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Land Market Imperfections and Agricultural Policy Impacts in the New EU Member States : A Partial Equilibrium Analysis

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Abstract: This paper analyses how market imperfections affect the welfare effects of introducing the CAP in the new Eastern Member States (NEMS) of the EU. We model how transaction costs and imperfect competition in the land market affect the distribution of policy rents. We find that benefits of direct payments end up with landowners in NEMS also with imperfections in the NEMS land markets. With unequal access to subsidies small tenant farmers may even lose out from the subsidies. Decoupling of payments shifts policy rents to farmers. However, decoupling will constrain productivity enhancing restructuring which would result from accession induced improvements in the land markets. Using reserve entitlements to mitigate this effect reduces the intended benefits on distortions and target efficiency.

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Introduction

In 2004 eight Central and Eastern European countries (CEECs), which 15 years ago were still under tight Communist rule, joined the EU. At least two more CEECs are expected to join before the end of the decade. Agricultural issues have played a prominent role in the enlargement debate. Crucial issues were whether a reform of the Common Agricultural Policy (CAP) was needed to avoid conflicts with budgetary and WTO constraints when the CAP would be extended to CEECs and whether CEEC farmers would get access to the same subsidies as farmers in the EU-15 (Hartell and Swinnen; Tangermann and Banse). In fact, the final days before this historic event were spent mostly on intense negotiations on agricultural subsidies and production quotas.

Several studies contributed to the debate by quantitatively estimating the impact of EU enlargement in agriculture on EU expenditures, protection levels, commodity markets, trade and WTO (e.g. Banse, Münch, and Tangermann; Frohberg et al.; Hertel, Brockmeier, and Swaminathan; Münch; Weber).

Two important shortcomings of these studies are that they generally ignore the presence of imperfections in factor markets and that the studies pay relatively little attention to the income distribution effects within the CEEC economies. The latter is a major weakness since much of the policy debate centered on how the implementation of the CAP would affect rural incomes in CEECs (European Commission, 2002b; NIAE).

The absence of factor market imperfections is also an important shortcoming, since rural factor markets in CEECs are characterized by major imperfections, due to the transition process and more general rural development problems (Bezemer; Dries and Swinnen; World Bank,

2001). In particular, in perspective of CAP payments per unit of land – which make up a large share of the CAP subsidies in the new EU member states (NEMS) – imperfections of the land markets are crucial since they may have a significant impact on both the efficiency and distributional effects of these payments. Several studies document that land markets in the NEMS function imperfectly as land sales are constrained, as important transaction costs in the land markets prevent efficiency enhancing land exchanges, and as large farm corporations use their monopoly power in local or regional land markets (Dale and Baldwin; Lerman, Csaki, and Feder; World Bank, 1999). We focus in particular on transaction costs and imperfect competition.

The land reform process has created a class of new, sometimes absentee, land owners while land is used by a mixture of smaller individual farms and large-scale corporate farms. These corporate farms are mostly successor organizations from the former collective and state farms after farm privatization and land reform. They are, on average, between 300 and 1200 hectares, and their share of land use is around 90% in Slovakia, 75% in the Czech Republic, 50% in Bulgaria, 40% in Hungary, and more than 30% in Romania and Estonia.[1] Moreover, in most countries they use a more than proportionate share of the best agricultural areas of the country, which are especially affected by the CAP payments.

Large scale corporate farms continue to use large parts of the land because of a variety of reasons. However, an important reason is that historically, the large-scale farms were the users of the land. New owners of the land face significant transaction costs if they want to withdraw their land from the farms and reallocate it. Transaction costs include costs involved in bargaining with the farm management, in obtaining information on land and tenure regulations, in implementing the delineation of the land and dealing with inheritance and co-owners (Mathijs and Swinnen,

[1] Based on national statistical sources (see also table 1).

1998; Prosterman and Rolfes).

The domination of large corporate farms also leads to imperfect competition in the land market. The combination of imperfect competition and transaction costs has a strong impact on land prices. For example, Vranken and Swinnen find that in Hungary land prices are lower in regions where corporate farms dominate. In several CEECs there is a large gap in rental prices between land used by corporate farms and land used by individual farms. Table 2 shows how in the Czech Republic and Slovakia land rents paid by corporate farms are generally much lower: most vary between 50% and 20% of the rents paid by family farms. Further, corporate farms also reduce payments by paying in kind instead of in cash. A study by IME found that in Bulgaria, corporate farms generally paid their rents in kind, while family farms were much more likely to pay cash or mixed cash/in-kind.

The objective of our research is to analyze explicitly how these land market imperfections affect the welfare effects of introducing the CAP in the CEECs, or as of 2004, the NEMS. In this paper we develop a theoretical framework and use a partial equilibrium model of the land market to analyze how the income and efficiency effects of the implementation of CAP area payments are affected by transaction costs and imperfect competition in the land market in the NEMS.

The analysis – and the impact of EU accession – is complicated by the reform of the CAP which was agreed in 2003 by the EU Council of Ministers and which will be implemented first in the EU-15 and only later in the NEMS. This reform will have a significant impact on the mechanism of CAP support in the future in the NEMS, and in the last part of the paper we analyze the effects of the introduction of this policy reform.

The paper is organized as follows. In section 2 we develop a model of imperfections in the land market. Section 3 analyses the effects of current CAP subsidies after accession. Section 4 analyses how these effects change with unequal access to subsidies. In the next section we

study how reform of the CAP affects the results and in section 6 we analyze the impact of EU accession on land market imperfections and how this affects the results. Section 7 concludes.

The Model

Before transition, effective land rights in CEECs were in the hands of the state, or the collective farms. Land was used by large-scale state and collective farms.[2] Land reform in the early 1990s reallocated most land property rights to individual households in CEECs. We will refer to them as "*landowners*". Land reform took several forms. The main form in CEECs was restitution of land to former owners (Lerman; Swinnen, 1999).

More or less simultaneous with the land reform important farm restructuring took place. Farm restructuring included a privatization of the farms and a restructuring of the management structure. This restructuring included a reorganization of collective and state farms into private cooperatives and farming companies. We will refer to them as "*corporate farms*", which are typically large-scale. The most dramatic restructuring was the break-up of collective and state farms into household plots and family farms. We will refer to these as "*individual farms*".

To keep the analysis tractable we will model these developments in a stylized way. First, consider a situation where all the land is now owned by individual households, but still used by the corporate farms. (This reflects a situation where the land reform is formally completed, and the farms have been privatized, but no restructuring to individual farms has occurred.)

Second, we assume that land transactions take place exclusively through rental agreements. This is consistent with the majority of land transactions in CEECs (Research Institute of Agricultural Economics; Statistical Office of the Slovak Republic; Swinnen and Vranken; VUZE). Including both sales and rental transactions would seriously complicate the

[2] The exceptions to this rule were Poland and the countries of former Yugoslavia, where land use and ownership remained in small private farms during the Communist system.

analysis without yielding much additional insights for most of the analysis. Landowners receive a rent r for each unit of land that they rent to corporate farms.

Several households, landowners or not, consider starting up an individual farm for which they need land. They can either withdraw land from corporate farms or rent from landowners who currently rent their land to corporate farms. In both cases the price they have to pay per unit of land is the sum of the rent paid by the corporate farms, r, (explicitly for rented land or implicitly as opportunity costs) and the transaction costs, t, involved in withdrawing the land from the corporate farms.

Transaction costs

Transaction costs in land exchange can be very substantial in CEECs. When a landowner wants to withdraw land from the CF there are several reasons why transaction costs may arise in this process. These include: bargaining costs, costs of enforcing right of withdrawal, and costs related to asymmetric information, co-ownership, unclear boundary definition and costs related to unknown owners. First, while the withdrawal procedure is usually stipulated by law, it is also determined by the willingness of the CF to implement it (Mathijs and Swinnen, 1998). For example, in Slovakia the CF has the right to give a plot of land to owners located in a different place than the one specified in the ownership title (based on former boundaries) if the plot affects the integrity of the CF's land operation. The landowner gets only usage right to this new plot while s/he keeps the ownership right to the original plot located in former boundaries. This asymmetry obviously increases the costs for the landowner, since s/he can be deterred from withdrawal by being offered a plot located far from his operation or the plot may be of lower soil quality. The laws in Bulgaria, Slovenia and Hungary contained similar transaction cost increasing features (see Bojnec and Swinnen; Mathijs; Prosterman and Rolfes; Swain).

Second, CF managers typically have more information than landowners about the economic situation of farm and about regulations governing local land transactions.[3] This is especially the case for landowners who have not been involved in agriculture, or are living outside the village where their land is located, or are pensioners (Swain).[4]

Third, other transaction costs follow from co-ownership of land, unclear boundary definition, and the problem of unknown owners. In many CEECs, land was never formally nationalized during the Communist regime, although effective property rights on land were controlled by the regime and the collective farms. Hence, legal ownership of land remained private (Swinnen, 1999). However, land ownership registrations were poorly maintained, if at all, and in many areas land consolidation was implemented, wiping out old boundaries and relocating natural identification points (such as old roads and small rivers). The loss of information on registration and boundaries produced a large number of unknown owners in some transition countries (Dale and Baldwin). In addition, unsettled land inheritance within families during the socialist regime caused a strong land ownership fragmentation and a large number of co-owners per a plot of land. For example, according to OECD (1997), in 1993 approximately 9.6 million plots were registered in Slovakia, which is 0.45 hectares per plot, and each plot was owned by on average 12 to 15 people. As Dale and Baldwin put it, "a single field of twenty hectares may have hundreds of co-owners". In the Czech Republic, there were 4 million ownership papers registered in 1998 for 13 million parcels, with an average parcel size of 0.4 hectares. In Bulgaria, a recent study found that 50% of the plots were co-owned, often by several people (Vranken, Noev, and Swinnen). The average number of co-owners was more than two (excluding husband and wife co-ownership). Some co-owners may be unknown, or may not be

[3] For example, Swain describes how pensioner-members of co-operatives in Slovakia were "forced" to rent the land to the co-operative by being threatened of losing their pension.

in the country, or may be scattered all over the country. This raises the costs of land withdrawal as land withdrawal from the CF normally requires agreement from co-owners. The study indeed finds that co-owned plots of land in Bulgaria are more likely to be used by corporate farms.

Finally, other costs related to land transfers include notary fees, taxes and other administrative charges. For instance, the studies on Poland, Bulgaria, Lithuania and Romania, estimate these costs between 10% and 30% of the value of the land transaction (OECD, 2000; Prosterman and Rolfes; World Bank, 2001).

To model these transaction costs, we need to distinguish between transaction costs which are specific to the plot, to the owner, and to the user. Transaction costs will depend on the distribution of land among households and farms, on individual characteristics of landowners, and on the fragmentation of the land. To reduce these dimensions we assume that initially all plots of one owner are used by one corporate farm.[5] Define G^j as the transaction costs specific to the relationship between owner j and the corporate farm. These costs can be due to asymmetric information and bargaining. Define as the g^{ij} transaction costs specific to plot i of owner j. Transaction costs may differ per plot due to the number of co-owners or boundary uncertainty.

We can now derive the transaction costs per unit of land, t^{ij}, as a function of these plot- and owner-specific transaction costs:

$$(1) \qquad t^{ij} = \frac{g^{ij}}{a^{ij}} + \frac{G^j}{A^j}$$

where and a^{ij} and A^j are, respectively, the size of plot *i* and total land owned by owner j with $A^j = \sum_i a^{ij}$.

[4] In Hungary "passive owners" (this include village-based pensioners, landowners that are not active in the co-operatives and those living outside of the village where their land is located) received around 71% of agricultural land (Swain).

[5] This assumption is realistic giving the regional organization of the CFs and also consistent with the further modeling approach using one representative CF.

First, it follows from (1) that fragmentation of land ownership increases the per unit transaction costs. This is reflected in the first term of equation (1). Ceteris paribus, with fragmentation the plot size will be smaller and hence the transaction costs per plot higher. This increases transaction costs per unit of land: $\partial t^{ij}/\partial a^{ij} < 0$ with A^j fixed.

Second, when land ownership is distributed unequally among households, transaction costs increase with the amount of land withdrawn from corporate farms. The reason is that part of the transaction costs G^j are fixed per owner. Hence, ceteris paribus, larger owners will have lower per unit land transaction costs, and will be withdrawing land first. Smaller owners of land have larger transaction costs per unit of land and hence the premium that IF have to pay to access the land of small land owners will need to be larger.

Third, transaction costs per unit of land will be constant if land ownership is distributed equally (A^j=A for all j) and homogenously (the plot size distribution is the same for all landowners), and if landowners and plots do not vary in other characteristics. In this case g^{ij}=g, G^j=G and a^{ij}=a for all i and j, and per unit transaction costs, t, are constant:

$$(2) \qquad t = \frac{g}{a} + \frac{G}{na}$$

where n is the number of plots per landowner. Fragmentation affects the level of t but not the distribution.

In reality, land ownership is fragmented and relatively egalitarian in the CEECs. The egalitarian distribution is due to a combination of factors (Swinnen, 1997). In many CEECs the Communist regimes immediately after World War II, and prior to collectivization, implemented radical land reforms, taking away land from large land owners, religious institutions and groups that had supported the pro-Nazi regime, distributing it among small tenants, landless people, and pro-communist groups. In other countries, further egalitarian land reforms were implemented during collectivization; and in yet other regions, more in southern Europe, the Ottoman empire

had left a very egalitarian land ownership structure. Land restitution restored, and in fact reinforced, these egalitarian land distributions. In those countries where restitution was not widely implemented (Slovenia and Poland) or mixed with other land reform procedures (Hungary and Romania), land ownership is also relatively equally distributed.

This implies that fixed transaction costs per unit could be a reasonable approximation of reality in many regions of the CEECs. However, in our analysis and mathematical derivations we use a more general specification and allow for both fixed and (monotonically) increasing transaction costs. To reduce the complexity of the graphs, we use only fixed per unit transaction costs to construct the figures. Our derivations will show that almost none of the results are affected by whether transaction costs are fixed or increasing per unit of land. Where it matters, we will discuss the implications.

The equilibrium with perfect competition

The land decision-making problem of a profit-maximizing individual farm (IF) is then:

(3) Max $\prod^I = pf^I(A^I) - (r+t)A^I$

where p is output price, A^I is amount of land rented by the IF, $f^I(.)$ is production function for which $\frac{\partial f^I(A^I)}{\partial A^I} > 0$ and $\frac{\partial^2 f^I(A^I)}{\partial A^{I2}} < 0$. The first order condition for optimal land use is:

(4) $$p\frac{\partial f^I(A^I)}{\partial A^I} = (r+t).$$

The optimal level of land rented is where the marginal value product of land, represented by the left hand side of (4), equals the IF's marginal cost of land, r + t. The marginal cost is the rental rate an IF has to pay to a landowner, and which equals the corporate farm rental rate (r) plus the transaction costs per unit of land (t). Condition (4) defines the demand for land of the individual farm. Aggregating this over all (potential) IFs yields the total demand for land by individual

farms, D^I. Total IF demand for land is represented in figure 1 by D^I for zero transaction costs (t=0) and D_{t1}^I and D_{t2}^I for transaction costs, t_1 and t_2, respectively, with $t_2 > t_1 > 0$. The horizontal axis in figure 1 represents the amount of land, with $A^I = A^T - A^C$. The vertical axis measures land rental price.

For reasons of exposition, consider first that corporate farms are also price takers in the land market (we will relax this assumption soon). In this case the CF demand for land is represented by D^C. When there are no transaction costs the equilibrium in the land market is at (A^*, r^*). The land used by the CF equals A^* and the land used by the IF is $A^T - A^*$.

With transaction costs, the equilibrium is at (A_{t1}^*, r_{t1}^*) and (A_{t2}^*, r_{t2}^*) for transaction costs t_1 and t_2, respectively. It is obvious from figure 1 that with increasing transaction costs, the share of land used by corporate farms is higher and the rent they pay is lower. Transaction costs allow CF to use more land and at lower costs. Their gains are equal to area A for transaction costs t_2.

Only the CF benefit from these reduced rents. The land rental price for IFs is the CF price plus the transaction costs. The land rental price for IFs *increases* with increasing transaction costs: from r^* to $r_{t1}^* + t_1$ and $r_{t2}^* + t_2$, for transaction costs t_1 and t_2, respectively. The losses of IFs are equal to area DE for transaction costs t_2. Landowners also lose because their income from land rents declines: without transaction costs they receive r^* per unit of land; with transaction costs t_2 they only get r_{t2}^* (which equals the rental rate of corporate farms and the net per unit payments from IFs after covering transaction costs). Their losses are equal to area ABC for transaction costs t_2. The net aggregate welfare losses with t_2 are equal to area CE, measuring the total transaction costs and area DB, measuring the deadweight costs of the induced economic distortions.

Imperfect competition

In several CEECs corporate farms may not be price takers in the land rental market. For

example, in countries such as Slovakia where they occupy around 90% of the land, corporate farms are likely to have important market power. To model this, assume that there is one (representative) corporate farm, CF, which recognizes that its land rental decisions will influence the land rental price. The CF is not a monopolist since there is a group of (potential) individual farms who are price takers in the rental market. The IFs will rent land up to the point where their demand equals their rental price (ie. r+t). The CF will take the reactions of the IFs to changes in the land rental price into account: it will adjust its land renting to maximize profit subject to the behavior of the IFs.

In this situation, the objective function of the corporate farm is the following:

(5) Max $\prod^C = pf^C(A^C) - r(A^C)A^C$

where Π^C are CF profits, A^C is amount of land rented by the CF, $r(A^C)$ represents the rental rate as a function of A^C, with $\frac{\partial r}{\partial A^C} > 0$. $f^C(.)$ is the CF's production function for which $\frac{\partial f^C}{\partial A^C} > 0$ and $\frac{\partial^2 f^C}{\partial A^{C2}} < 0$.

The first order condition is as follows:

(6) $$p\frac{\partial f^C}{\partial A^C} = r + A^M \frac{\partial r}{\partial A^C}$$

where A^M is the optimal land allocation of the CF.

The left hand side of condition (6) represents the marginal benefits, i.e. the marginal value product of land, and the right hand side is the marginal cost of land for the CF. The marginal cost of land includes both the rental rate and changes in the rental rate when the CF rents in more or less land. The corporate farm will take into account increases in the price of land when it rents more land. It will choose its land use where the marginal cost of land renting equals the marginal benefits. Graphically, this can be represented as in figure 2. For simplicity, we assume

for a moment that there are no transaction costs (t = 0). MC^C represents the marginal cost function of land renting for the CF.[6] The equilibrium land use by the corporate farm is where MC^C equals D^C, ie at A^M. The resulting CF rental price is r^M.

Compared to the competitive market equilibrium (A^*, r^*), the domination of the market by the CF leads to a reduction of land use by the CF ($A^M < A^*$), and a corresponding increase of land use by the individual farms. The land rental price is lower for all farms ($r^M < r^*$). The surplus gains of the CF are area A – C (>0). The IFs also gain, by area EGL. The losses are for the landowners who lose rental income equal to area ADEGL. The effect on rural households depends to what extent they are employed by the CF, or are IFs, or landowner. For rural households who are both landowner and individual farmer, the losses in rental income may outweigh the gains in farm profits from lower rental prices. Finally, the total welfare effects are negative. Social costs due to the market power of the CF equals area CD.

Figure 2 also shows the situation of imperfect competition with transaction costs t. In this case, the equilibrium is at (A_t^M, r_t^M). The CF rental price falls further to $r_t^M < r^M < r^*$: both the transaction costs and the market power of CF push the CF rental price down. Compared to the competitive market equilibrium with transaction costs (A_t^*, r_t^*), the domination of the market by the CF leads to a reduction of land use by the CF ($A_t^M < A_t^*$), and a corresponding increase of land use by the individual farms.

The combination of imperfect competition and transaction costs results in extra benefits for the CF. Relative to the competitive equilibrium without transaction costs (A^*, r^*), the surplus gains of the CF equals area ABDE. Landowners lose twice as both factors put a downward pressure on rental prices. Their combined loss equals area ABDEGHLN. For individual farms

[6] The shape of the marginal cost function is basically determined by the elasticity of individual farmers land demand. Since the total land demand is fixed, when the CF rents an additional hectare of land, it must pay a higher rent, the one that IF are willing to offer (the first term on right hand side of the equation (6)), plus the increase of

the two market imperfections have opposite effects. IFs gain from lower rental prices and more land with imperfect competition, but lose from higher rental prices and less land with transaction costs. The net effect depends on the relative size of the transaction costs. With low transaction costs, the benefits from CF market power will dominate. With high transaction costs (as is the case in figure 2), the losses due to transaction cost will dominate. The net loss for IFs is equal to area FK.[7] The total welfare effects are negative. Compared to the competitive market equilibrium (A^*, r^*), (A_t^M, r_t^M) implies losses equivalent to – KLN –FGH, where KLN represents the total transaction costs incurred and FGH the market distortions.

Impact of CAP payments

Since the 1992 MacSharry reform and the Agenda 2000 reforms, the vast majority of CAP subsidies are so-called direct payments (DPs). In 2001, 27.4 billion euro was spent in the EU-15 on direct payments alone. They make up around two-thirds of the CAP budget and include both per hectare payments for some commodities and payments per animal for some livestock activities. They formed one of the most hotly disputed issue in the EU enlargement negotiations, as the NEMS insisted on getting full access to DPs, while EU-15 member states only wanted to give partial DPs. The ultimate agreement, reached in Copenhagen in 2002, allowed for DPs to be partially introduced from the date of accession and then gradually increased, from maximum 55% in 2004 to 100% in 2010.[8]

Define s as the subsidy (area payment) per unit of land, and assume that all land in the

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rent for every hectare of land rented (the second term on the right hand side of equation (6)). The more inelastic the IF land demand is, the higher is this increase in rent and consequently the steeper the MC^C is.

[7] Notice that if transaction costs would be such that the marginal cost function MC_t^C would go through point (A^*, r^*) that both effects would exactly offset each other and the combined impact on IF welfare would be zero.

[8] The EU budget only pays for 25% in 2004 and gradually increases this amount to reach 100% in 2013. However, NEMS governments are allowed to add subsidies from their own budget (the so-called "top-ups") to a combined maximum of 55% in 2004, gradually increasing to 100% by 2010. Also, NEMS have an option to combine the total direct payments envelope and grant it per hectare bases, instead of granting it separately per animal or per hectare for crop commodities.

analysis qualifies for the subsidies. The objective function of the IF then changes to

(7) $$\prod^I = pf^I(A^I) - (r + t - s)A^I .$$

The subsidy s shifts the value marginal product of land curve by s:

(8) $$p\frac{\partial f^I(A^I)}{\partial A^I} = r + t - s .$$

The objective function for the CF changes as well.

Proposition 1: *Area payments benefit only landowners, with and without transaction costs and perfect competition in the land market.*

Proof: see Appendix A1.

Figure 3 shows the first part of the result. Without transaction costs and with perfect competition in the land market, the IF and CF land demand function with subsidies are D_s^I and D_s^C, respectively, and the equilibrium shifts from (A^*, r^*) to (A_s^*, r_s^*). Notice that the land allocation does not change: $A^* = A_s^*$. Furthermore, the surplus of neither CF nor IF is affected. Their incomes remain unaffected by the subsidy. All the gains go to the landowners. The total gains for landowners are equal to the area B, which is equal to the total subsidies $sA^T = (r_s^* - r^*)A^T$.

This result holds in general. With transaction costs and imperfect competition in the land market, all the benefits of subsidies still go to landowners. Figure 4 shows the general case. The subsidy shifts the marginal cost function from MC_t^C to MC_{ts}^C. With transaction costs t and imperfect competition, the subsidy causes the equilibrium to shift from (A_t^M, r_t^M) to (A_{ts}^M, r_{ts}^M). The land allocation does not change: $A_t^M = A_{ts}^M$. Rental prices increase from r_t^M to r_{ts}^M for corporate farms and from $r_t^M + t$ to $r_{ts}^M + t$ for individual farms. The difference between both rental prices is exactly the size of the subsidy ($s = r_{ts}^M - r_t^M$). As a result the subsidies get fully captured by land price increases and the surplus of neither CF nor IF is affected. All the gains go to the

landowners, equal to the sum of areas F + G, which equals the subsidy per unit of land times the total amount of land used ($sA^T = (r_{ts}^M - r_t^M)A^T$).

Unequal access to subsidies

An important assumption behind these results is that both corporate farms and individual farms get the same subsidies per hectare. In reality this assumption may not be correct. Access to the payments may be complicated for small individual farmers because of administrative constraints in applying for the subsidies and problems in satisfying additional requirements.[9] If so, some of the individual farms may not get access to the payments.

Proposition 2 : *With unequal subsidies, area payments benefit landowners and CF, while IF lose on average.*

Proof: see Appendix A2.

To analyse the effect of this, assume that only part of the individual farms get area payments. This will result in a smaller shift of the aggregate IF land demand function than would be if all would get the subsidy s. Define s^I as the "equivalent subsidy", i.e. the subsidy which would cause the same shift in the land demand function if all individual farmers would get the same subsidy s^I. Figure 5 illustrates this situation. For simplicity, we start from figure 3 where we assumed no transaction costs and perfect competition. The result of unequal subsidies is that the new demand curve D_u^I is below the D_s^I curve, while the CF demand is still represented by D_s^C. The new equilibrium is now at (A_u^*, r_u^*). Notice that the land allocation changes now: A_u^* is to the right of $A^* = A_s^*$. Corporate farms use more land and individual farms use less.

[9] A typical requirement is so-called "cross-compliance", which means that, among others, farms need to fulfil some agri-environmental conditions in order to obtain the subsidies. These conditions for example may require farmers to meet certain obligations regarding fertilisers, pesticides and seeds use, food safety, landscape quality, etc.. Another problematic requirement for IF may be minimum farm size criteria. In countries such as Bulgaria, Estonia, Hungary Lithuania and Romania the average IF farm size is between 1 and 4 hectares (table 1).

Total subsidies allocated equal area ABCDE (to CFs) and F (to IFs). A large part of the subsidies still end up with landowners through an increase in land rental prices, equal to area BCEFG. Individual farmers lose out because the land rental price increases more than the subsidies they get: $r_u^* - r^* > s^I$. Their losses equal area EG. Corporate farms gain because the increase in rental prices is lower than the subsidies they receive: $r_u^* - r^* < s$. Their gains equal area A. As subsidies now induce distortions in the allocation of land, there are deadweight costs, equal to area D and E. Obviously, the relative sizes of these effects depend on the elasticity of the demand curves and on the difference in the subsidies.

Similar conclusions follow when including transaction costs and market imperfections. This is illustrated in figure 6. We start from figure 4 where transaction costs, market imperfections and equal access to subsidies were assumed. For unequal subsidies the new marginal costs function, MC_u^C, along which the CF decides on the quantity of land rented, is below the MC_{ts}^C. This leads to a new equilibrium (A_u^M, r_u^M). The land allocation changes. Corporate farms use more land ($A_u^M > A_t^M = A_{ts}^M$) and individual farmers less. Total subsidies allocated in the equilibrium equal area ABDE. A substantial part of the subsidies still go to landowners through increased rental prices, equal to area BDEF. Individual farmers loose, while corporate farms gain. The losses to individual farmers equal area DF and the gains to corporate farms equal area AC. Because the CF uses its market power, it rents less land than socially desirable (see figure 2). However, unequal subsidies make it profitable for the CF to use more land. This leads to a land allocation that is closer to the perfect competition equilibrium. However, if the difference in subsidies obtained by the CF and IF is sufficiently large, the CF could even use more land than the equilibrium with perfect competition.

Impact of the 2003 CAP reform

In 2003 the EU decided to decouple CAP subsidies starting from 2005. This means, in

terms of our model, that subsidies will be given as a fixed set of payments per farm, so-called single farm payments (SFP). The SFP for a specific farm equals the support the farm received in the previous "reference" period. The SFP is an entitlement, but future SFP payments depend on the farm operating an amount of "eligible hectares" equivalent to the size of the entitlement.

Specifically, define E^C as the total payment for the corporate farm after CAP reform, and A_E^C as the amount of eligible area for payments. Assuming that E^C equals the total subsidies the corporate farm received with the area payment system, and that all the land it used qualifies as eligible land, we have $E^C = A_E^C$. s, which is equal to area F, with $A_E^C = A_t^M$ in figure 4. Making similar assumptions for the individual farms, $E^I = A_E^I$. s, where $A_E^I = A^T - A_t^M$, which equals area G in figure 4. Hence, payments per eligible hectare, e, are equal in this case: $e = e^C = e^I$.

The policy reform has important impacts on the distribution of policy rents. The first implication is that policy rents shift from landowners to farms with the new CAP support system.

Proposition 3 : *Decoupled single farm payments benefit only farms, with and without land market imperfections*.

The corporate farm and individual farmers are not granted payments for the land that they rent above the eligible area, A_E^C and A_E^I respectively. Consider first the case when the IFs want to rent more land, $A^I > A_E^I$. Since the total land supply is fixed, it implies that the CF would then rent less land than its eligible area, $A^C < A_E^C$. In this case the respective land demand functions are determined by:

(9) $pf_A^I = r + t(A^I)$

(10) $pf_A^C + e = r + A^C \dfrac{\partial r}{\partial A^C}$

For the extra land (area $A^I - A_E^I > 0$), IFs cannot pay more than the marginal production value of the land. In contrast the CF is willing to pay a higher rent, up to e more.

Secondly, consider the case when land rented by IFs is less than the eligible area, $A^I < A_E^I$ and $A^C > A_E^C$. The demand functions are then defined by:

(11) $pf_A^I + e = r + t(A^I)$

(12) $pf_A^C = r + A^C \frac{\partial r}{\partial A^C}$.

In this case the reverse logic holds. The payments increase the IF land demand. The rent that IF is willing to pay is increased by e.

Equations (9) and (11) for IF and equations (10) and (12) for CF imply kinked land demand functions with the SFP. Consider figure 4 again. Starting in the left hand side of the figure and following the thick lines, IF demand is given by D_t^I D_{ts}^I while CF demand is given by D_s^C D^C. The CF marginal cost function is also kinked. For the land area $A_E^I = A^T - A_t^M$ or lower, the CF marginal cost function is given by thick line MC_{ts}^C. For $A^I > A^T - A_t^M = A_E^I$, the CF marginal cost is represented by thick line MC_t^C. At A_t^M the demands and CF marginal costs are represented by thick vertical lines.

The equilibrium with SFP is (A_t^M, r_t^M). Compared to the area payments, the land allocation is the same $A_t^M = A_{ts}^M$, but the rental price is lower: the rent will decline from r_{ts}^M to r_t^M. When the CF rents marginally more land than A_t^M, it is willing to pay only r_t^M (determined by $D^C = MC_t^C$). Similarly, when IF wants to rent marginally more than $A^T - A_t^M$, the rent that IF is willing to pay is r_t^M (given by D_t^I). The equilibrium land rent will be r_t^M. Farmers gain all the subsidies, equal to area FG. The gains to the corporate farm equal area F and the gains to individual farms equal area G.

However, this result is conditional upon how potential new entrants in farming are treated. With support now linked to current farms, new farmers (who are potentially more dynamic and productive and therefore a source of growth) are excluded from benefiting from the support system. These problems appear particularly problematic in the NEMS where major farm

restructuring continues to take place, and is required to stimulate the productivity of the farm sector. To address some of these concerns, it was decided to create a 'reserve' to grant subsidy entitlements to new entrants. It turns out that these reserve entitlements can have an important impact on the total distribution of policy rents.

Proposition 4 : *Benefits of SFP will shift to landowners when new entrants are eligible for SFP entitlements, with and without land market imperfections.*

Proof: see Appendix A3.

The introduction of SFP entitlement to new entrants will induce a rise of the land rental price from r_t^M to r_{ts}^M. The rise is equivalent to the per hectare payment e. The reason is that there is an increased demand at the margin. Landowners may rent their land to new entrants if the tenants do not pay this price. In the above case, up to area A_E^C ($=A_t^M$) only incumbent CF could use e to bid the rent up, while for the rest of the area, A_E^I ($=A^T - A_t^M$)), only incumbent IF were able to do the same. New entrants were not eligible for e. However, if new entrants are eligible for SFP, their marginal benefit of cultivating land equals the marginal value product of land plus per hectare payment e. So, a new entrant is willing to offer the landowner a higher price for the land. But the farm (either CF or IF) that currently uses the land is willing to offer to the landowner a price up to $r_t^M + e$ (see figure 4). Hence, the new entrant and the farm will bid until the rental price will reach $r_{ts}^M = r_t^M + e$.

If the reserve for new entitlements is temporary, there will be an impact on the dynamics of rents. At the time of the SFP introduction the rental price will rise to $r_{ts}^M = r_t^M + e$, because there will be a demand from new entrants who are willing to pay this price. However, when the reserve will be exhausted this demand will disappear and the price will return back to its pre-reform period level to r_t^M.

In summary, the availability of reserve entitlements for entrants makes that the effects of

the new CAP system are very similar to the effects of the old CAP system. When the reserve entitlements stop, the effects shift dramatically. In reality, farm managers, new and current, may have some expectation on when the reserve runs out and rational agents will take this information in consideration. The dynamics of the rental price will reflect this, smoothing the price changes.

EU accession, CAP reform, and farm restructuring

Accession to the EU will not only affect the benefits which the NEMS farms will receive, but also the market imperfections themselves. In particular, one should expect transaction costs in the factor markets, including the land market, to reduce, at least gradually, with EU accession. Such reduction in transaction costs will come from a combination of factors, such as legal and institutional requirements for EU accession which improve the legal and institutional framework in which land market transactions occur. Improved profitability in farming from enhanced productivity of the farms and subsidies will also stimulate land transactions and thereby improve experience, transparency, and understanding of the market.

Such improved functioning of the land market through reductions in transaction costs will stimulate farm restructuring, transferring land use from less efficient to more efficient organisations. In terms of our model, this implies a shift of land use from the corporate farm to individual farms.[10] To see this consider figure 1.[11] The equilibrium in the land market with

[10] Notice that we do *not* assume that *all* individual farms are more efficient than *all* corporate farms. We assume that there are some individual farms that can use (some) land more efficiently than some of the corporate farms, as is reflected in the two demand functions. Without imperfections, the rental market will transfer land up to the point where land productivity is equal in corporate farms and individual farms, at the margin. As can be seen from our graphs, we assume an "interior solution", meaning that we assume that in this equilibrium, corporate farms will still use some of the land. These assumptions are consistent with the empirical literature. Studies measuring relative farm efficiencies in CEECs typically find (a) that the relative efficiency depends on various factors, including the types of activities (eg grain, livestock, vegetables, …), institutions, infrastructure and economic conditions, (b) that at least part of the new individual farms are more efficient than the corporate farms they replaced, and (c) that the variations in farm efficiency within the "corporate farm" group and within the "individual farm" group is often larger than between the groups (see e.g. Mathijs and Swinnen, 2001; Gorton and Davidova).

transaction costs equal to t_2 is (A_{t2}^*, r_{t2}^*). With transaction costs reducing to t_1, the equilibrium shifts to (A_{t1}^*, r_{t1}^*), or when transaction costs fall to zero, the equilibrium becomes (A^*, r^*). It is clear that this implies that land is moved from less productive use by the corporate farm to more productive use by individual farms – the difference in marginal productivity at (A_{t2}^*, r_{t2}^*) equals t_2 – up to the point where the marginal productivity in both types of farms is equal. Furthermore, with increased marginal productivity of land at the equilibrium, equilibrium land rents have increased with falling transaction costs. These results hold in a situation where there are no subsidies. How do CAP subsidies affect this efficiency enhancing effect of EU accession?

Proposition 5 :

a. Area payments have no effect on productivity enhancing restructuring in NEMS.

b. Reform to single farm payments constrains restructuring.

c. Making SFP available to new farms will stimulate restructuring, but cause a transfer of policy rents from farms to landowners.

Proof: see Appendix A4.

First, let us look at the case of area payments. Figure 7 is an extended version of Figure 1 to illustrate this case. As in figures 3-6, the subscript s of various curves refers to their shape with area payments s. When area payments are introduced, the initial equilibrium with transaction costs t_2 shifts from (A_{t2}^*, r_{t2}^*) to (A_{t2}^*, r_{t2s}^*). The reduction in transaction costs from t_2 to t_1 shifts the equilibrium to (A_{t1}^*, r_{t1s}^*) and when transaction costs disappear (t=0), the equilibrium is (A^*, r_s^*). Notice that the restructuring with the area payments is identical to the restructuring without subsidies. With transaction costs falling to t_1, land use by individual farms increases from A^T - A_{t2}^* to A^T - A_{t1}^* and further to A^T - A^* when transaction costs go to zero. Hence, the area

[11] Since the argument here is about the impact of the reduction in transaction costs, we limit our argument to the perfect competition model – the imperfect competition analysis can be obtained from the authors.

payments have no effect on the restructuring process.

The effect of the SFP on restructuring is different. The eligible area in the case depicted in figure 7 is $A_E^C = A_{t2}^*$ for CF and $A_E^I = A^T - A_{t2}^*$ for IF. As we explained before, in this case the demand curves of IF and CF are kinked, with a shift occurring at A_{t2}^* for initial transaction costs t_2. The equilibrium is at (A_{t2}^*, r_{t2}^*). Consider now what happens if transaction costs decline from t_2 to t_1. The kinked land demand curve of IFs shifts up by $\Delta t = t_2 - t_1$. This results in a relatively large change in the rental price, but no change in land allocation. The new equilibrium is (A_{t2}^*, r_{t1e}^*). The increase in rental price $(r_{t1e}^* - r_{t2}^*)$ is identical to the decline in transaction costs $t_2 - t_1$, which is larger than with area payments. The reason is that there is no land reallocation because the decline in transaction costs is insufficient to overcome the gap in subsidies between CF and IF for land renting beyond A_{t2}^*. Even with reduced transaction costs, the marginal value of additional land for the IF at A_{t2}^* is equal to r_{t1e}^*, which is less than r_{t2s}^*, which is the marginal value of land for the CF at A_{t2}^*. Only if the reduction in transaction costs (Δt) is larger than the per unit subsidies (e) there will be restructuring. To see this, consider what happens when transaction costs fall to zero with $\Delta t = t_2 > e$. Now the IF demand curve shifts from D_{t2}^I to D^I for land allocations to the left of A_{t2}^*. This results in a new equilibrium at (A_e^*, r_e^*). The decline in transaction costs is now so large that it more than offsets the subsidy gap at the margin at A_{t2}^* and IFs will rent more land despite the subsidy gap. This results in restructuring, but still less than without subsidies or with area payments. Land use by IFs increases by only $A_{t2}^* - A_e^* < A_{t2}^* - A^*$.

Hence, while some restructuring takes place, it is clear that this is less with SFP than with area payments. In other words, CAP reform will reduce farm restructuring and will restrict productivity gains associated with it. The old CAP system would yield the largest change in land allocation from IF to CF. The SFP may even lead to a total freeze of farm structures if subsidies

are large compared to the reduction of transaction costs.

Finally, attempts to address this problem by making new individual farms eligible for SFPs will stimulate farm restructuring but simultaneously induce a shift of policy rents from farms to landowners. The logic is analogous to that of proposition 4. The introduction of additional subsidies for new entrants effectively transforms the SFP situation into an area payments effect at the margin, stimulating more restructuring, but pushing up rental prices as well, shifting CAP benefits to landowners.

In summary, while the introduction of CAP reform in the NEMS will shift CAP benefits from landowners to farms there is an important trade-off. Restructuring which is needed to increase the competitiveness of the NEMS farm system will be constrained. Granting the SFP to new entrants mitigates this problem, but will simultaneously induce a transfer of policy rents to landowners.

Discussion and Conclusions

Eastern enlargement of the EU implies integration of the agricultural economies of the NEMS in the CAP. As a consequence farmers in the NEMS will receive area payments for the land they use, gradually increasing over a transition period. In well functioning land markets such payments typically get incorporated in land values and thereby benefit mainly landowners and lead to increases in input costs for farmers. However, NEMS rural land markets are characterized by important imperfections.

In this paper we have shown that, as long as there is competition from individual farms, domination of the land market by corporate farms and transaction costs will not affect the result that CAP subsidies will end up as increases in land prices and benefit landowners instead of farmers. Furthermore, if the land payments are distributed unequally, for example because of problems of small farms in fulfilling the requirements for obtaining subsidies, small farmers

(especially tenant farmers) may even be net losers from the subsidies, while large corporate farms gain, as well as the landowners.

In the last part of the paper, we show how the 2003 CAP reform has both positive and negative efficiency effects in NEMS. While distortions are reduced and policy rents are shifted to farmers, restructuring of the farms is blocked. Mitigating this effect through reserve entitlements causes a reduction in subsidy benefits for farmers as land prices will increase.

We should caution about simplistic interpretations of our results. How the effects analyzed in this paper affect rural households in the NEMS depends on whether the households are landowners or farmers, or both, and on the importance of corporate farms. These structural conditions differ strongly between NEMS. For example, farming in countries like Slovakia and the Czech Republic is concentrated on large-scale corporate farms, who rent most of their land. In Slovakia, CF use 88% of farmland. More than 90% of total land used by CF and by IF is rented. Land ownership is very fragmented and many landowners are living in urban areas. (Research Institute of Agricultural Economics). In contrast, in countries such as Poland and Slovenia, farming is dominated by small family farms (IFs), owning most of the land. In Poland, IFs cultivate around 87% of the total land and own most of the cultivated land. Thus, many farmers are also landowners in Poland. That said, it should be noted that (a) there are generational differences, as the most dynamic farmers are typically younger and land ownership is typically concentrated in older rural households, and (b) that there are also important regional variations: in the north and western regions of Poland, larger farms operate on rented (former state farm) land (Csaki and Lerman; Dries and Swinnen). Most other countries, such as Hungary and Bulgaria, have a mixed structure. For example, in Hungary, IFs use 59% of farm land and CF use 41%. CF rent most of the land they use, while individual farmers operate on a mixture of owned land and rented land. The share of rented land typically increases with the size of the IF

(Vranken and Swinnen). Many land owners are living in urban areas, but land ownership is less fragmented than in Slovakia.

When taking in consideration these facts, the implications of our analysis are different for these countries. The most striking difference is between countries such as Poland and Slovakia. For most farms in Poland, leakages of policy rents to land owners is less of a problem since the dominating farm model is IFs who themselves own the land. There are some problems of rents being concentrated with older farmers who are typically the land owners. In contrast, for many farms in Slovakia and Hungary increased rental rates with the introduction of area payments have a significant impact. Interestingly, there was a persistent view in the 1990s that "land markets are not working" and "prices are very low". All this has changed dramatically since 2002. The anticipation and the implementation of CAP payments has strongly pushed up land prices and rental rates in Slovakia and Hungary. In both countries, land owners are benefiting from this, but to a larger extent in Hungary than in Slovakia. In Slovakia, large farms are more dominant and have more market power. In addition, fragmentation is more excessive and the concentration of land owners in the cities is stronger. In combination, these factors increased transaction costs for land owners, and reduced their gains. Despite this, CF managers in Slovakia, and in other countries such as the Czech Republic, have started lobbying the government to introduce regulations of land rental prices, which they claim is "unfairly benefiting urban land owners". An alternative strategy by CF managers was to lock land owners into long term contracts before land prices started increasing. Surveys show that land rental contracts with CF in Slovakia and the Czech Republic are typically longer than with IFs (Swinnen and Vranken).

The smallest farms in countries such as Slovakia and Hungary may suffer from the subsidies, as they may not get access to subsidies while facing increased land prices. In addition

to the administrative hurdles, there is a regulatory limit of one hectare in order to apply for subsidies. However, this disadvantage may be limited as the smallest farms often use own land for farming.

The shift from area payments to decoupled single farm payments is planned in a few years in NEMS. The impact on income distribution will be limited in Poland but significantly in Slovakia and Hungary. Large CFs are likely to benefit very strongly from the decoupled farm payments, as the rents are likely to fall and large income transfers will benefit them directly.

Finally, this change in subsidy instruments may have an undesirable effect on restructuring, which is important to increase the competitiveness of the farm sector in the NEMS. The shift to SFPs will limit the pressure for restructuring. In some of the countries, especially Slovakia and Czech Republic, this is likely to constrain much needed further restructuring of some of the corporate farms. This is especially the case since the subsidies will increase rapidly over the 2005 – 2013 period and will be large by the time of the SFP introduction, possibly outweighing the gains in transaction cost reductions. In this case the constraining effect may be very strong.

Finally, an important issue which needs further analysis is the interaction of the land market imperfections and the subsidy systems with other market imperfections, in particular labor and credit markets. It is well known that both credit and labor market imperfections have an important impact on land allocation and farm structures in NEMS (see eg. Rizov and Swinnen; World Bank, 2001). There are interactions between these imperfections and the subsidy effects. For example, subsidies that increase land prices are likely to reduce credit constraints by improving collateral options. Also, labor market constraint will certainly affect the farm restructuring impact of the various subsidies. These interactions between various factor

market imperfections and the subsidy effects are complex and beyond the scope of analysis in this paper. This is the topic of our future research.

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Appendix

A1. Proof of Proposition 1.

Part 1: To show: $\frac{d\Pi^I}{ds} = 0$, $\frac{d\Pi^C}{ds} = 0$ and $\frac{d\Pi^L}{ds} > 0$ without transaction costs and perfect competition. In this case, total profits of IF, CF and landowners, respectively, are $\prod^I = pf^I(A^I) - (r-s)A^I$, $\prod^C = pf^C(A^C) - (r-s)A^C$, and $\prod^L = rA^T$.

Then we must show that:

(A1.1) $\frac{d\prod^I}{ds} = -A^I \frac{dr}{ds} + A^I = 0$

(A1.2) $\frac{d\prod^C}{ds} = -A^C \frac{dr}{ds} + A^C = 0$

(A1.3) $\frac{d\prod^L}{ds} = r\frac{dA^T}{ds} + A^T \frac{dr}{ds} > 0$

With $\frac{dA^T}{ds} = 0$, (A1.1 - A1.3) can only hold if $\frac{dr}{ds} = 1$.

In equilibrium the following conditions must be satisfied (with $\frac{\partial f^I(A^I)}{\partial A^I} = f_A^I$ and $\frac{\partial f^C(A^C)}{\partial A^C} = f_A^C$):

(A1.4) $pf_A^I = r - s$ First order condition of a representative IF

(A1.5) $pf_A^C = r - s$ CF' first order condition

(A1.6) $A^T = A^I + A^C$ Land equilibrium condition

Total differentiating equations (A1.4 – A1.6) yields:

(A1.7) $pf_{AA}^I dA^I = dr - ds$

(A1.8) $pf_{AA}^C dA^C = dr - ds$

(A1.9) $dA^I + dA^C = 0$

Using (A1.7 – A1.9), it follows that:

(A1.10) $\frac{dr}{ds} = \frac{pf_{AA}^C + pf_{AA}^I}{pf_{AA}^C + pf_{AA}^I} = 1$

Q.E.D of part 1.

Part 2: To show: $\frac{d\Pi^I}{ds} = 0$, $\frac{d\Pi^C}{ds} = 0$ and $\frac{d\Pi^L}{ds} > 0$ with transaction costs and imperfect competition. Now the total profit of IF is defined by equation $\prod^I = pf^I(A^I) - (r + t - s)A^I$. For CF and landowners total profits are defined as in part 1. Then we must show that:

(A1.11) $$\frac{d\prod^I}{ds} = -A^I \frac{dr}{ds} - A^I t_A \frac{dA^I}{ds} + A^I = 0$$

(A1.12) $$\frac{d\prod^C}{ds} = pf_A^C \frac{dA^C}{ds} - (r - s)\frac{dA^C}{ds} - A^C \frac{dr}{ds} + A^C = 0$$

as well as (A1.3).

Where t(A^I) allows for increasing unit transaction costs ($\frac{\partial t}{\partial A^I} = t_A \geq 0$).

(A1.11) (A1.12) and (A1.3) hold if $\frac{dA^I}{ds} = \frac{dA^C}{ds} = 0$ and $\frac{dr}{ds} = 1$.

With imperfect competition and transaction costs, the conditions (A1.6) must be satisfied, as well as:

(A1.13) $pf_A^I = r + t - s$ First order condition of a representative IF

(A1.14) $pf_A^C = r - s + A^C \frac{\partial r}{\partial A^C}$ CF' first order condition

From (1.13) and (A1.6) $\frac{\partial r}{\partial A^C}$ can be obtained:

(A1.15) $\frac{\partial r}{\partial A^C} = -pf_{AA}^I + t_A$

Total differentiating equations (A1.6) (1.13) and (A1.14) and using equation (A1.15) (with $\frac{\partial^2 t(A^I)}{\partial A^{I\,2}} = t_{AA}$, $\frac{\partial^3 f^I(A^I)}{\partial A^{I\,3}} = f^I_{AAA}$) yields (A1.9), as well as:

(A1.16) $pf^I_{AA} dA^I = dr + t_A dA^I - ds$

(A1.17) $\left(pf^C_{AA} + pf^I_{AA} - t_A\right)dA^C + \left(A^C pf^I_{AAA} - A^C t_{AA}\right)dA^I = dr - ds$

Using (A1.9), (A1.16) and (A1.17), it follows that:

(A1.18) $\frac{dA^C}{ds} = \frac{dA^I}{ds} = \frac{1-1}{-pf^C_{AA} - 2pf^I_{AA} + 2t_A + A^C\left(pf^I_{AAA} - t_{AA}\right)} = 0$

(A1.19) $\frac{dr}{ds} = \frac{-pf^C_{AA} - 2pf^I_{AA} + 2t_A + A^C\left(pf^I_{AAA} - t_{AA}\right)}{-pf^C_{AA} - 2pf^I_{AA} + 2t_A + A^C\left(pf^I_{AAA} - t_{AA}\right)} = 1$

Q.E.D.

A2. Proof of proposition 2

To show: $\frac{d\Pi^I}{ds} < 0$, $\frac{d\Pi^C}{ds} > 0$ and $\frac{d\Pi^L}{ds} > 0$, if $s^I = as$ and $0 < a < 1$.

A2.1. Perfect competition and no transaction costs

In equilibrium the conditions (A1.5) and (A1.6) must be satisfied, as well as:

(A2.1.1) $pf^I_A = r - as$

Total differentiating equations (A1.5), (A1.6) and (A2.1.1) yields (A1.8) and (A1.9) as well as:

(A2.1.2) $pf^I_{AA} dA^I = dr - a\,ds$

Solving (A1.8), (A1.9) and (A2.1.2) it follows that:

(A2.1.3) $\frac{dA^I}{ds} = \frac{1-a}{pf^C_{AA} + pf^I_{AA}} < 0$

The denominator is negative with $f^C_{AA} < 0$ and $f^I_{AA} < 0$, implying a decline of land used by IF.

The effect of unequal subsidies on land market rent is:

(A2.1.4) $\frac{dr}{ds} = \frac{pf_{AA}^{I} + apf_{AA}^{C}}{pf_{AA}^{C} + pf_{AA}^{I}}$ and $0 < \frac{dr}{ds} < 1.$

Using these results it follows that:

(A2.1.5) $\frac{d\prod^{I}}{ds} = \frac{-A^{I} pf_{AA}^{I}(1-a)}{pf_{AA}^{C} + pf_{AA}^{I}} < 0$

(A2.1.6) $\frac{d\prod^{C}}{ds} = \frac{A^{C} pf_{AA}^{C}(1-a)}{pf_{AA}^{C} + pf_{AA}^{I}} > 0$

(A2.1.7) $\frac{d\prod^{L}}{ds} = \frac{A^{T}\left(pf_{AA}^{I} + apf_{AA}^{C}\right)}{pf_{AA}^{C} + pf_{AA}^{I}} > 0$

Landowners and CF gain while IF loose with unequal subsidies.

Q.E.D.

A2.2. Imperfect competition and transaction costs

Now conditions (A1.6) and (A1.14) must be satisfied, as well as:

(A2.2.1) $pf_{A}^{I} = r + t(A^{I}) - as$

Total differentiating equations (A1.6), (A1.14) and (A2.2.1) and using equation (A1.15) yields (A1.9) and (A1.17), as well as:

(A2.2.2) $pf_{AA}^{I} dA^{I} = dr + t_{A} dA^{I} - a\,ds$

Using (A1.9), (A1.17) and (A2.2.2) it follows that:

(A2.2.3) $\frac{dA^{I}}{ds} = \frac{-(1-a)}{-pf_{AA}^{C} - 2pf_{AA}^{I} + 2t_{A} + A^{C} pf_{AAA}^{I} - A^{C} t_{AA}} < 0$

(A2.2.4) $\frac{dr}{ds} = \frac{-(1+a)pf_{AA}^{I} + (1+a)t_{A} + a\left(-pf_{AA}^{C} + A^{C} pf_{AAA}^{I} - A^{C} t_{AA}\right)}{-pf_{AA}^{C} - 2pf_{AA}^{I} + 2t_{A} + A^{C} pf_{AAA}^{I} - A^{C} t_{AA}} > 0$

The necessary condition for a maximum for the CF profit function is that its second derivative must be negative ($\frac{\partial^2 \Pi^C}{\partial A^{C\,2}} < 0$):

(A2.2.5) $-pf^C_{AA} - 2pf^I_{AA} + 2t_A + A^C pf^I_{AAA} - A^C t_{AA} > 0$

This implies that the denominators in equations (A2.2.3) and (A2.2.4) as well as the numerator in (A2.2.4) are positive. Hence, unequal subsidies lead to a decrease of land used by individual farmers and to an increase of the land rent.

Calculating the effect of unequal subsidies on profits, yields:

(A2.2.6) $$\frac{d\Pi^I}{ds} = \frac{A^I pf^I_{AA}(1-a)}{-pf^C_{AA} - 2pf^I_{AA} + 2t_A + A^C pf^I_{AAA} - A^C t_{AA}} < 0$$

(A2.2.7) $$\frac{d\Pi^C}{ds} = \frac{\left[-pf^C_{AA} - 2pf^I_{AA} + 2t_A + A^C pf^I_{AAA} - A^C t_{AA}\right]A^C(1-a)}{-pf^C_{AA} - 2pf^I_{AA} + 2t_A + A^C pf^I_{AAA} - A^C t_{AA}} > 0$$

(A2.2.8) $$\frac{d\Pi^L}{ds} = \frac{A^T\left[(1+a)t_A - (1+a)pf^I_{AA} + a\left(-pf^C_{AA} + A^C pf^I_{AAA} - A^C t_{AA}\right)\right]}{-pf^C_{AA} - 2pf^I_{AA} + 2t_A + A^C pf^I_{AAA} - A^C t_{AA}} > 0$$

Q.E.D.

A3. Proof of proposition 4

The proof of this proposition is similar to the proof of proposition 1. When new entrants are eligible for the SFP, the IF and the CF marginal conditions with transaction costs and imperfect competition are given by equations (11) and (10) respectively, and they are equivalent to equations (A1.13) and (A1.14). Thus the effect of SFP with new entrants eligible for the payments is equivalent to the effect of area payments. The proof for perfect competition is analogous.

A4. Proof of proposition 5

Part a:

Step 1: To show: $\frac{d\left(Q^T/A^T\right)}{dt}<0$, where Q^T is total output, $Q^T = f^I(A^I)+ f^C(A^C)$, and thus $\frac{Q^T}{A^T}$ is land productivity. Total differentiating $\frac{Q^T}{A^T}$ and using (A1.9) then we must show:

(A4.1) $\frac{d\left(Q^T/A^T\right)}{dt}=\frac{\left(f_A^I - f_A^C\right)}{A^T}\frac{dA^I}{dt}<0$

With transaction costs (assuming fixed per unit t), perfect competition, and without subsidies condition (A1.6) must be satisfied, as well as:

(A4.2) $pf_A^I = r + t$

(A4.3) $pf_A^C = r$

Total differentiating equations (A1.6), (A4.2) and (A4.3) yields (A1.9), as well as:

(A4.4) $pf_{AA}^I dA^I - dr = dt$

(A4.5) $pf_{AA}^C dA^C - dr = 0$

Using (A1.9), (A4.4) and (A4.5) it follows that:

(A4.6) $\frac{dA^I}{dt}=\frac{1}{pf_{AA}^C + pf_{AA}^I}<0$

From equations (A4.2) and (A4.3) it results that in equilibrium (at point A_{t2}^* in figure 7) $f_A^I > f_A^C$ with t>0 (with t_2>0 in figure 7). Hence $f_A^I - f_A^C > 0$.

With $\frac{dA^I}{dt}<0$ and $f_A^I - f_A^C > 0$, it follows that $\frac{d\left(Q^T/A^T\right)}{dt}<0$.

Step 2: To show: $\left.\frac{d\left(Q^T/A^T\right)}{dt}\right|_{s=0} = \left.\frac{d\left(Q^T/A^T\right)}{dt}\right|_{s>0}$. (A4.1) implies that this will be the case if $\left.\frac{dA^I}{dt}\right|_{s=0} = \left.\frac{dA^I}{dt}\right|_{s>0}$ and $\left(f_A^I - f_A^C\right)_{s=0} = \left(f_A^I - f_A^C\right)_{s>0}$.

From proposition 1 it follows that subsidies do not change land allocation. Hence $\left.\frac{dA^I}{dt}\right|_{s=0} = \left.\frac{dA^I}{dt}\right|_{s>0}$. At the initial equilibrium (A_{t2}^* in figure 7), the marginal productivity of land of IF and CF are not affected by s. Hence $\left(f_A^I - f_A^C\right)_{s=0} = \left(f_A^I - f_A^C\right)_{s>0}$.

With $\left.\frac{dA^I}{dt}\right|_{s=0} = \left.\frac{dA^I}{dt}\right|_{s>0}$ and $\left(f_A^I - f_A^C\right)_{s=0} = \left(f_A^I - f_A^C\right)_{s>0}$, it follows that:

(A4.7) $\left.\frac{d\left(Q^T/A^T\right)}{dt}\right|_{s=0} = \left.\frac{d\left(Q^T/A^T\right)}{dt}\right|_{s>0} < 0$.

Q.E.D. of part a.

Part b:

Assume s = e > 0. Since the SFP effects are not continuous, we analyze part b with discrete changes in t. From (A4.2) and (A4.3) it follows that for all $A^I < A^T - A^*$ (where A^* is the CF equilibrium land renting with t = 0) it holds (a) that $f_A^I > f_A^C$, (b) that $\frac{\Delta A^I}{\Delta t} < 0$, which implies that $\frac{\Delta\left(Q^T/A^T\right)}{\Delta t} < 0$, and (c) that $\left.\frac{\Delta A^I}{\Delta t}\right|_s < \left.\frac{\Delta A^I}{\Delta t}\right|_e$, which implies that $\left.\frac{\Delta\left(Q^T/A^T\right)}{\Delta t}\right|_s < \left.\frac{\Delta\left(Q^T/A^T\right)}{\Delta t}\right|_e$.

(This is bounded by $|\Delta t|$ t.) What is then left to show is: $\Delta A^I\big|_s > \Delta A^I\big|_e$ for $|\Delta t|$ t.

Case 1: $e > |\Delta t|$ t

In equilibrium (at A_{t2}^* in figure 7) for $\Delta A^I > 0$ the marginal land revenue for the IF remains smaller than the marginal land revenue of the CF:

(A4.8) $pf_A^I - t < pf_A^C + e$

IF do not get SFP for ΔA^I because they would rent more than the eligible area. The difference between the right hand side of equation (A4.8) and the left hand side of equation (A4.8) is equal to e, $\left(pf_A^C + e\right) - \left(pf_A^I - t\right) = e$. This follows from proposition 3.

The reverse holds for $\Delta A^I < 0$:

(A4.9) $pf_A^I - t + e > pf_A^C$, where $\left(pf_A^I - t + e\right) - pf_A^C = e$.

Because e > |Δt|, (A4.8) implies:

(A4.10) $pf_A^I - \left(t - |\Delta t|\right) < pf_A^C + e$

Hence, there will be no change in land allocation: $\Delta A^I\big|_s > \Delta A^I\big|_{e>|\Delta t|} = 0$.

Case 2: e < |Δt| t

The equilibrium with SFP (e) is determined by condition (A1.6) as well as by:

(A4.11) $pf_A^I = r + (t - |\Delta t|)$

(A4.12) $pf_A^C = r - e$

The area payments equilibrium is determined by conditions (A1.5), (A1.6) as well as by:

(A4.13) $pf_A^I = r + (t - |\Delta t|) - s$

Comparing (A4.11) and (A4.13) implies that for each |Δt| t it must be that in equilibrium $f_A^I\big|_s < f_A^I\big|_e$, and hence that $\Delta A^I\big|_s > \Delta A^I\big|_{e<|\Delta t|}$

Q.E.D. of part b.

Part c: This follows directly from the combination of part a and proposition 4.

Q.E.D.

Table 1.

Farm structures in CEECs.

Country	Family farms		Corporate farms	
	Share in total agricultural area (%)	Average size (ha)	Share in total agricultural area (%)	Average size (ha)
Bulgaria	52	1	48	536
Czech Republic	28	20	72	937
Estonia	63	2	37	327
Hungary	59	4	41	312
Latvia	90	12	10	297
Lithuania	89	4	11	483
Poland	87	8	13	
Romania	55	2	45	274
Slovakia	12	42	88	1185
Slovenia	94		6	

Sources: European Commission, 2002a; Czech Statistical Office; Statistical Office of Estonia; Central Statistical Office of Poland; Statistical Office of Latvia; Lithuanian Statistical Office; Statistical Office of Slovenia; Romania National Institute of Statistics; Slovak Ministry of Agriculture.

Table 2.

Land rents in the Czech Republic and Slovakia (the value of rents are in local currencies)

	Individual farms *A*	*Corporate farms* *B*	*IF Mark-Up* *A/B (%)*
Czech Republic			
Average 1999	718	346	208
by region			
Corn growing region	1330	597	223
Sugar beet growing region	846	731	116
Potato growing region	447	174	257
Potato-oats growing region	761	158	482
Mountain growing region	205	68	301
Slovakia			
2001	795	242	329
2002	816	333	245

Source: Czech Ministry of Agriculture; Research Institute of Agricultural Economics.

Figure 1. Equilibria in the land market with transaction costs

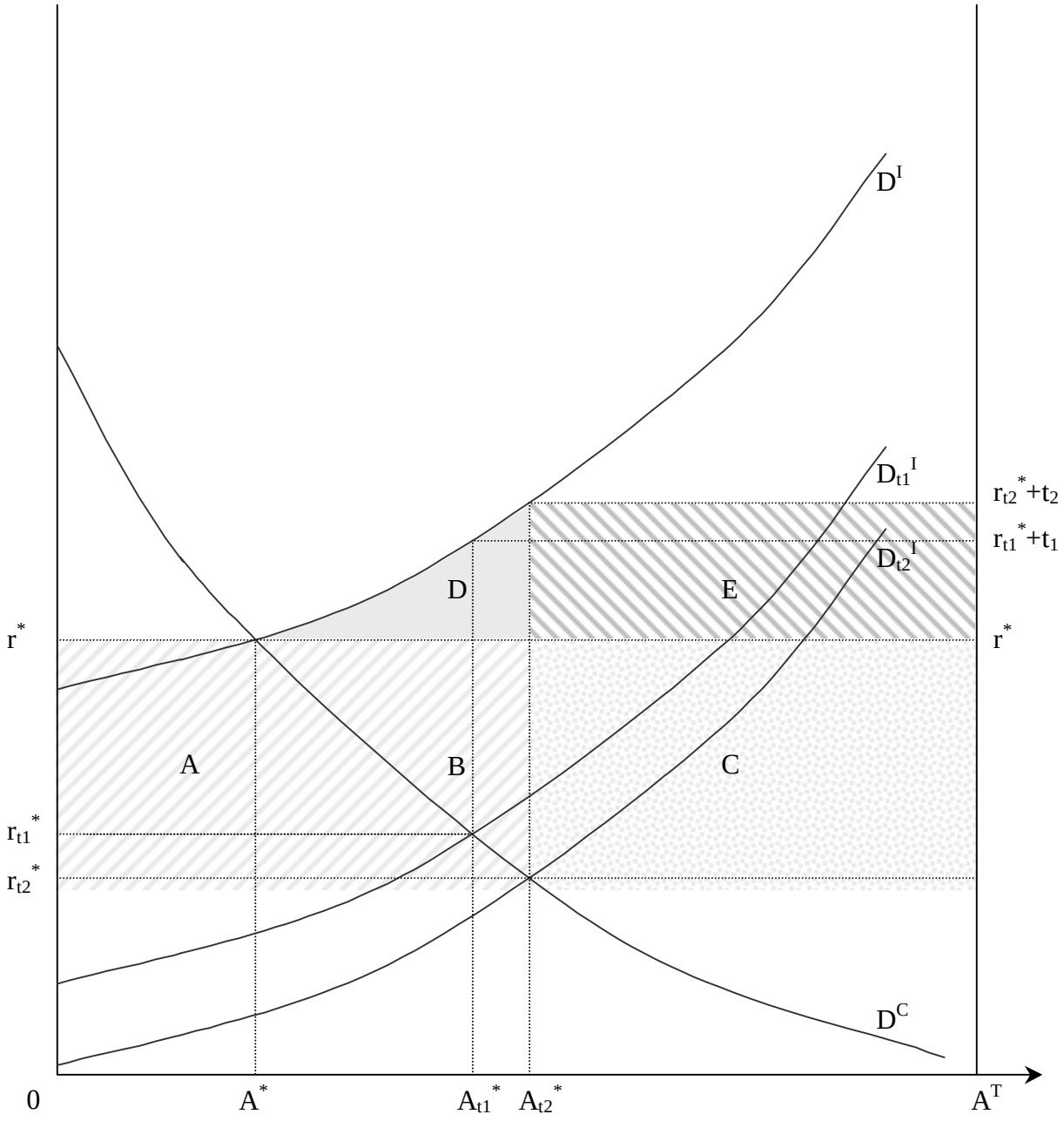

Figure 2. Effect of imperfect competition and transaction costs in the land market

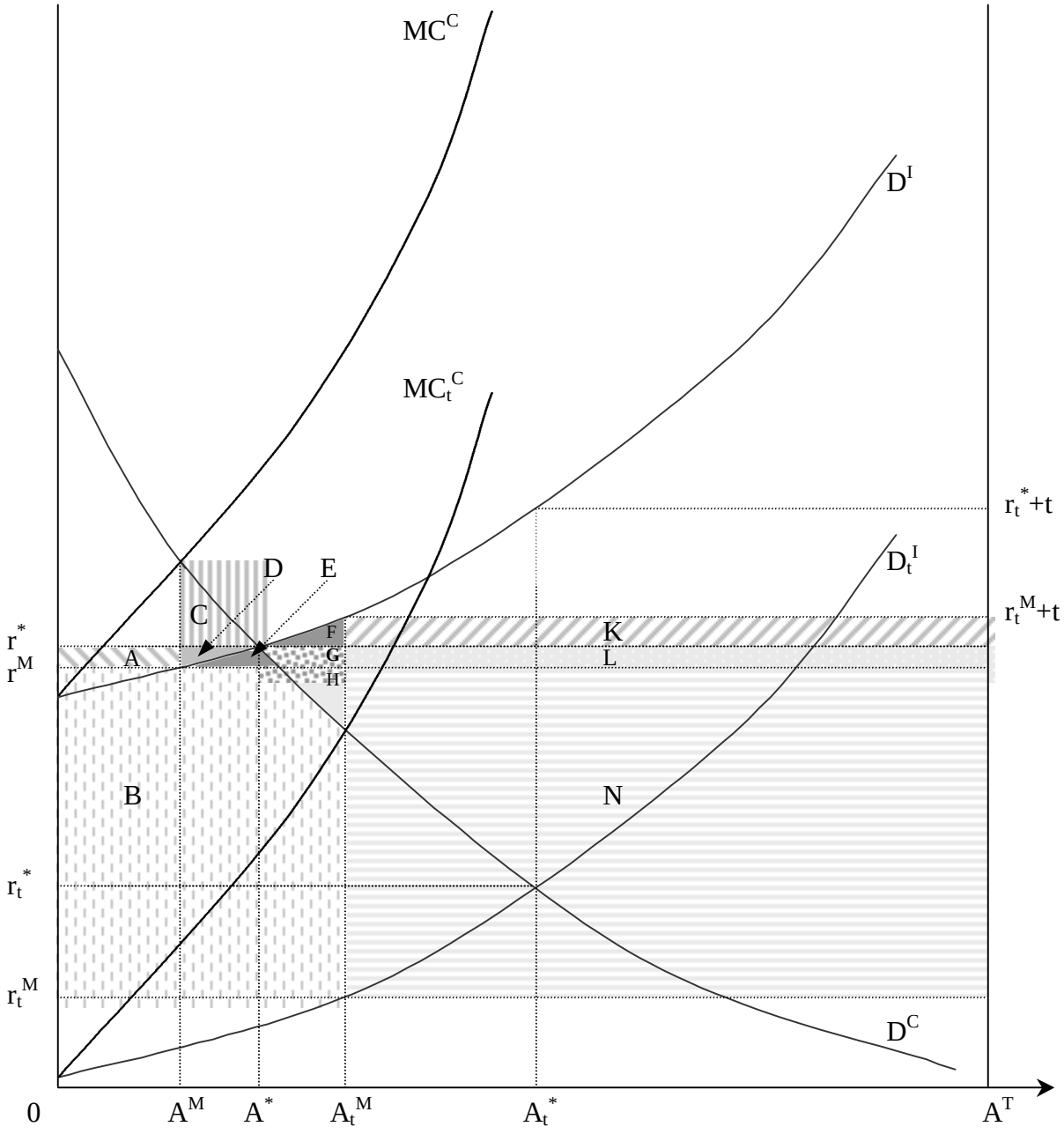

Figure 3. Effect of subsidies without imperfect competition and transaction costs in the land market

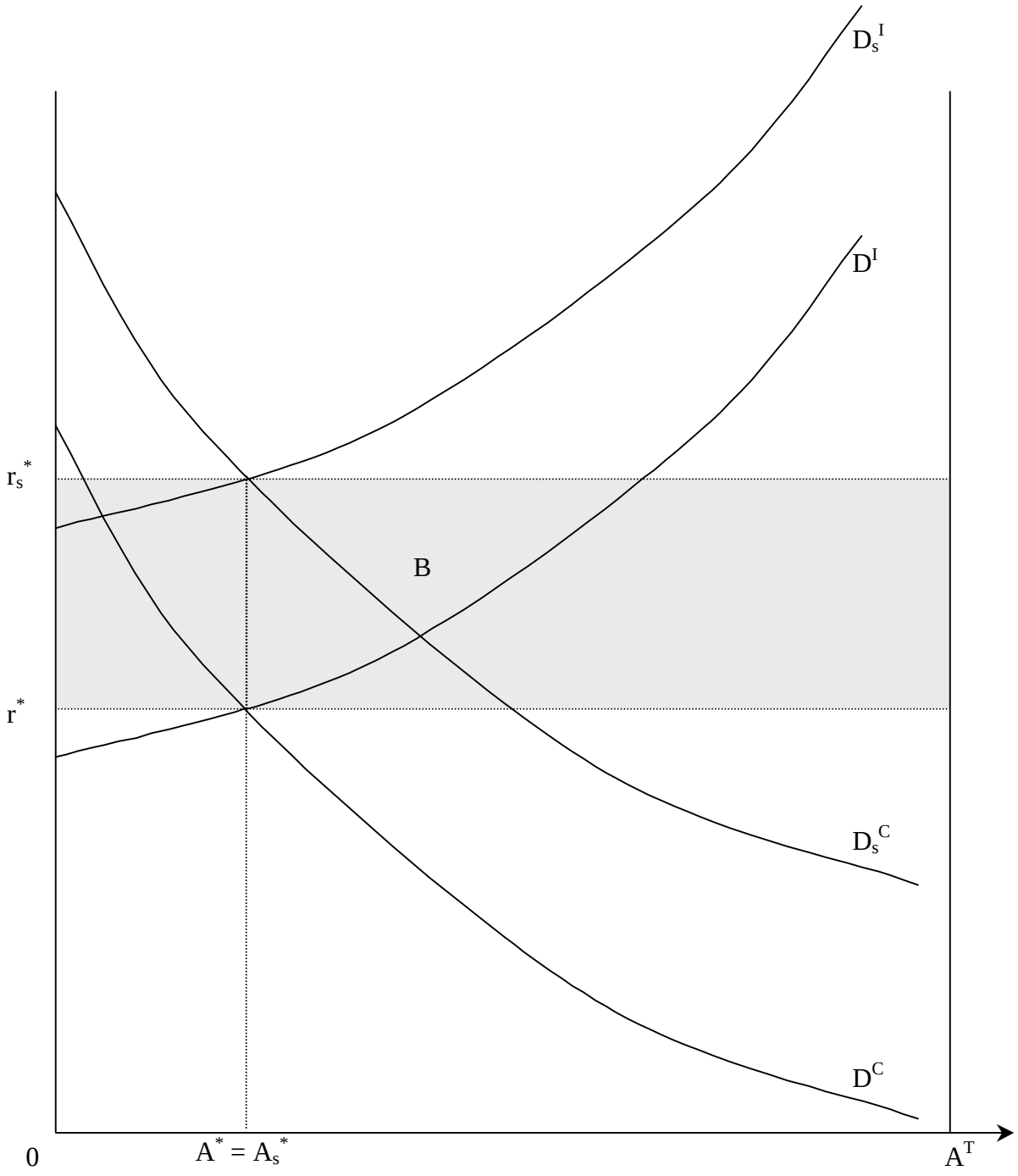

Figure 4. Effect of subsidies with imperfect competition and transaction costs in the land market

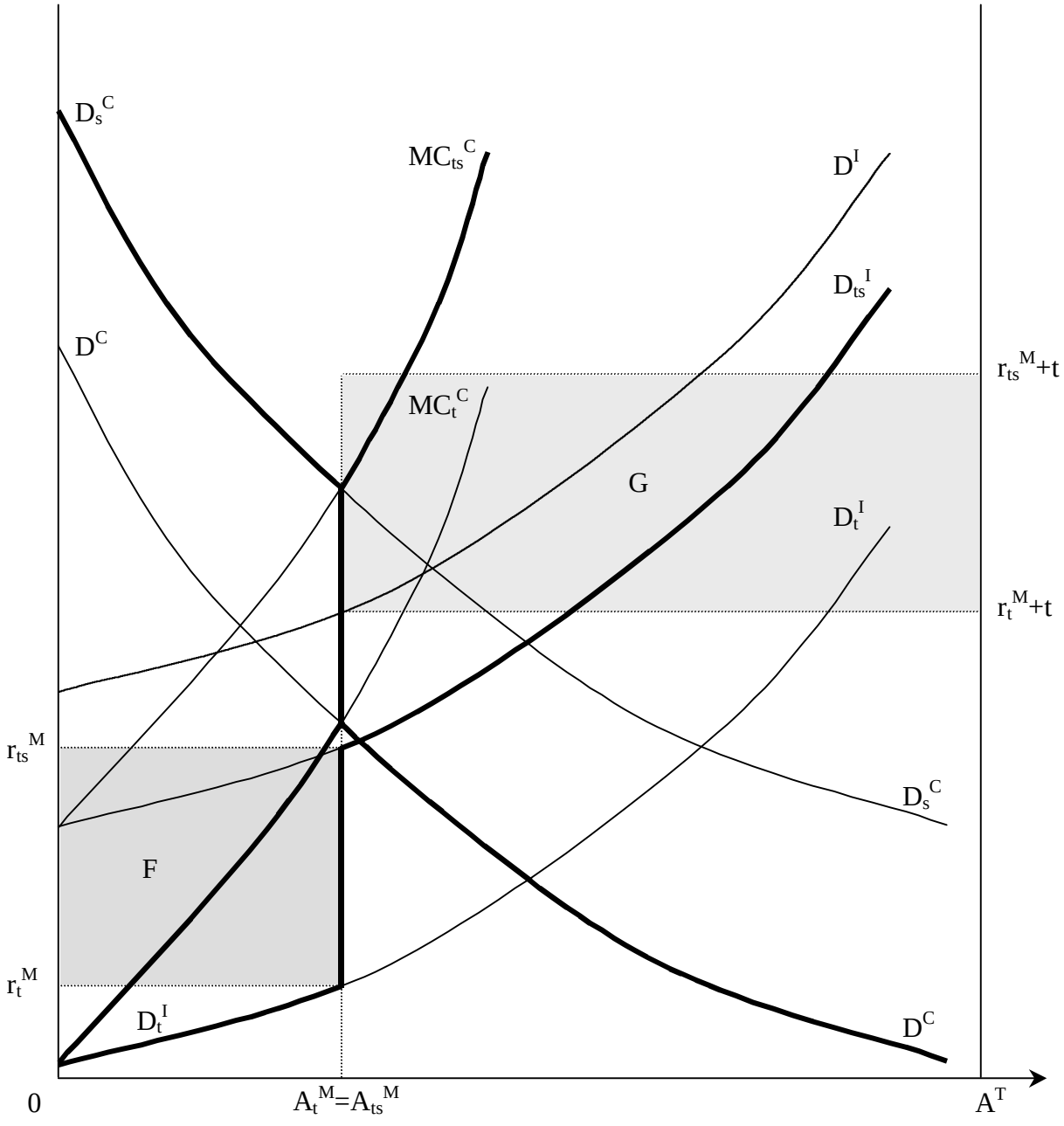

Figure 5. Effect of unequal subsidies (without imperfect competition and transaction costs) in the land market

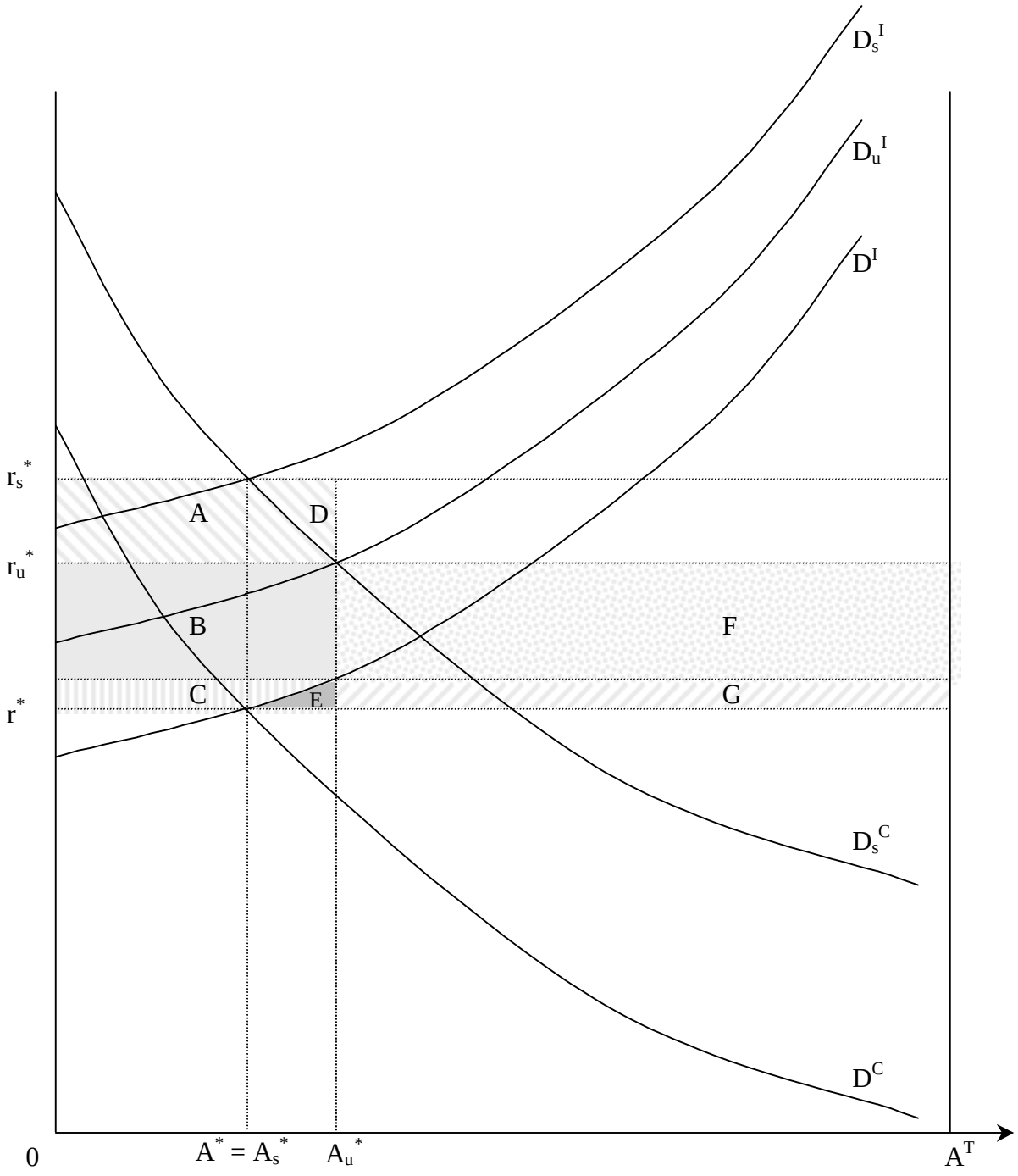

Figure 6. Effect of unequal subsidies with imperfect competition and transaction costs in the land market

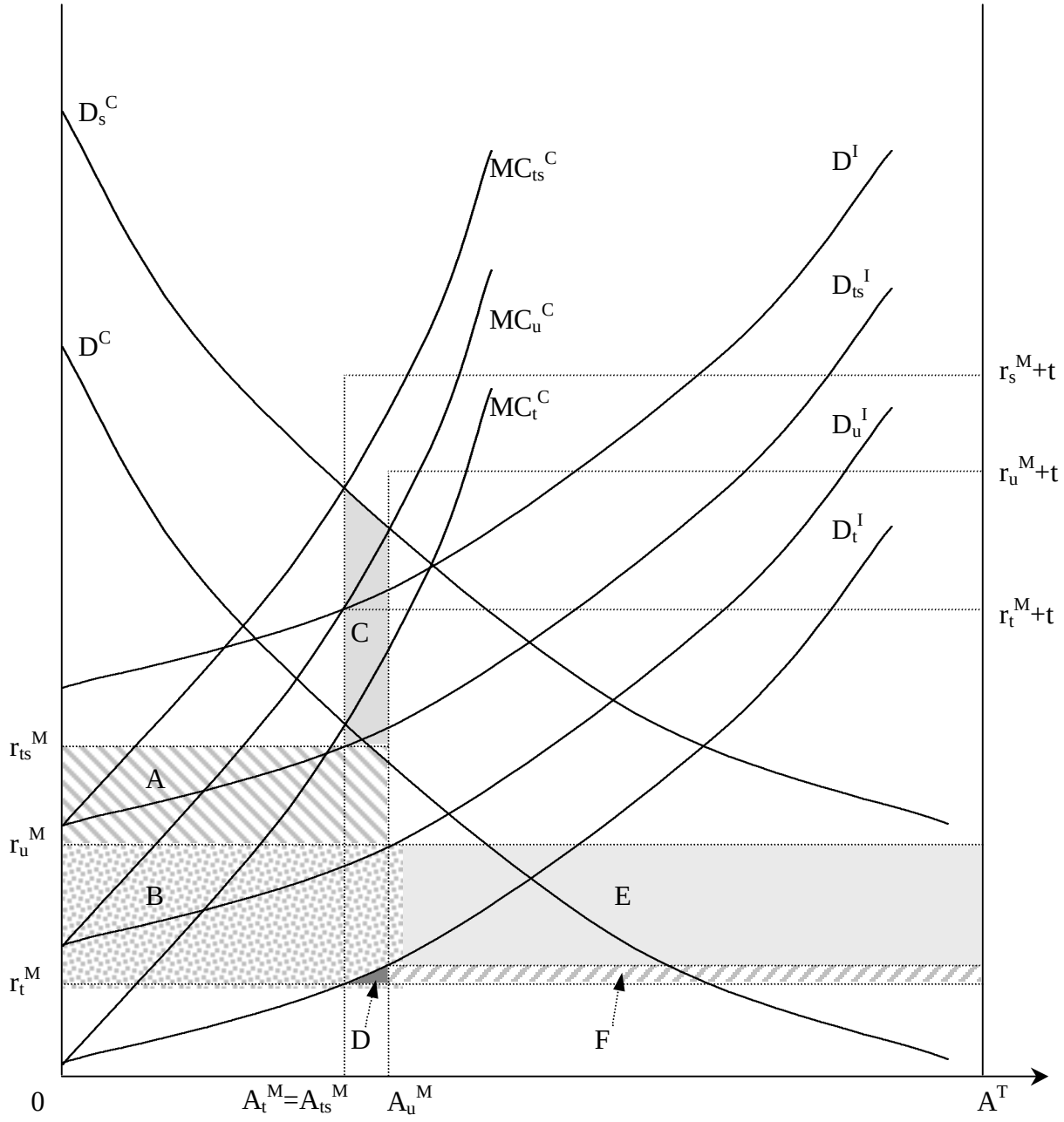

Figure 7. Effect of area payments and SFP on restructuring