture. Recent studies asses the impact on EU budgetary expenditures, on CEECs' protection levels (Banse et al. (2000), Hartell and Swinnen (2000), Hertel et al. (1997)), and on commodity markets, trade and WTO and the macroeconomy (Munch (2000), Hertel et al. (1997)), Banse (2000)). However, the impact of accession on factor markets and on income distribution is less explored. This is surprising given the prominence of these arguments in the debate and whether or not CEEC farmers should get access to full CAP subsidies, including direct payments.

The impact of the enlargement on the agricultural factors' incomes was in majority studies deduced based on the output developments. However, the distribution of income to the factors employed in agriculture, or the distribution of the farmers' income *versus* the other factors' income, is more complex and requires to incorporate a more detailed factor markets structure into the model. For instance, in an agricultural sector where the outsiders own the most of the agricultural land and also the majority of labour is hired, the increase of output does not necessary lead to a same increase of the farmers' income. Consequently, the share of farmers' income in the total agricultural income may be adversely affected. The land rents relative to the prices of the other factors may increase and the factors supplied by the farmers are usually less responsive to a price change compared to factors supplied by the outsiders; thus providing a change in farmers' income that differs from that of the output change. Further, the issue of imperfect factor markets, extensively emphasised in the general literature and in the policy debate, is addressed by none of the above papers. Credit is usually not easily accessible to farmers - they are rationed - and concerning the agricultural land market is working imperfectly in CEECs, due to institutional constraints.

This paper presents the first attempt (a) to asses income distribution effects within the CEECs economies of CAP accession, and (b) to analyse how factor market imperfection affect the outcome. For this we use an empirical model to evaluate the effect of introducing the Common Agricultural Policy (CAP) on the income distribution and welfare of the owners of agricultural production factors (land, labour and capital) in Poland, the Czech Republic and Slovakia after joining the EU. As a first approach, the model is partial equilibrium, single product and static. The model explicitly models transaction costs and credit rationing to integrate imperfections in land and credit markets.

The three countries were chosen because they are expected to be among the first group that will join the EU and because they have very different farm structures, which allows to incorporate the impact of this variation in the analysis (see tables 1-3). Poland is representative for the countries where the farm sector is dominated by individual family farmers, such as Slovenia, Latvia, Lithuania and Romania. Slovakia represents the other extreme, where the farm sector is dominated by large corporate farms i.e. partially transformed collective and state farms. The Czech Republic is somewhere in between with a dualistic farm structure, where individual farms as well as large corporate farms are operating in the agricultural sector. Hungary, Estonia and Bulgaria also have such dualistic structures.

The paper is organised as follows. The next section gives a short description of the situation of the agricultural sector in Poland, the Czech Republic and Slovakia. The model description is presented in section three. The fourth section discuses the results and the last section summarises.

2. AGRICULTURE IN POLAND, THE CZECH REPUBLIC AND SLOVAKIA

The agricultural sector, as can be seen from table 4, is more important in the overall economy of Poland, the Czech Republic and Slovakia than it is in the EU. The share of agricultural production, the share of agricultural employment and the share of food consumption on the total economy are at higher levels for all three CEECs when compared to EU-15 average. The most substantial difference is in agricultural employment in Poland, where a significant portion of the Polish population derives its income from the agricultural sector. Its share of the total employment is about four times higher than the EU average, while for the Czech Republic and Slovakia, these values are higher just by a factor of less

then two. The two other indicators - share of total agricultural production of the GDP and share of food consumption on total expenditure - do not differ by a such high margin, as in the case of Polish agricultural labour, but they are still higher by a factor ranging from 1.5 to 2.3 compared to EU average.

In the development of agricultural production during the transition, two periods can be distinguished for the three CEECs. The first period is immediately after the fall of Communism, around 1989-1994, when agricultural production had declined dramatically, reaching in 1993 only around 60% to 80% of the corresponding figure in 1989 (figure 1). This was mainly caused by deep structural changes that took place at that time, especially privatisation, liberalisation and substantial decrease in agricultural protection. The paper of Macours and Swinnen (2000) found that almost half of the output decline can be attributed to price liberalisation and to subsidy cuts. Other important factors found to be relevant in explaining these output developments were transition uncertainty, drought, each explaining around 10%, and privatisation. The second period is after 1994, when production stabilisation to new relative prices and economic environment seems to have taken place. This stabilisation is relevant for selection of the base year for the model calibration. Otherwise, if too many disequilibria existed in those economies, then calibrated parameters may be misleading.

Regarding the farm structure, all three countries differ substantially, both among themselves and with respect to EU-15 average as well. The Polish farm sector is fragmented into a large number of small family farms totalling around 2 million and averaging 7 hectares per farm (table 1). On the other hand, agriculture in Slovakia is dominated by large farms, predominately former co-operatives or joint stock and limited liability companies that have been created from the former state farms or have been transformed from the former co-operatives. Their average size is 1 225 ha for joint stock and limited liability and 1 537 ha for co-operatives (table 3). The farm structure in the Czech Republic is somewhere in between these two countries with a higher share of individual family farms then in Slovakia. Their share in the total agricultural area (TAA) is around 24%, while in Slovakia it is just around 9%, (tables 2 and 3). For comparison purposes, the average farm size in the EU is around 18.4 hectares, and the total number of farms is close to 7 million (European Commission).

3. THEORETICAL FRAMEWORK

To analyse the impact of the implementation the CAP on welfare and incomes in Poland, the Czech Republic and Slovakia, we use a static and partial equilibrium model of the agricultural sector.[1] Its results represent the long-run outcomes based on a comparison between an initial condition (i.e. with current CEECs' policies) and a counterfactual equilibrium computed with the changed policies, that is, with the integration of CEECs in the EU and consequent adoption of the CAP.

The model is calibrated on the benchmark year 1999. Consequently some parameters are adjusted to fit the model with benchmark data. Elasticities are taken from the economic literature (see appendix A for details).

The model considers following market participants: one domestic consumer, foreign consumers, one farm, resource suppliers (agricultural factor input owners) and government, all assumed to behave competitively, exempt for the market imperfections in land and credit market, and government, which exogenously imposes its policies. There is assumed one product in the market, which is the monetary value of farm production (crop and livestock production). Credit rationing is assumed in the credit market and the concept of transaction costs is used to address the issue of land market imperfection. To a large extent, the structure of the model resembles the model of Hertel (1989), exempt for the market imperfections. He has developed a long-run partial equilibrium model with approximated functional relationships and linear in elasticities and percentage changes in quantities and prices. The structure of his model consists of an aggregate product demand, farm sector represented by a constant return to scale production function, and factor supply equations. The model was used to bring a general evaluation of the impact of different agricultural policy instruments on agricultural markets with special attention on the structure of the production technology and factor mobility. Also, he has applied the model for the US agriculture.

The disadvantage of this approach is that the assumption of one product in the sector appears to be restrictive by not being able to capture the differential response of the different product categories to policy changes. Additionally, partial equilibrium model can not capture the changes of non-agricultural measures introduced in the other areas of the economy after

[1] The literature that has addressed the enlargement issue had used partial-equilibrium models (European Commission (2002), Kancs and Weber (2001), Munch (2000), and Anderson and Tyers (1993)), general equilibrium models (Hertel et.al. (1997), Banse (2000) and Liapis and Tsigas (1998), or a combination of partial and general-equilibrium models (Banse et.al. (2000)).

the CEECs integration, which might affect the agricultural sector as well. Nevertheless, we think that the model is a good approximation to explain the development of incomes and welfare of the agricultural factors after the accession, which is the main intention of this paper. The truth is that some of the output categories may react in a very different manner when the agricultural policies are changed, but overall, the impact on the aggregated agricultural product should be the same for both considerations, for the single product model or for the model with a more richer output structure.

3.1. DEMAND

Following Armington (1969) we assume that the domestic consumer differentiates the good by its production location (domestic *versus* foreign). Consequently, the product purchased on the international market (Q_I) is an imperfect substitute for the same product purchased from the domestic producer (Q_d). This consumer behaviour leads to the phenomenon where a country both imports and exports the same commodity. In addition, the advantage of this specification is that it does not lead to too excessive specialisation when assessing the change of trade policies.

Demand is then determined in two steps. First, the *equilibrium demand*[2] of composite bundle $\boldsymbol{X}_d$ is determined assuming constant elasticity as follows:

$$\boldsymbol{X}_d = C_1 \boldsymbol{P}^{-\eta} M^{\eta_m} \qquad (1)$$

where $\boldsymbol{P}$ is the price index of the composite good and equals $\boldsymbol{P} = \left[\theta_d^{\sigma} (P_d (1+t_d))^{1-\sigma} + \theta_I{}^{\sigma} (P_I (1+t_d))^{1-\sigma}\right]^{1-\frac{1}{\rho}}$;

where C_1 is a constant; θ_d, θ_I are share parameters; t_d is an *ad valorem* consumer tax (subsidy if negative); M refers to aggregate income; η, η_m are own-price and income

[2] The *equilibrium demand* differs from the *ordinary demand* in the sense that the former allows for equilibrium adjustment in processing industry and final demand market as output price, Π_i changes; the latter one indicates how industry, $\boldsymbol{X}_d$, responds to alternative output prices given all prices in up-stream industries are held fixed. The consequence of this consideration is a price elasticity difference between these two specifications. It is lower for the e*quilibrium demand* than for *ordinary demand.* This difference arises because effects of price change, Π_i are also shifted to all up-stream industries, thus mitigating the effect on $\boldsymbol{X}_d$. What concerns welfare measurement of a market intervention, the change of consumer surplus calculated from the *equilibrium demand,* is in fact the change of surplus of all up-stream industries altogether (this holds under some restrictions regarding final consumer, otherwise this surplus change is an approximation).

elasticities of demand, respectively; $\rho = 1 - \frac{1}{\sigma}$ is the elasticity of substitution between Q_I and Q_d; P_d is the domestic price; and finally, P_I is the import price, distorted proportionally by tariff τ with respect to the world price, P_w, hence

$P_I = P_w(1+\tau)$.

In the second stage the consumer selects the optimal composition of Q_I and Q_d. By minimising expenditure on Q_I and Q_d subject to the constraint

$\boldsymbol{X}_d = \left[\theta_d Q_d^{\rho} + \theta_I Q_I^{\rho}\right]^{1/\rho}$,

explicit demand equations for Q_I and Q_d may be derived as follows:

$$Q_d = \left(\frac{\theta_d}{P_d(1+t_d)}\right)^{\sigma} \boldsymbol{X}_d^{\sigma} \boldsymbol{X}_d; \qquad (2)$$

$$Q_I = \left(\frac{\theta_I}{P_I(1+t_d)}\right)^{\sigma} \boldsymbol{X}_d^{\sigma} \boldsymbol{X}_d. \qquad (3)$$

Foreign demand is distinguished for three regions, the EU, Q_d^{EU}; the CEECs, Q_d^{CEEC}; and the rest of the world, Q_d^e. They are given as follows.

$Q_d^e = C_{12} P_e^{-\eta_e}$;

$Q_d^{EU} = C_{13}\left(P_e\ (1+\tau_{EU})\right)^{-\eta_e}$;

$$Q_d^{CEEC} = C_{14}\left(P_e\ (1+\tau_{CEEC})\right)^{-\eta_e} \qquad (4)$$

where C_{12}, C_{13}, C_{14} are constants; η_e is the own-price elasticity of foreign demand; P_e is the price paid by foreign demander and is equal to

$P_e = P_d(1-e_S)$;

e_s, if positive, then represents the unit subsidy to exporter (otherwise tax). The price, P_d, that the exporter (farmer) gets is higher than the price at what he is selling, P_e; t_d is *ad valorem* consumer tax (subsidy if negative); and τ_{EU}, τ_{CEEC} are import tariffs of the EU and CEEC, respectively. These tariffs will become zero under the EU integration scenario.

3.2. PRODUCTION

The agricultural farm sector is represented by a single production unit (one farm) assumed to behave competitively. This farm produces agricultural product by using constant return to scale technology (CES):

$$Q_s = C_2\left[\alpha_a A^{-\rho_s} + \alpha_l L^{-\rho_s} + \alpha_v V^{-\rho_s} + \alpha_k K^{-\rho_s}\right]^{-1/\rho_s} \quad (5)$$

with the constant elasticity of factor substitution given by $\sigma_s = 1/(1+\rho_s)$.

where C_2 is constant, $\alpha_a, \alpha_l, \alpha_v, \alpha_k$ are distribution parameters ($\alpha_a + \alpha_l + \alpha_v + \alpha_k = 1$); Q_s is output of the farm and supplied to the output market (domestic or international); and production factors, agricultural land (A), labour (L), variable capital (V) and investment capital (K), respectively, used to produce Q_s.

Concerning the credit market, several studies indicate that farmers in transition countries are credit constrained. Consequently, the model assumes credit rationing, in the sense of Stiglitz and Weiss (1981). We assume that supply, due to imperfect information present in the loan market, offer to farmers a fixed amount of credit, denoted by $\overline{K}$, at a fixed price $\overline{k}$.

Given input prices, credit constraints and government policies, the farm operates so as to minimise costs of producing at a given output level. The first-order conditions of the farm problem yield factor demands which are as follows:

$$A_d = \left(\frac{\alpha_a}{r_d(1+s_{da})}\right)^{\frac{1}{1+\rho_s}}\left(\frac{Q_s}{C_2}\right)H;$$

$$L_d = \left(\frac{\alpha_l}{w_d(1+s_{dl})}\right)^{\frac{1}{1+\rho_s}}\left(\frac{Q_s}{C_2}\right)H \quad (6)$$

$$V_d = \left(\frac{\alpha_v}{v_d(1+s_{dv})}\right)^{\frac{1}{1+\rho_s}}\left(\frac{Q_s}{C_2}\right)H;$$

$$K_d = \overline{K}$$

$$H = \left[\alpha_a^{\frac{1}{1+\rho_s}}(r_d(1+s_{da}))^{\frac{\rho_s}{1+\rho_s}} + \alpha_l^{\frac{1}{1+\rho_s}}(w_d(1+s_{dl}))^{\frac{\rho_s}{1+\rho_s}} + \alpha_v^{\frac{1}{1+\rho_s}}(v_d(1+s_{dv}))^{\frac{\rho_s}{1+\rho_s}} + \frac{\alpha_k \overline{K}^{-\rho_s} A^{\rho_s}}{(r_d(1+s_{da}))^{\frac{-\rho_s}{1+\rho_s}}\alpha_a^{\frac{\rho_s}{1+\rho_s}}}\right]^{\frac{1}{\rho_s}}$$

where r_d, w_d, v_d refer to the prices per unit of agricultural land (r_d), labour (w_d) and

variable capital (k_d); and if s_{di} positive then it is *ad valorem* input tax (otherwise it is input subsidy) (for i = A,L,V,K).

All rents that the farm obtains are distributed to input factors, such that the profits of the farm are zero:

$$P_s(1+t)Q_s + S + \phi.tc.r_s.A_s^p - r_d(1+s_{da})A - w_d(1+s_{dl})L - v_d(1+s_{dv})V - \bar{k}\ (1+s_{dk})\overline{K} = 0 \quad (7)$$

The positive value of t refers to *ad valorem* direct output subsidy that the farm gets; P_s is the price at which the producer sells the product to consumer; *S* - are subsidies given to the farm which are not based on the production level or the factor use; and $\phi.tc.r_s.A_s^p$ is the total benefit that the farmer is able to subtract from landowners rent as a result of imperfect agricultural land markets (explained in the next section (3.3)).

The foreign supply of the agricultural product is considered to be perfectly elastic; available to the domestic consumer at an exogenously determined world price, P_w, distorted by tariff, τ.

3.3. PRODUCTION FACTOR SUPPLY

The agricultural production factors are aggregated in four main categories: agricultural land, labour, variable capital and investment capital. Each of them, except investment capital, is distinguished according to whether it is owned (or supplied) by the farm or not.

Factor supply functions for land, labour and variable capital, similar to the equilibrium demand function, are assumed to have a constant elasticity form. The functions are separately given for factors supplied by the farmer and factors supplied by the outside suppliers who are not involved in farming. Superscript notations are, respectively, *o* for the own factor and *p* for the purchased factor.

$A_s^o = C_{ao}(r_s\ (1-(1-tc)s_{sa}))^{\varepsilon_{ao}}$; *farmers own land supply* (8)

$A_s^p = C_{ap}(r_s\ (1+s_{sa})(1-tc))^{\varepsilon_{ap}}$ *non-farm (outside) land supply* (9)

$L_s^o = C_{lo}(w_s(1+s_{sl}))^{\varepsilon_{lo}}\ w^{-\varepsilon_o}$; *farmers own labour supply*

$L_s^p = C_{lp}(w_s(1+s_{sl}))^{\varepsilon_{lp}}\ w^{-\varepsilon_p}$ *non-farm (outside) labour supply* (10)

$V_s^o = C_{vo}(v_s(1+s_{sv}))^{\varepsilon_{vo}}$ *farmers own variable capital supply*

$V_s^p = C_{vp}(v_s(1+s_{sv}))^{\varepsilon_{vp}}$ *non-farm (outside) variable capital supply* (11)

where $C_{ai}, C_{li}, C_{vi}, C_k$ are constants; A_s^i, L_s^i, V_s^i, K_s are quantities of factors, respectively, agricultural land, labour, variable capital and investment capital, supplied to the farm; r_s, w_s, v_s, k_s are prices received by the owners (suppliers) of factors agricultural land, labour variable capital and investment capital, respectively; $\varepsilon_{ai}, \varepsilon_{li}, \varepsilon_{vi}, \varepsilon_k$ are own-price elasticities of supply for land, labour variable capital and investment capital, respectively; ε_i is labour supply elasticity with respect to opportunity wage, (for *i= o,p.*); w is the wage that can be earned in other sectors of the economy (opportunity wage); *and* s_{si} if positive then it is *ad valorem* input subsidy (otherwise it is input tax) given to suppliers (for *i= A, L, V, K).*

The modelling of the land market requires a more detailed explanation. The concept of transaction costs, equation 9, is used in order to incorporate land market imperfections into the model, denoted *tc*. These costs are faced by the landowners who are not farming their land themselves but instead rent it out to farms.[3] They usually have less information on how the farm is run, about farm profitability, about the opportunities, they are bound by the rental contract and they usually have to face withdrawal costs and bargaining costs when they are interested to take out their land from the co-operative. Additional costs arise when the landowner is interested in changing the tenant or in finding a buyer for his land. These costs seem to be high, since the observed demand for land is low, especially in Slovakia and the Czech Republic where even a reference land price is not available to market participants. Fragmentation of land is an other impediment, which restricts the agricultural land market[4]. In Poland, where small family farmers use the majority of the land, this fact causes difficulties in negotiating the leasing or selling contracts. An owner, who intends to sell or rent his land out, consisting of more plots, incurs higher transaction costs compared to a situation when the plots are consolidated into one parcel. The reason is that the dispersion of the plots may not fit the existing land structure of a potential buyer/user, consequently, this prolongs the searching period and requires for the negotiations to take place with more interested parties. Also, the buyers/users usually prefer larger plots. On the other hand, in Slovakia and the Czech Republic where the majority of land is under the usage of co-operatives and commercial farms, the fragmentation of land makes an owner more reluctant

[3] In this paper we will refer to them as *"landowners"*.
[4] As of 1 January 1998, there were 3 962 000 ownership papers, and the land is divided into 12 900 000 parcels in the Czech Republic, thus giving an average parcel of around 0.4 hectares. Concerning Poland, according to a

to withdraw his land out of the co-operative or the commercial farm. This is because the gains from doing this are low - especially because it is difficult to find someone who will rent it in, the rent is low and practically it is impossible to sell it, and thus small plots give practically zero returns - compared to costs which are relatively high - namely withdrawal costs, bargaining costs and search costs[5].

That is, as given in the equation 9, the price effectively received by the landowners is lower than the market price, r_s, by the unobserved amount *tc* and equals to $r_s(1-tc)$. These costs, as already explained, arise because landowners may be less informed about opportunities, bargaining costs, contractual settings, etc. For instance, an owner interested in changing contractual partner will incur costs related to changing a not terminated contract, search costs, withdrawal costs and bargaining costs.

Someone, however, has to get the above costs or the lost revenues of the landowners that arises due to the imperfections in land market. The ones who are the beneficiaries of them are the farms and this revenue are assumed to affect their behaviour in a manner similar to that of *S* (equation 7). This shift of revenue from owner to farm occurs because the farm pays a lower price to the landowner than the equilibrium price by the amount of transaction costs, *tc*. The landowner accepts this lower price because otherwise, in equilibrium, the increase in price that he would be able to negotiate when changing the contract or tenant would just compensate incurred transaction costs. Consequently, the farm gains the price difference ($tc * r_s$) multiplied by the amount of land demanded (A_s^p) minus the costs incurred to farm[6], which are assumed to be a fixed proportion of the total landowners' lost revenue, $1-\phi, \quad \phi \in \langle 0,1 \rangle$.

Hence, the portion of transaction costs incurred to landowners that remain with the farm is denoted by ϕ and total farm revenue equal to $\phi * tc * r_s * A_s^p$ (equation 7).

There are no reliable estimates of the size of the landowner's transaction costs, *tc,* and of the farm benefits resulting from imperfect land market, ϕ. Therefore, we make some assumptions and the values for these parameters will be chosen the ones, which seem to be the most reasonable for each of the three considered countries.

European Commission study, some 43% of farms are split into four or more plots, and on 45% of farms the furthest plot was more than 2 km away (European Commission, 1998, p. 51).

[5] For a discussion about agricultural land market in Poland and the Czech Republic, see Ciaian (2001).

[6] The costs that farm faces are related to search costs that may still arise when a farm leaves the sector or rents out some of his land. In addition farm (co-operatives) may incur bargaining costs that arise when the landowner is trying to withdraw his land from the co-operative.

Equation 8 - the farm own land supply - includes also transaction costs *tc*. However, in this case they reflect their effect on the rental income tax that farmer pays. The land rent that farmer earns from his own land supply is not fully observed in practice for different reasons such as not reporting own consumption. Thus the reference rent for income tax calculations is taken the one that farmer pays to landowners or the market rent lowered by the amount of transaction costs, *tc*.

Concerning the credit market, credit rationing is assumed in the model. Several factors led us to consider this assumption. In general, the financial markets in transition countries are underdeveloped, which makes it difficult for the interested parties to obtain necessary credit to run a healthy business. This is particularly as a result of the financial sector's poor institutional structure, of the past policies (businesses were not used to operate under hard budget constrain), of the poor contract enforcement, of the lack of a skilled banking staff, of the poor developed accountancy and booking system and of the poor informational system in these countries (see Koester (2001) and Swinnen and Gow (1999)). Additionally, the specificity of the agricultural sector in general, such as the existence of many uncertainties faced by agricultural business (eg. weather conditions) and the sector's low profitability, as well as unfavourable input and output price developments in these countries, lead to a greater unwillingness of the financial sector to finance investment project to farmers compared to other sectors of the economy. The fragmented farm sector in small family farms, as it is in Poland, also contributes to lack of interest in the financial sector to provide credits to farmers in need. This is because usually small borrowers are more risky and also screening problem arises. In Slovakia and the Czech Republic this seems to be less problematic because most farms, co-operatives and commercial farms are large. However, due to the fact that the land market is not working properly, the farms cannot use land as collateral, which is important to decrease lenders' risk, and thus having an easier access to credits.

The simplest way to model credit constraint is by fixing capital supply. The lenders offer farmers a fixed amount of credit, denoted by $\overline{K}$, at a fixed price, $\overline{k}$. Thus $\overline{K}$ is the maximum amount of credit available to agricultural sector, which binds the producer to expand investment capital stock. However, in the case of oversupply of credit, that is when the credit supply is not binding, the supply is assumed to have usual upward sloping shape represented in figure 2 by the curve *a*.

Thus the credit supply is as follows:

$K = \min(K_s, \overline{K})$,

where

$K_s = C_k(k_s(1+s_{sk}))^{\varepsilon_k}$ (12)

A final remark regarding the agricultural input factors is related to their mobility to other sector of the economy. The upward sloping shape of the supply functions - equations 8, 9, 10, 11, 12 - reflects their imperfect mobility. For the agricultural land this rather straitforward: its supply is restricted and it cannot be used in other sectors of the economy therefore the land supply is highly inelastic at the aggregate level. Concerning the capital, its specificity makes it imperfect mobile between the other sectors. For the agricultural labour, low education level, agricultural specific skills, farmers' sunk investments and underdeveloped rural infrastructure in CEECs makes it less mobile (see Swinnen et al. (2000)). However, in the long-run it is expected that labour is able to adjust faster to economic condition in the country, hence the model considers a relatively high labour supply response to a change in agricultural wages but still being imperfectly mobile.

3.4. EQUILIBRIUM CONDITIONS

(1) Price equilibrium (13)

$P_s = P_d$;

$P_I = P_w(1+\tau)$;

$P_e = P_d(1-e_s)$

$r_d = r_s$;

$w_d = w_s$;

$v_d = v_s$;

$k_d = k_s = \overline{k}$

(2) Product market clearing (14)

$Q_s = Q_d^t$;

$Q_I^s = Q_I$

where:

$Q_d^t = Q_d + Q_d^e + Q_d^{EU} + Q_d^{CEEC}$ is total demand for domestically produced good. (15)

(3) Factor market clearing (16)

$$A_d = A_s^o + A_s^p$$

$$L_d = L_s^o + L_s^p$$

$$V_d = V_s^o + V_s^p$$

$$K_d = K_s$$

3.5. AGRICULTURAL POLICIES APPLIED IN THE MODEL

Besides agricultural policies, the model also includes general policies (VAT, income tax etc.) that are imposed on all economic agents in the considered countries. Thus the model is calibrated for the base year 1999 with all policies included, agricultural as well as general ones. The simulated scenario or counterfactual equilibrium is calculated with changed agricultural policies only, as they were in the EU in 1999. These include all agricultural measures of the EU: market price support, direct payments, export subsidies, tariffs and other measures.

The import tariffs and export subsidies were derived from the OECD data from the percentage market price support (%MPS) component of the producer support estimate. %MPS equals to the value of the price differential divided by the production value.

$$\%MPS = \frac{Q_S(P_d - P_W)}{Q_S P_d}. \qquad (17)$$

Thus the extent to which domestic price exceeds world price (P_d / P_W) is given by $1/(1-\%MPS)$. This price ratio is exactly analogous to a nominal import tariff or export subsidy.

The acreage payments given under the CAP to farmers was modelled as a land subsidy given to farmers (s_{da}). Its value was calculated as the average payment per hectare for 1999. Concerning headege payments, it was assumed that farmers will use this money to finance their investments. Usually the farmers own the livestock based on which the headege payments are granted and not the landowners that rent the land to the farmers; thus this money are expected to stay with the farmers. Consequently, based on this consideration, these payments will be used by the farmers to substitute the credit, which is not available due to the imperfect credit market, and they directly increase the stock of investment capital, which also includes livestock.

4. SELECTED SIMULATION RESULTS

A recent European Commission proposal set the strategy that will deal with the enlargement issue in agricultural area. A system of gradual increase of direct payments for CEECs was proposed starting immediately after the integration at a rate equivalent to 25% of the EU level and with a gradual increase afterwards such that, in 2013 the full level of direct payments is reached. In order to get an inside picture on how these different levels of direct payments affect incomes and welfare in integrated CEECs, simulations with five levels of direct payments were performed. These levels are as follows: 0%, 25%, 35%, 60% and 100%. Regarding transaction costs incurred to landowners (*tc*) and transaction costs incurred to farmers ($1-\phi$) specific values were chosen, as shown in table 5 that seemed to be the most reasonable for each of the three considered countries.

The results of the above simulations provide an important argument in support of the proposal of the European Commission not giving full level of the direct payments to CEECs farmers. The actual purpose of the direct payments was to compensate farmers for the income deterioration after the decrease in market price support of agricultural products, which was the result of the CAP reform. Table 6 shows the change in incomes of the agricultural production factors with respect to base year income, with five levels of direct payments applied after the integration in Poland, the Czech Republic and Slovakia. Total agricultural incomes[7] in all three countries increase substantially after the integration, even when the farmers get zero percent of the direct payments, thus giving no reason to compensate farmers' incomes in CEECs. Poland experiences the highest growth, while Slovakia experiences the least growth in both income categories when comparison is made between countries. Differences in initial protection level applied in those countries and differences in composition of the initial agricultural support are main factors that explain these figures. Poland and the Czech Republic apply mostly market price support, which is highly market distortive, and their initial support level is lower than the one in Slovakia. On the other hand, market price support in Slovakia is less important in the overall agricultural support, while a substantial share have direct payments.

[7] Total agricultural income is sum of the all production factors' incomes earned in the agricultural sector. It includes (1) farmers' income, (2) hired labour income, (3) landowners' rental income and (4) income of the outside suppliers of the variable capital (or outsiders' variable capital income). The farmers' income is further split in (1) labour income, (2) rental income, (3) variable capital income and (4) investment capital income.

As far as specific income categories are concerned the rental income experiences the highest change, when compared with the other income categories, by a factor between 0.1 and 8.7 (table 6). The explanation is rather straightforward. The area payments given to farmers under the CAP are directly transmitted into rental price change, since land supply is highly inelastic. Consequently, the changes in the level of direct payments granted to CEECs' farmers will be reflected in the change of land rent and thus in the change of the total rental income.

When looking at the change of labour and variable capital income, a common feature arises in all three countries: the change is always lower for the income of farm-supplied labour and variable capital than for the income of labour and capital that is supplied by other suppliers. This is as a result of the assumption of smaller farmers' factor supply response to price change compared to the response of outsiders who react faster to price changes, reflected in lower own price elasticity for former input factors compared to latter input factors.

The budgetary consequences of these simulations are shown in table 7. Most striking is the case of no direct payments, which leads to a decrease in government expenditure for Slovakia because of complete reduction of direct payment; this is fairly important in the base year 1999.

Table 8 shows the estimated income distribution of factors employed in agriculture for Poland, the Czech Republic and Slovakia, respectively. Those values represent the share of specific factor income category earned in agricultural sector on the total income generated by this sector, with policies included.

As a result of higher involvement of individual family farms in Poland than in Slovakia and in the Czech Republic and as a result of the differences in institutional structures of those countries, the income generated by the agricultural sector is distributed more favorably to farmers in Poland. Agricultural income in Poland is evenly allocated between farmers and other agricultural production factors (hired labour, landowners and outside variable capital suppliers) - 50%-50% - meanwhile in the Czech Republic and especially in Slovakia, only less than a quarter of income generated by the agricultural sector remains in the sector, 23.4% and 19.2%, respectively, for the base year. The largest share of the total agricultural income goes to variable capital suppliers' in all three countries - between 78% and 85% - for the base year 1999, whereas the smallest share goes to landowners - between 2.2% and 5.6%. Following from land ownership structure and agricultural labour composition, the share of *farmers'* labour income and the share of *farmers'* rental income is

higher than the share of *hired* labour income and the share of *landowners'* rental income, respectively, in Poland for the base year. The reverse is valid for the Czech Republic and Slovakia.

After the integration farmers' income increases less for the majority of the simulations compared to increase in the total agricultural income (table 6). These developments lead to a deterioration in the share of farmers' income in the total agricultural income as shown in table 8 (A) Poland, (B) Czech Republic, (C) Slovakia. Due to institutional differences, such as land market imperfections and ownership structures, only Poland, experiences a higher increase in farmers' income than the total agricultural income increases, in the case of full levels of direct payments, and thus producing a slight improvement in farmers' income share on the total agricultural income. The share improves from around 50% in 1999 to around 51% after the integration.

Direct payments have a significant impact on land rent, as shown in table 9, which may the result of the modelling approach. The above mentioned European Commission proposal gives the option for CEECs to implement a simplified and de-coupled system of granting direct payments to farmers. An average area payment would be calculated for each country that would be applied to the whole agricultural area. This system is relatively highly transparent, and the information on the level of area payment applied in each country would be easily accessible to all landowners, farmers as well as landowners, eg. trough news media. Consequently, knowing the level of direct payment, landowners may be willing to rent their land only if they receive a portion of these payments. Following this reasoning, the treatment of direct payments as a direct farm land subsidy in the model seems appropriate. The simulated results show that the rents in comparison to base year 1999 have increased by a factor between -0.9 and 2 for the scenario zero percent of direct payment and by a factor between 2 and 8 for the scenario of full level of direct payments. However, the presence of the transaction costs, *tc*, in the land market produces a situation in which landowners' get a lower price than the market price is. This is shown in table 9. This arises because the increase of price which landowners can obtain - for instance by searching for a better land user or by withdrawing his land from the co-operative and again searching for a more efficient user - will just compensate the transaction costs incurred. Consequently, it gives no incentive to landowners to take such actions, rather they continue to rent the land to the same users. The most affected is Slovakia where, for the low levels of direct payments granted to Slovak farmers, the landowner rent is lower than the one obtained in the base year 1999.

Welfare effects of these simulations resemble the above income developments to a large extent. Table 10 shows the welfare before and after the integration for all three countries and for all five levels of direct payments. Both, the total welfare and the farmers' welfare increase even when farmers are granted zero percent of direct payments. Total welfare increases by 59% for Poland, by 45% for the Czech Republic and by 31% for Slovakia. For farmers' welfare, these changes are 53%, 28% and 11%, respectively. With the full level of direct payments, the welfare increases between 60% and 110%, the highest change being observed in Poland and the smallest in Slovakia. In fact, total gains in welfare that resulted from the integration are mostly channelled to non farm suppliers of production factors in Slovakia and in the Czech Republic, such as hired labour, landowners and outside suppliers of variable capital. Their gains are between 65% and 90% of the total integration welfare gains, depending on the level of direct payments. Contrary to Slovakia and the Czech Republic, in Poland the non-farm suppliers of production factors get only about 24% to 40% of the total welfare gains resulted from the integration.

5. CONCLUSIONS

A partial equilibrium model for agricultural sector was developed to assess the impact of integrating Poland, the Czech Republic and Slovakia into the EU on welfare and income distribution of agricultural factors in these three countries. The model uses the concept of transaction costs to approach the problem of imperfect land markets and concerning credit market, credit rationing is assumed. The modelling results represent the long run equilibrium situation of the agricultural sector that arises after the adoption of the Common Agricultural Policy (CAP) by these three countries. The model was calibrated for the base year 1999, which is also used for comparison purposes. Several simulations were performed in the paper with different levels of direct payments as given in the most recent European Commission proposal.

Poland, with its large number of small family farmers, with high labour intensive agriculture and with relatively better performing agricultural land market, gains the most in terms of total value of subsidies and in terms of increase of agricultural income and welfare after the integration. Depending on the level of direct payment granted to CEECs' farmers, the CAP expenditure on Poland are between 2 and 5.2 billion Euro, total agricultural income increases by around 5.1 to 6.2 billion Euro and finally welfare increases by around 1.9 to 3.3 billion Euro after the integration into the EU. When looking at specific factor categories, landowners experience the largest gains in welfare and rental income due to large increase of acreage payments. However, the share of overall farmers' income on the total agricultural income, which comprises all income sources that are earned by input factors supplied by the farm, is practically unaffected after the full adoption of the CAP, and it is negatively affected if Polish farmers would get only a small share of the direct payments applied in the EU.

On the other hand, *Slovakia* which has an agricultural sector dominated by large farms that mostly hire labour and rent land from landowners, a rigid agricultural land market, and a higher initial protection level, gains the least in terms of increase in income, in subsidies and in welfare. Depending on the level of direct payment granted to CEECs' farmers, the CAP expenditure on Slovakia are between 0.12 and 0.55 billion Euro, total agricultural income increases by around 0.52 to 0.7 billion Euro and finally welfare increases by around 0.13 to 0.25 billion Euro after the integration into the EU. The rigid land market causes a substantial shift of rental income from landowners to farmers - mostly to co-operatives and commercial farms. For the low level of direct payment granted to CEECs' farmers the rent would not

reach even the base year period level. The farmers' rental income increases the most among all income categories. However, its share in the total agricultural income remains at a very low level after the integration. This development can be attributed mostly to the presence of a large number of co-operatives and commercial farms, which distort agricultural land market. Contrary to farmers' rental income, the share of total farmers' income is adversely affected by the integration. It continues to decline from a already low value, less than half-quarter, observed before the integration.

The *Czech Republic* is somewhere in between these two countries, in terms of gains due to integration, resembling most closely the Slovak case as a result of their similarity in institutional structure. This is obvious since both countries split from the same country, Czechoslovakia, in 1993. The most notable difference is in a higher presence of private family farms in the Czech Republic, which contributes to income distribution more favourable to farmers, but still being far different from the polish income distribution that represents the other extreme. Depending on the level of direct payment granted to CEECs' farmers, the CAP expenditure on the Czech Republic are between 0.34 and 1.07 billion Euro, total agricultural income increases by around 1.2 to 1.4 billion Euro and finally welfare increases by around 0.31 to 0.50 billion Euro after the integration into the EU.

Even the most sceptical European Commission proposal to give CEEC's farmers only 25% of the direct payments will bring an increase in welfare and incomes to agricultural factors in all three countries. Thus, the fears that farmers would be worst off after the integration compared to the situation before the integration can be ruled out. However, another issue arises, namely that of the distribution of extra income and welfare generated by the integration of CEECs in the EU and consequent adoption of the CAP. Institutional structure that is in Slovakia but also in the Czech republic has an adverse impact on allocation of incomes and welfare that are generated by the integration. The major part of it - between 65% to 93% - is transferred to outside input factor suppliers, such as hired labour, landowners and outside variable capital suppliers and not as desired to support farmers' incomes. In Poland the gains resulting from the integration are allocated more favourably to farmers; outsiders retain only around 24% to 61%, depending on the level of direct payments.

APPENDIX A

A.1. Output Demand Elasticities

Regarding the choice of elasticities, the literature was consulted in search of plausible values for these parameters. There are few papers providing estimates for CEECs, especially at the aggregate level. Therefore, the model uses proxies for these parameters based on the estimates found in the literature for other countries.

A survey of own-price demand elasticities, η, and income elasticities, η_m, (for equation (1)) is given in table 19. The own price-demand elasticity varies from a very low value of -0.03 to a value of 1.49. The explanation for this relatively high variation is ambiguous. First of all, the estimated demand elasticity depends on functional form specification. On the other hand, it is generally accepted that the own price elasticity of food as a whole should decline in absolute value as income increases.[8] This argument is supported by Finke et al.'s (1984) estimations of own-price elasticities for 30 countries. However, Pollak and Wales (1978) report the converse. These values increase (rather then decrease) with income.

This paper follows the generally accepted argument, in choosing the own price elasticity of demand for CEECs. The specific value for each CEEC is taken the Finke's (1984) estimated elasticity of a country with similar income as considered CEEC. Thus, in general, a CEEC with a higher income has own-price elasticity lower than a CEEC with a lower income. Table 12 (first row) shows selected elasticities.

Concerning the choice of income elasticities, similar arguments were considered as in the case of the own-price elasticity, even though there are studies reporting results contrary to this reasoning (Crombrugghe (1997), Flood el al. (1984)). For example, De Crombrugghe (1997) estimated the income elasticity for the Netherlands increased over time, from 0.34 in 1980 to 0.47 in 1988. This implies an increase of elasticity with income. However, the same paper also reports a decrease in the income elasticity over time for the United States (US), from 0.610 in 1941 to 0.551 in 1950 and 0.386 in 1972.

Moving further to the own-price elasticity of foreign demand (equations 2), a short examination of the literature is summarised in table 13; table 12 (row three) shows the elasticies used for the modelling. The findings of Bredahl et al. (1979) show a substantial

change in the elasticity when trade protection of the country that buys the exported product increases. Therefore, crucial for choosing a specific value for CEECs was the trade protection of major CEECs' trading partners. In 1999, around 62% of CEECs' exports had flown to EU and CEECs. Thus, upon integration the trade barriers will be lifted, making the demand more sensitive to prices.

Finally, concerning the Armington assumption of product differentiation, the literature in most cases is supportive for this assumption. Most notably, Trefler (1995) finds that modelling an Armington home bias is statistically and economically significant in explaining trade flows between countries. This differential perception of actually physically identical goods may arise because of differences in convenience of purchase, availability in time, after-sales service bundled with the good, or even consumers' perceptions of inherent unobservable quality. The paper of Blonigen (1999) brings some evidence, among others, that trade barriers may increase home bias, thus lowering the Armington elasticity, σ. A theoretical study of Turrini (2001) argues that home bias arises due to higher legal cost when business is done abroad because of the differences in legal systems of trading countries, thus making it cheaper to buy from domestic producers. Further, he suggests that legal system harmonisation may increase cross-border trade. Upon EU integration of CEECs, their economies will form a common market with the EU countries, trade barriers will be lifted and the *acquis communautaire* will enter in force. Since in 1999 64% of imports to CEEC come from the EU and CEECs, the model considers a relatively high elasticity of substitution between home product and imported product. A short survey of the literature on Armington elasticity of substitution, is given in table 14, and table 12 (row 4) gives values applied in the model.

A.2. Production Elasticities

The elasticity of substitution between inputs, σ_s, is critical in assessing the impact of EU integration on factors' income. A value of 1 leads to a Cobb-Douglas production function with the *constant factors' income share*. The other interesting situation is when the elasticity is zero; in this case the *factor proportions are constant*. However, this does not imply that elasticity of substitution of *one* or *zero* is wrong, the question is rather what the true value of this parameter is.

[8] The argument is based on Engel's Law, stating that if income elasticity declines with income, then the income

For the short-run modelling the elasticity may be considered close to zero because the factor composition, especially the stock or replacement of investment capital, is not expected to change substantially, even though the true elasticity is higher then zero. In the long-run modelling, however, all factors may change thus important is to know true value. Table 15 shows that the use of machinery and fertilisers in majority CEECs is much lower than in the EU (reverse is valid for labour). Therefore, if considering that CEECs and EU have similar technology, then adjustments in factor proportions need to take place when the relative prices will change due to the adoption of CAP. Consequently, this reasoning implies a relatively high elasticity of factor substitution (definitely higher than zero) for the production function. A survey of the literature on the estimated elasticity of substitution, using a classification of factors' aggregation similar to the one used in this paper, is provided in table 16. The median of the estimates ranges from 0.2 to 1.1. Table 12 (row 5) shows the values used in the model for each CEEC.

A.3. Production Factors' Elasticities

The following facts were assumed or taken in consideration when choosing the elasticities and other parameters for factor supply functions.

- Farm labour is more attached to agricultural sector than hired labour is. The paper of Dries and Swinnen (2000) shows a strong correlation between the regional outflow of labour from agriculture and the importance of state farms in Poland. The higher the presence of the state farms in a region was the higher outflow of labour from the agriculture was in that region. This implies a higher incentive of labour to stay in agriculture for the regions where the individual family farming is more important.
- Agricultural labour is less educated relative to labour employed in other sectors of the economy (table 17). Hence, agricultural labour's alternative job opportunities are restricted to sectors that require less education and less skills, considered in this model to be manufacturing or industrial sector. Consequently as proxy for the opportunity wage of agricultural labour is used average wage earned in the industrial sector.

effect component of own-price elasticity decreases, thus leading to a smaller own-price elasticity.

- Technically, and for agronomic reasons, it is more costly for farmer to increase the supply of variable capital than for outside suppliers.
- As a consequence of the above conclusions, the farm-owned factor supply elasticities are assumed to be lower than elasticities of purchased factor supply. A literature summary of labour supply elasticity is reported in table 18, and table 12 shows the elasticities used in the model.
- Due to natural restrictions, land supply is highly inelastic at the aggregate level.

APPENDIX B: DATA

This appendix provides a short description of the parameters and the variables used in the model and lists the data sources:

Variable or Parameter name	Proxy used	Data Sources
Aggregate income, *M*	GDP for 1999, in current prices	-OECD: Main Economic Indicators: Non Member countries 2001; published by Statistics Directorate & CCNM, -OECD: Gross Domestic Product (GDP), from internet page of OECD -Documentation
Tariffs and export subsidy, $\tau, \tau_{EU}, \tau_{CEEC}, e_s$	Calculated from PSE	-OECD, Agricultural Policies in OECD countries -OECD, Agricultural Policies in transition countries
Export $Q_d^{EU}, Q_d^{CEEC}, Q_d^e$; and imports Q_I	Monetary values of total exports and imports	-European Commission
Consumer tax, t_d	Value added tax	-Doing Business in Poland - OECD: The tax system in the Czech Republic, Economic Department working paper No. 245, 2000 -Low No 289/1995: Low on value added tax, Slovakia
Farm production:, Q_s	Monetary value of total agricultural production	-European Commission: Economic accounts for agriculture
Distribution parameters, $\alpha_a, \alpha_l, \alpha_v, \alpha_k$	Calculated by using the F.O.Cs, factor's costs share and base year factor demands	-European Commission: Economic accounts for agriculture -FAO internet data base -OECD: Quarterly labour force 2000 - Statistical yearbook of the republic of Poland, 2000
Quantity of agricultural land, *A*	Utilised agricultural area	-FAO internet data base
Quantity of own agric. land, A_s^o		-Expert opinion
Quantities of agricultural labour, *L*	Total population economic active in agriculture	-FAO internet data base -OECD: Quarterly labour force 2000 - Statistical yearbook of the republic of Poland, 2000
Quantity of own labour, L_s^o		- Statistical yearbook of the republic of Poland, 2000 - Zelena zprava, Czech ministry of agriculture - Zelena sprava, Slovak ministry of agriculture
Opportunity wage, *w*	Average wage in industrial sector	- Statistical yearbook of the Republic of Poland - Statistical yearbook of the Czech Republic - Statistical yearbook of Slovak Republic
Quantity of variable capital, *V*	Total fertilisers - consumption	-FAO internet data base
Quantity of investment capital, *K*	Monetary value of investment capital costs	-European Commission: Economic accounts for agriculture
Land tax (subsidy if negative), s_{da}	Land tax and for integration scenario area payments as well	- Doing Business in Poland - OECD: The tax system in the Czech Republic, Economic Department working paper No. 245, 2000 -Low No 317/1992: Low on property tax - Slovakia -European Commission: DG agriculture
Variable capital tax (subsidy if negative), s_{dv}	Variable input subsidies	-OECD, Agricultural Policies in OECD countries, 2000 -OECD, Agricultural Policies in transition countries, 2000 -Zelena zprava, Czech ministry of agriculture -Zelena sprava, Slovak ministry of agriculture -European Commission: DG agriculture
Variable capital tax (subsidy if negative), s_{dv}	Credit subsidies and for integration scenario headege payments.	-OECD, Agricultural Policies in OECD countries, 2000 -OECD, Agricultural Policies in transition countries, 2000 -Zelena zprava, Czech ministry of agriculture -Zelena sprava, Slovak ministry of agriculture -European Commission: DG agriculture
Output subsidy, *t*	Subsidies based on output	-OECD, Agricultural Policies in OECD countries, 2000 -OECD, Agricultural Policies in transition countries, 2000 -Zelena zprava, Czech ministry of agriculture -Zelena sprava, Slovak ministry of agriculture -European Commission: DG agriculture
Dismantled subsidies, *S*	Subsidies that are not based on production level or the factor use	-OECD, Agricultural Policies in OECD countries, 2000 -OECD, Agricultural Policies in transition countries, 2000 -Zelena zprava, Czech ministry of agriculture -Zelena sprava, Slovak ministry of agriculture -European Commission: DG agriculture
Input suppliers tax (subsidy if positive), s_{si}	Personal income tax +social security	- Doing Business in Poland OECD: The tax system in the Czech Republic, -Economic Department working paper No. 245, 2000 -Low No 366/1999: Low on income tax - Slovakia

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TABLES

Table 1. Evaluation of the structure of agricultural enterprises in Poland

Year		Private farms	State Farms	Co-operatives
1990	share of TAA (in %)	76%	20%	4%
	Average area (hectares)	6.3	2 924	311
	Number of farms	2 138 000	1 112	2 240
1992	share of TAA (in %)	78%	18%	4%
	Average area (hectares)	6.3	1 786	310
	Number of farms	2 144 000	1 752	2 186
1998	share of TAA (in %)	82%	7%	3%
	Average area (hectares)	7	636	203
	Number of farms	2 041 380	1 953	2 467
1999	share of TAA (in %)	84%	-	-
	Average area (hectares)	-	-	-
	Number of farms	-	-	-

Source: OECD, 1995b, PSI, 2000, PMAD, 2001.
Note: TAA-Total agricultural area

Table 2. Evaluation of the structure of agricultural enterprises in the Czech Republic

	1989		1991		1994		1999	
	share of TAA (in %)	Average area (hectares)	share of TAA (in %)	Average area (hectares)	share of TAA (in %)	Average area (hectares)	share of TAA (in %)	Average area (hectares)
Individual farms	0.4	4	3.3	10	23.2	16	23.5	25
Co-operatives	61.4	2 561	61.1	2 191	47.7	1 430	32.2	1 394
Commercial farms*	-	-	0.1	266	25.7	827	43.3	618
State farms	25.3	6 261	25.7	3 558	2.7	498	-	-
Other enterprises	12.9		9.8	-	0.7	267	1.0	86

Source: OECD (1995) and Zelena zprava (2000)-Czech ministry of agriculture
Note: TAA-Total agricultural area
* This includes joint stock and limited liability companies

Table 3. Evaluation of the structure of agricultural enterprises in Slovakia

	1989		1998		1999	
	share of TAA (in %)	Average area (hectares)	share of TAA (in %)	Average area (hectares)	share of TAA (in %)	Average area (hectares)
Individual farms			7.88	11.4	9.02	10.4
Co-operatives			53.8	1 583	50.24	1 537
Commercial farms*			24.98	1 154	26.82	1 125
State farms			0.58	3 546	0.25	3 071
Other enterprises			12.76		13.67	

Source: OECD (1995) and Zelena sprava (2000)- Slovak ministry of agriculture
Note: TAA-Total agricultural area
* This includes joint stock and limited liability companies

Table 4. Basic data - key general and agricultural statistics for Poland, the Czech Republic, Slovakia and the EU-15 in 1999

	GDP/ Inhabitants PPS[1]	Share of agric. in the GDP (GVA/GDP) (%)	Share of agric. employment in total employment (%)	Share of food consumption expenditure in total consumer expenditure (%)	Unemployment rate (%)	Utilised agricultural area (1 000 ha)
Poland	7 806	3.3	18.1	36.9	15.3	18 413
Czech Republic	12 498	3.4	5.2	26.8	8.7	4 282
Slovakia	10 279	4.1	7.4	31.8	16.2	2 444
EU-15	20 610	1.8	4.5	15-18.9	9.2	135 825

Source: European Commission
-[1]GDP price deflator

Table 5. The value of the transactions costs incurred to landowners (tc) and incurred to the farmers (1-ϕ) applied for the simulations that analyse the impact of the different level of direct payment on the agricultural income and welfare in Poland, the Czech Republic and Slovakia

	Poland	**Czech Republic**	**Slovakia**
Farm transaction costs 1-ϕ	0.8	0.6	0.4
Landowner transaction costs -*tc*	0.3	0.5	0.6

Table 6. Agricultural factors' *income change* (base year = 100) for simulation with different *levels of direct payment given* to CEECs farmers in:

A) Poland

Index (base year = 100)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' income	100	148	155	158	165	177
Labour income	*100*	*170*	*169*	*168*	*167*	*165*
Rental income	*100*	*232*	*301*	*329*	*398*	*509*
Variable capital income	*100*	*141*	*140*	*140*	*139*	*137*
Investment capital income	*100*	*100*	*109*	*112*	*121*	*135*
Hired labour income	100	205	203	202	200	197
Landowners' rental income	100	113	147	161	195	249
Outsiders' variable capital income	100	173	171	170	169	166
Total agricultural income	**100**	**160**	**163**	**164**	**167**	**172**

B) The Czech Republic

Index (base year = 100)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' income	100	131	136	138	142	151
Labour income	*100*	*147*	*148*	*148*	*149*	*150*
Rental income	*100*	*99*	*282*	*356*	*539*	*833*
Variable capital income	*100*	*137*	*137*	*138*	*138*	*139*
Investment capital income	*100*	*100*	*115*	*121*	*137*	*171*
Hired labour income	100	171	172	172	173	175
Landowners' rental income	100	24	69	87	132	204
Outsiders' variable capital income	100	165	166	167	167	170
Total agricultural income	**100**	**155**	**158**	**159**	**161**	**166**

A) Slovakia

Index (base year = 100)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' income	100	115	123	126	134	147
Labour income	*100*	*146*	*147*	*148*	*149*	*151*
Rental income	*100*	*61*	*264*	*345*	*548*	*873*
Variable capital income	*100*	*129*	*130*	*130*	*131*	*132*
Investment capital income	*100*	*100*	*111*	*116*	*127*	*145*
Hired labour income	100	169	171	171	173	176
Landowners' rental income	100	10	45	58	93	147
Outsiders' variable capital income	100	150	152	153	154	156
Total agricultural income	**100**	**142**	**146**	**147**	**150**	**156**

Table 7. Total government's agricultural expenditure (in bn. Euro)

		Poland	Czech Republic	Slovakia
Base year 1999		0.528	0.205	0.184
Integration, The share of direct payments given to farmers in CEECs	0%	2.054	0.340	0.128
	25%	2.841	0.526	0.236
	35%	3.154	0.601	0.279
	60%	3.936	0.786	0.386
	100%	5.179	1.079	0.557

Table 8. Agricultural factors' *income distribution* for simulation with different *levels of direct payment given* to CEECs farmers in:

A) Poland

Income distribution (%)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' income	49.6	45.7	47.1	47.6	48.9	50.9
Labour income	*8.1*	*8.6*	*8.3*	*8.3*	*8.0*	*7.7*
Rental income	*4.8*	*6.9*	*8.8*	*9.5*	*11.3*	*14.0*
Variable capital income	*28.6*	*25.2*	*24.6*	*24.3*	*23.7*	*22.8*
Investment capital income	*8.1*	*5.1*	*5.4*	*5.6*	*5.9*	*6.4*
Hired labour income	0.5	0.6	0.6	0.6	0.6	0.5
Landowners rental income	0.8	0.5	0.7	0.8	0.9	1.1
Outsiders' variable capital income	49.2	53.1	51.6	51.0	49.6	47.4
Total agricultural income	**100**	**100**	**100**	**100**	**100**	**100**

B) The Czech Republic

Income distribution (%)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' income	23.4	19.8	20.2	20.3	20.6	21.3
Labour income	*1.1*	*1.1*	*1.1*	*1.1*	*1.1*	*1.0*
Rental income	*0.2*	*0.1*	*0.4*	*0.5*	*0.8*	*1.1*
Variable capital income	*18.4*	*16.2*	*16.0*	*15.9*	*15.7*	*15.3*
Investment capital income	*3.6*	*2.4*	*2.7*	*2.8*	*3.1*	*3.7*
Hired labour income	7.7	8.5	8.4	8.3	8.2	8.1
Landowners' rental income	2.1	0.3	0.9	1.1	1.7	2.5
Outsiders' variable capital income	66.9	71.4	70.6	70.3	69.5	68.2
Total agricultural income	**100**	**100**	**100**	**100**	**100**	**100**

C) Slovakia

Income distribution (%)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' income	19.2	15.5	16.2	16.5	17.2	18.1
Labour income	*0.7*	*0.7*	*0.7*	*0.7*	*0.7*	*0.7*
Rental income	*0.2*	*0.1*	*0.4*	*0.5*	*0.8*	*1.2*
Variable capital income	*9.1*	*8.3*	*8.1*	*8.1*	*7.9*	*7.7*
Investment capital income	*9.2*	*6.4*	*7.0*	*7.2*	*7.7*	*8.5*
Hired labour income	7.1	8.4	8.3	8.3	8.2	8.0
Landowners' rental income	2.0	0.1	0.6	0.8	1.2	1.9
Outsiders' variable capital income	71.8	75.9	74.9	74.5	73.5	72.0
Total agricultural income	**100**	**100**	**100**	**100**	**100**	**100**

Table 9. Average land rent per hectare (in Euro)

		Poland		Czech Republic		Slovakia	
		Land rent that farmer gets	Land rent paid to landowner	Land rent that farmer gets	Land rent paid to landowner	Land rent that farmer gets	Land rent paid to landowner
Base year 1999		25.6	25.6	11.3	11.3	11.1	11.1
Integration, the share of direct payments given to farmers in CEECs	0%	59.3	29.1	11.2	2.7	6.8	1.2
	25%	77.1	37.8	31.9	7.8	29.4	5.0
	35%	84.2	41.3	40.2	9.9	38.5	6.5
	60%	102.0	50.0	60.9	14.9	61.1	10.3
	100%	130.4	63.9	94.2	23.1	97.2	16.4

Table 10. Agricultural factors' *welfare change* for simulation with different *levels of direct payment* given to CEECs farmers in:

A) Poland

Index (base year = 100)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' welfare	100	153	168	173	188	211
Labour welfare	100	170	169	168	167	165
Rental welfare	100	232	301	329	398	509
Variable capital welfare	100	141	140	140	139	137
Investment capital welfare	100	100	112	117	129	149
Hired labour welfare	100	205	203	202	200	197
Landowners' rental welfare	100	113	147	161	195	249
Outsiders' variable capital welfare	100	173	171	170	169	166
Total welfare	**100**	**159**	**168**	**172**	**182**	**198**

B) The Czech Republic

Index (base year = 100)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' welfare	100	128	137	141	150	169
Labour welfare	*100*	*147*	*148*	*148*	*149*	*150*
Rental welfare	*100*	*99*	*282*	*356*	*539*	*833*
Variable capital welfare	*100*	*137*	*137*	*138*	*138*	*139*
Investment capital welfare	*100*	*100*	*121*	*130*	*151*	*199*
Hired labour welfare	100	171	172	172	173	175
Landowners' rental welfare	100	24	69	87	132	204
Outsiders' variable capital welfare	100	165	166	167	167	170
Total welfare	**100**	**145**	**151**	**154**	**160**	**172**

C) Slovakia

Index (base year = 100)	Base year 1999	Integration, The share of direct payments given to CEECs farmers				
		0%	*25%*	*35%*	*60%*	*100%*
Farmers' welfare	100	111	125	130	144	166
Labour welfare	100	146	147	148	149	151
Rental welfare	100	61	264	345	548	873
Variable capital welfare	100	129	130	130	131	132
Investment capital welfare	100	100	116	122	138	163
Hired labour welfare	100	169	171	171	173	176
Landowners' rental welfare	100	10	45	58	93	147
Outsiders' variable capital welfare	100	150	152	153	154	156
Total welfare	**100**	**131**	**139**	**142**	**149**	**161**

APPENDIX TABLES

Table 11. Literature survey: the own-price demand elasticity and the income elasticity

	Tiffin. and Tiffin .(1999)	Finke. et. al. (1984)	Flood el. al (1984)	Van Driel et. al (1997)	De Crombruggh e et. al (1997),	Lluch et al. (1975)	Pollak and Wales (1978)
Own-price demand elasticity, η	-0.114	-0.03 to -0.64	-	-0.2, -0.45	-	-0.045 to -1.128	-0.42 to -1.49
Income elasticity, η_m	0.524	-	0.3 to 0.72	0.35, 0.65, 0.75	0.386 to 0.610	0.316 to 1.143	-
Number of countries	Grate Britain	30	Japan and Sweden	U.S. Netherlands	U.S. Netherlands	19	U.K.

Table 12. Parameters applied in the model

		Czech Republic	Poland	Slovakia
Own-price demand elasticity, η	(1)	-0.18	-0.24	-0.3
Income elasticity, η_m	(2)	0.42	0.46	0.48
Own-price elasticity of foreign demand, η_e	(3)	-3.2	-3.2	-3.2
Armington elasticity of substitution (domestic versus foreign product), σ	(4)	3.5	3.5	3.5
Elasticity of factor substitution, σ_s	(5)	0.8	0.8	0.8
Price elasticity of own labour supply, ε_{lo}	(6)	0.8	0.8	0.8
Price elasticity of purchased labour supply, ε_{lp}	(7)	1.3	1.3	1.3
Opportunity wage elasticity of own labour supply, ε_o	(8)	-3	-3	-3
Opportunity wage elasticity of purchased labour supply, ε_p	(9)	-3.7	-3.7	-3.7
Price elasticity of own variable capital supply, ε_{vo}	(10)	1.5	1.5	1.5
Price elasticity of purchased variable capital supply, ε_{vp}	(11)	3	3	3

Table 13. Literature survey: the own-price elasticity of foreign demand (exports)

	Tweeten (1967)	Johnson (1977)	Senhadji and Montenegro (1999)	Stern, et al. (1976)
Price elasticity of foreign demand, η_e	-6.42	-6.69	short-run: -0.0 to -0.96 long-run: -0.02 to -4.72	long-run: -0.23 to -4.14
for countries	U.S.	U.S.	53 countries	18 countries

Table 14. Literature survey: the Armington elasticity of substitution, σ

	Davis (1993)	**Blonigen, (1999)**	**Ronald-Holst et al. (1992)**
Elasticity of substitution, σ	3.41	-0.96 to 3.52	0.02 to 1.22
for countries	Japan	U.S.	U.S.
Number of industries/commodities	wheat	146 industries	22 industries

Table 15. Factor use in CEECs and in the EU in 1999

	Estonia	**Czech Rep.**	**Hungary**	**Latvia**	**Lithuania**	**Poland**	**Slovenia**	**Slovakia**	**EU**
Tot population Ec. Act. in Agriculture; per hectare	0.06	0.06	0.04	0.06	0.07	0.21	0.09	0.11	0.06
Total Fertilisers; per hectare	0.02	0.06	0.06	0.02	0.05	0.08	0.16	0.04	0.12
Tractors per 1000 hectares	35	20	15	22	29	71	210	10	49

Source: FAO internet data-base; and OECD Quarterly labour force, 2000

Table 16. Literature survey: the elasticity of input factor substitution, σ_s.

	Piesse and Thirtle (2000)	**Baffes and Vasavada (1989)**	**Kako (1978)**	**Binswanger (1974)**
Elasticity of factor substitution, σ_s	0.011 to 0.098	-0.316 to 1.091	-0.9 to 0.93	-1.622 to 2.987
for countries	Hungary	U.S.	Japan	U.S.

Table 17. Agricultural labour market indicators for Poland the Czech Republic and Slovakia

		Poland	Czech Republic	Slovakia
Total employment in agriculture (1000)		3 944.6	247	273
of which				
Own Labour (%)		94.4%	13%	9%
Hired labour (%)		5.6%	87%	91%
Agricultural average monthly wage (in Euro)		368	266	190
Wage parity (agricultural wage/industrial wage)		87.7%	79.4%	75.4%
Education	Elementary education	54.0%	15.9%	23.7%
	Vocational education		57.2%	51.5%
	Complete secondary education		21.0%	18.5%
	University education	1.9%	4.9%	4.7%
Unemployment	in rural areas			18.7%
	in non-farm areas			6.7%
Gross agricultural value added *per* agricultural worker (in Euro)		1 796	6 800	4 178

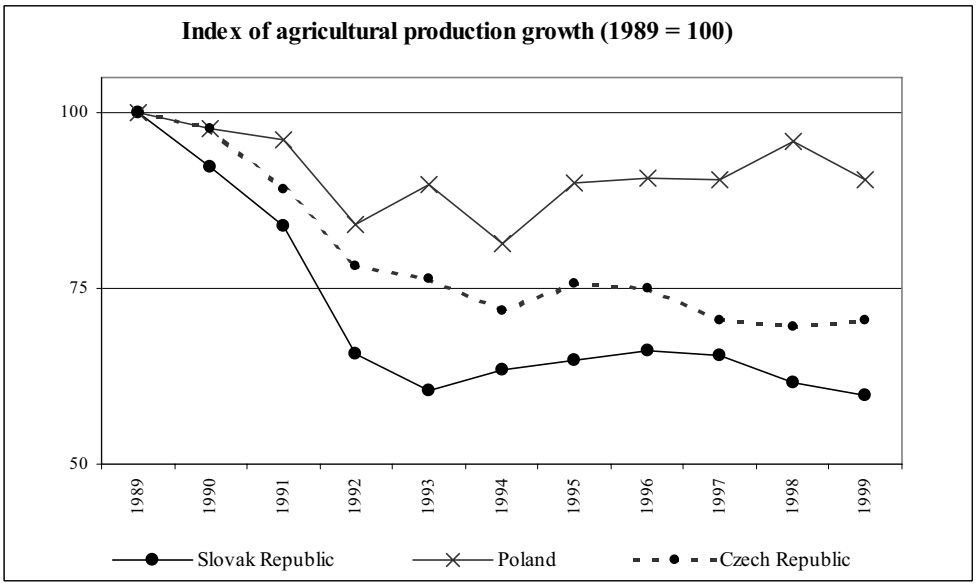
Source: Statistical Yearbooks of Poland, the Czech Republic and Slovakia; FAO, OECD, Zelena Sprava, WUZE, European Commission

Table 18. Literature survey: the elasticity of labour supply.

	Lopez (1984)	Thijssen (1988)	Balcombe and Prakash (2000)	Jacoby (1993)
Price elasticity of own labour supply, ε_{lo}	0.12	0.17 to 0.22	3.71 long-run	0.02 to 0.82
Price elasticity of purchased labour supply, ε_{lp}				
Opportunity wage elasticity of own labour supply, ε_{o}		-0.107	-3.71 long-run	
Opportunity wage elasticity of purchased labour supply, ε_{p}				
for countries	Canada	Netherlands	United Kingdom	Peru

FIGURES

Figure 1. Agricultural production change in Poland, the Czech Republic and Slovakia



Source: OECD (2000),

Figure 2. Investment capital supply