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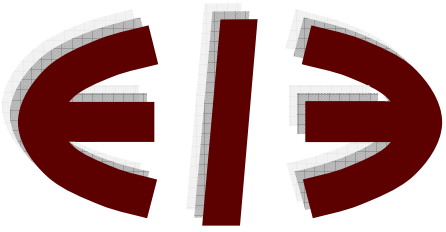

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Abstract

This paper uses a model with transaction costs and imperfect competition in the land market to analyze the efficiency and welfare effects of land reforms. We show that removing only one imperfection may have very different efficiency and welfare effects than would otherwise result from reforms that reduce both imperfections. In extreme cases, partial reforms can actually lead to welfare losses. The welfare effects are affected by the size of transaction costs, relative farm productivity and farm land demand elasticities. Partial reforms also have important income distribution effects.

Key words: land market, transaction costs, imperfect competition, land reform, welfare effects.

JEL Classification: D33; D61; L12; P23; Q12; Q15.

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Introduction

Land reform and the creation of optimal land institutions has attracted renewed attention because of its importance in transition processes such as in China, Vietnam, South Africa, the former Soviet Union, and Eastern Europe and because of new political pressure for land reforms in countries with highly unequal land distributions such as Zimbabwe and Brazil.

Land markets are an important instrument to enhance efficiency and reduce poverty – which is often concentrated in rural areas (Binswanger, Deininger, and Feder 1993; Deininger and Feder 2000). However, land markets – as rural markets in general – often do not work well in developing and transition countries. For example, Carter and Salgado (2001) emphasize the impact of credit constraints, Yao (2000) labor market imperfections, and Skoufias (1995) the effect of land transaction costs, and Vranken and Swinnen (2006) several factor market imperfections to explain the land market imperfections in developing and transition countries. In an environment with uncertainties, transaction costs, weak property rights, imperfect credit, insurance, and output markets, land markets do not function efficiently: for example, sales are typically thin and limited to distress sales, and renting is segregated (Platteau, 2000; Macours, 2006). Therefore policy implications from these studies have focused on reforms to improve property rights, reduce transaction costs etc. to remove market imperfections and stimulate productivity growth.

However, an important assumption of all these studies is perfect competition in land markets. This is not realistic in many regions where land use is dominated by large farms, such as, for example, in Latin American countries like Brazil and in African countries like

Zimbabwe and South Africa. Similarly, in several transition countries large corporate farms use a large share of agricultural land. For example, they use more than 80% in countries such as Belarus, Slovakia, and Russia and more than 50 % in the Czech Republic, Bulgaria, Kazakhstan and Ukraine.[1] They are, on average, around 500 to 1000 hectares in these countries, but in Kazakhstan and Russia some farming companies use more than 100,000 hectares.[2]

The interaction of imperfect competition and transaction costs has a strong impact on the efficiency of the land market, and on land prices and payments. In several transition countries 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 70% and 20% of the rents paid by family farms. Further, in several countries, corporate farms are more likely to pay their rents in kind, while family farms are more likely to pay cash or mixed cash/in-kind (Swinnen and Vranken, 2005).

Some even argue that the domination of large farms, and the associated imperfect competition in the land market, may grow in the future. An important question is whether the land reforms and liberalized land markets will contribute to a (re-)concentration of land. While the evidence on this effect is mixed and limited (see e.g. Deininger and Jin (2003) for a review), Lerman, Csaki, and Feder (2004) point out that in an environment characterized by asymmetric access to information, capital, and legal means of enforcement - a situation typical in transition economies re-concentration - may be a realistic outcome.

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

[2] 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 and transaction costs constrain the shift of land to new farms (Mathijs and Swinnen, 1998). 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 (Bloch, 2002; Prosterman and Rolfes 1999) – see also further.

The objective of this paper is to explicitly model imperfect competition in the land market and to analyze the efficiency and welfare effects of reforms which reduce transaction costs. We show that the efficiency gains from transaction cost reductions are mitigated, and can even be offset. To show these effects, we use a model which incorporates features which are consistent with the land market situation in transition countries where large farms remain important. However, the analysis and figures in this paper are relevant as well for other parts of the world with unequal land use, such as in Latin America or Africa.

The analysis in this paper is related to studies on second best polices and policy effects in the presence of distortion (see e.g. Aronsson and Blomquist, 2003; Blackorby, Davidson, and Schworm, 1991; Boadway and Harris, 1977; Milner, 1992 in general and Alston, Edwards, and Freebairn, 1988; Murphy, Furtan, and Schmitz, 1993 in agricultural policies). Our paper is, to our knowledge, the first to analyze these issues in the context of land markets and reforms.

The paper is organized as follows. The next section develops a model of imperfect competition and transaction costs in land markets.[3] We derive the equilibrium land allocations, income distributions, and welfare losses under various combinations of market imperfections. Then, we analyze how reductions in the market imperfections, for example by reform-induced reductions in transaction costs, affects efficiency and welfare.

[3] The traditional literature on rental markets typically focuses on sharecropping or on the relationship between large landlords and small tenants (Bravermman and Stiglitz, 1982; Bardhan, 1989). While these assumptions are relevant for parts of the developing world, they do not capture essential characteristics of land rental markets in transition countries (or other parts of the developing world), which are characterized by dispersed landownership among many rural and urban households and where small farms compete for access to land with large-scale corporate farms (Lerman et al., 2004; Mathijs and Swinnen, 1998; Tillack and Schulze, 1999). Transition countries provide a unique opportunity to study the development of land markets as land reforms have reallocated property rights and liberalized land exchange restrictions. 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 – with large variations across (Lerman, Csaki, and Feder 2004; Rozelle and Swinnen 2004; Curtiss, et. al 2006; Brandt et al. 2002; Deininger and Jin, 2003).

The Model [4]

Before transition, effective land rights were in the hands of the state, or the collective farms. Land was used by large-scale state and collective farms.[5] Land reform in the early 1990s reallocated most land property rights to individual households, sometimes employed in agriculture or sometimes not. We will refer to them as "*landowners*". Land reform took several forms. In East Europe land was often restituted to former owners, elsewhere land was given in plots to rural households, or under the form of shares to farm workers (Lerman, Csaki and Feder; Rozelle and Swinnen).

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 closely reflects reality since recent study shows that the majority of land

[4] The model is based on Ciaian and Swinnen (2006), who applied the model to analyze how transaction costs and imperfect competition in the land market affect distributional effects of agricultural subsidies in the New Eastern Member States of the European Union. In this paper we use the model to analyze the efficiency and welfare effects of reforms which try to reduce transaction costs and/or imperfect competition in the land market.

[5] 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.

transactions in transition countries is through rental agreements; particularly corporate farms rent more than 90% of the land they use (Swinnen and Vranken, 2005).[6] 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 transition countries. 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; Bloch, 2002). 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

[6] Also for developing countries, recent studies have recently re-emphasized the role of land rental markets as important for providing access to land for the poor and as an efficiency-enhancing institution in environments characterized by large uncertainties, such as countries in transition (de Janvry et al., 2001; Sadoulet, de Janvry, and Davis 2001).

in Bulgaria, Slovenia and Hungary contained similar transaction cost increasing features (see Bojnec and Swinnen 1997; Mathijs 1997; Prosterman and Rolfes 1999; Swain 1999).

Second, CF managers typically have more information than landowners about the economic situation of farm and about regulations governing local land transactions.[7] 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).[8]

Third, other transaction costs follow from co-ownership of land, unclear boundary definition, and the problem of unknown owners. In many Transition countries, 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 1999). 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

[7] 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.

[8] 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 1999).

2004). 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 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 1999; 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.[9] 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 a^{ij} is the size of plot *i* and A^j total land owned by owner *j* with $A^j = \sum_i a^{ij}$.

[9] 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:

$$t = \frac{g}{a} + \frac{G}{na} \tag{2}$$

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 many transition countries. The egalitarian distribution is due to a combination of factors (Swinnen 1999). In many Transition countries 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 transition regions.

To analyze the impact of the market imperfections on welfare and productivity, define the incomes of the three groups in the economy as follows:

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

(4) $\prod^C = pf^C(A^C) - rA^C$,

(5) $\prod^L = rA^T$,

where $\prod^I$ is IF profits, $\prod^C$ is CF profits, $\prod^L$ is landowners' income, p is output price, A^I is amount of land rented by the IF, A^C is land rented by the CF, A^T is total land, $f^I(.)$ is IF production function for which $\frac{\partial f^I(A^I)}{\partial A^I} = f_A^I > 0$ and $\frac{\partial^2 f^I(A^I)}{\partial A^{I2}} = f_{AA}^I < 0$, $f^C(.)$ is the CF's production function for which $\frac{\partial f^C}{\partial A^C} = f_A^C > 0$ and $\frac{\partial^2 f^C}{\partial A^{C2}} = f_{AA}^C < 0$.

Total welfare (W) is the sum of the incomes of the three groups in the economy as given in equations (3), (4) and (5).

(6) $W = \prod^I + \prod^C + \prod^L$

The equilibrium with perfect competition

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

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

The first order condition for optimal land use is:

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

The optimal level of land rented is where the marginal value product of land, represented by the left hand side of (8), 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 (8) 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). The land decision-making problem of CF is maximization of profit function given in equation (4). The first order condition for optimal CF land use is:

$$(9)\quad p\frac{\partial f^{C}(A^{C})}{\partial A^{C}} = r$$

The optimum is where land marginal value product equals land market rent. Equation (9) represents CF land demand given by D^C in figure 1. 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 (and appendix A1) 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 B for transaction costs t_2.

Only the CF benefit from these reduced rents. The rental price for IFs is the CF price plus transaction costs. The 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 *EF* 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 *BCD* for transaction costs t_2. The net aggregate welfare losses with t_2 are equal to area *EFCD* with *FD* measuring the total transaction costs and area *EC*, measuring the deadweight costs of the induced economic distortions. (see appendix A1)

Imperfect competition

Corporate farms are not price takers in the land rental market in many regions. For example, in countries such as Russia, Slovakia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan, among others, where they occupy more than 80% of the land (see table 1), CF have important market power.[10] To model this, assume that there is one (representative) 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 rental actions of the IFs 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:

$$(10) \quad \text{Max } \prod^C = pf^C(A^C) - r(A^C)A^C$$

where $r(A^C)$ is the rental rate as a function of A^C and the rest of variables are defined as above.

[10] Even in countries where their average share is lower, there may be imperfect competition in certain regions.

The first order condition is as follows:

$$(11) \qquad p\frac{\partial f^{C}}{\partial A^{C}} = r + A^{M}\frac{\partial r}{\partial A^{C}}$$

where A^M is the optimal land allocation of the CF. The left hand side of condition (11) 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 CF chooses its land rent where the marginal cost 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.[11] 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 $B - C$ (>0). The IFs also gain, by area *EGJ*. The losses are for the landowners who lose rental income equal to area *BDEGJ*. 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*.

[11] 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 (11)), plus the increase of rent for every hectare of land rented (the second term on the right hand side of equation (11)). The more inelastic the IF land demand is, the higher is this increase in rent and consequently the steeper the MC^C is.

Efficient land allocation with multiple market imperfections

As shown in the previous section, each of these markets imperfections distorts the economy and shifts the land allocation away from its social optimum, i.e. its efficient use. However, when both imperfections are present, the results is more complex. The formal analysis of the combined effects is in Appendix 2. Here we will discuss the effects based on the graphical analysis in figure 2.

With both imperfect competition and transaction costs *t*, 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.

For the corporate farm and for landowners both market imperfections reinforce each other: 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 *BDEK*. Landowners lose twice as both factors put a downward pressure on rental prices. Their combined loss equals area *BDEGJKL*.

However, for individual farms the two market imperfections have opposite effects. IFs gain from lower rental prices and having more land due to imperfect competition, but lose because of higher rental prices and having less land due to transaction costs. The net effect depends on the relative size of the transaction costs. With relatively low transaction costs, the benefits from CF market power will dominate. With relatively 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 *FH* [12] (see also appendix A2).

The effect of the two market imperfections are also opposite in terms of land allocation. To illustrate this, consider the special case shown in figure 3. We denote t^* as the level of transaction costs for which the CF marginal cost curve ($MC_{t^*}^C$) crosses the

[12] 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.

equilibrium with perfect competition and no transaction costs (A^*, r^*). With perfect competition and transaction costs t^*, the equilibrium is ($A_{t^*}{}^*$, $r_{t^*}{}^*$), where $r_{t^*}{}^* < r^*$, $A_{t^*}{}^* > A^*$ and hence $A^T - A_{t^*}{}^* < A^T - A^*$. However, with imperfect competition and t^* the land allocation distortions are eliminated. The equilibrium land renting shifts to the competitive land allocation equilibrium A^*, where $A^* = A_{t^*}{}^M$. There are no land allocation distortions with the combination of t^* and imperfect competition.[13] Transaction costs smaller than t^* and imperfect competition would imply that the equilibrium will be to the left of the competitive equilibrium. In this case IF rent more land than the socially optimal level. With transaction costs larger than t^* the equilibrium is to the right of the competitive equilibrium. IF rent less land than the socially optimal level.

However, it is important to point out that, while the allocation of land with the combination of imperfections equals the optimal allocation, the total welfare effects are always negative (for a formal proof see appendix A2 part b). In figure 2 compared to the competitive market equilibrium (A^*, r^*), (A_t^M, r_t^M) implies losses equivalent to – *HJL –FG*, where *HJL* represents the total transaction costs incurred and *FG* the market distortions. For the special case in figure 3, there are no land allocation distortions. Only land market rent is affected, $r_{t^*}{}^M < r^*$. For this reason landowners lose relative to perfect competition and zero transaction costs equilibrium. Their loses equal to *DEFGHJK*. A part of this loses are transferred to CF, equal to area *DEFHJ*. The rest, area *GK*, are transaction costs. IF welfare is not affected. But social welfare is negatively affected: the net welfare effect is negative equal to area *GK*.

Effects of reforms: reduction of transaction costs and more competition

Institutional and economic reforms can lead to increased competition and reduced transaction costs. For example, in European transition countries which joined the EU, the

[13] Only the land market rent is depressed. It declines to $r_{t^*}{}^M$ ($r_{t^*}{}^M < r_{t^*}{}^* < r^*$).

legal and institutional reforms which were required as part of the EU accession process improve the legal and institutional framework in which land transactions occur. At the same time, reforms which enhance profitability and productivity of the farms, for example through stimulating foreign investment in the processing sector, will also stimulate land transactions and thereby improve experience, transparency, and understanding of the market, all reducing transaction costs.

Productivity and total welfare increase

Imperfect competition and transaction costs t (for $t \neq t^*$) create a wedge between the marginal value products of the IFs and the CFs, i.e. $pf_A^I \neq pf_A^C$.[14] Depending on the level of t, either the marginal value product of the IFs is larger than the marginal value product of the CFs or the marginal value product of the CFs is larger than the marginal value product of the IFs.[15] In any case a more efficient land allocation can be found where land productivity is higher.

The removal of both market imperfections stimulates land transactions leading to a reallocation of land from farms with smaller marginal value products to farms with higher marginal value products, up to the point where the marginal value products are equalized. The reduction of transaction costs reduces IF rental costs and thus increases their land rental demand. At the same time, more competition reduces monopoly rents. If before the reform $pf_A^I > pf_A^C$, IF can now offer a higher rent and outcompete CF and this leads to an increase in IF renting and a reduction in CF renting. Inversely, if before the reform $pf_A^I < pf_A^C$, then more competition and less transaction costs will increase CF renting and reduce IF renting. Now CF can offer a higher rent than IF and therefore their land renting increases. The equilibrium after the reform is at the point where there are no more profitable land

[14] For the special case when $t=t^*$ $pf_A^I = pf_A^C$.

[15] This follows from FOC with imperfect competition and transaction costs given by equations (8) and (A2.1).

reallocation transactions by market participants, i.e. where $pf_A^I = pf_A^C$.[16]

How does this affect output and productivity? Land productivity before the reform is $\gamma\big|_{t>0}^{M} = \frac{pf^I\left(A^T - A_{t2}^M\right) + pf^C(A_{t2}^M)}{A^T}$, while land productivity after the reform is $\gamma\big|_{t=0}^{*} = \frac{pf^I\left(A^T - A^*\right) + pf^C(A^*)}{A^T} = \frac{pf^I\left(A^T - A_{t2}^M\right) + pf^C(A_{t2}^M)}{A^T} + \frac{Q^T\big|_{t=0}^{*} - Q^T\big|_{t>0}^{M}}{A^T}$ implying that:

(12) $\gamma\big|_{t=0}^{*} = \frac{pf^I\left(A^T - A^*\right) + pf^C(A^*)}{A^T} \geq \gamma\big|_{t>0}^{M} = \frac{pf^I\left(A^T - A_{t2}^M\right) + pf^C(A_{t2}^M)}{A^T}$.

The total output change induced by the reform is positive, $Q^T\big|_{t=0}^{*} - Q^T\big|_{t>0}^{M} \geq 0$[17] leading to increase of land productivity defined as $\gamma = \frac{pQ^T}{A^T}$.

The output effect is shown in figure 4. The equilibrium with imperfect competition and transaction costs t_2 (where $t_2 > t^*$) is (A_{t2}^M, r_{t2}^M). This implies that in equilibrium $pf_A^I > pf_A^C$. The reform which reduces transaction costs t_2 to zero and imposes perfect competition shifts the equilibrium to (A^*, r^*). IF rent more land ($A^T - A^* > A^T - A_{t2}^M$), while CF land renting declines: ($A^* < A_{t2}^M$). Inversely, if before the reform transaction costs t_0 are smaller than t^* ($t_0 < t^*$), the equilibrium is (A_{t0}^M, r_{t0}^M). Now in equilibrium $pf_A^I < pf_A^C$. IF rent more land than the socially optimal level: $A^T - A_{t0}^M > A^T - A^*$. The reform shifts the equilibrium to (A^*, r^*). IF renting declines ($A^T - A^* < A^T - A_{t0}^M$), while the renting of CF increases ($A_{t0}^M < A^*$).

In both cases (with t_0 and t_2) output increases. With transaction costs t_2 IF output gain is given by area *MNOPQR* while CF output loss is given by area *OPQR*. As a result, total

[16] For the special case when $t=t^*$ land reallocation will not take place because marginal products are equal already before reform, $pf_A^I = pf_A^C$, and no farm can offer a higher rate. The only effect will be an increase in land market rent.

[17] This follows from the reverse of the proof shown in appendix A2 part b.

output increases by area *MN*. With transaction costs t_0 the total output increases by area *FG* as CF output increases by area *FGHJKL* while IF output decreases by area *HJKL*.[18]

Distributional effects

The reform that simultaneously removes transaction costs and eliminates imperfect competition has significant income implications for the farms and landowners. Most obviously, reforms which eliminate CF market power reduces CF profits.[19] At the same time the removal of transaction costs increases land competition from IF leading to an increase in the market rent and further decreasing CF profits. This is illustrated in figure 4. The equilibrium before the reform is (A_{t2}^M, r_{t2}^M) for transaction costs t_2. The reform shifts the equilibrium to (A^*, r^*) and CF pay a higher rent ($r^* > r_{t2}^M$) and rent less land ($A^* < A_{t2}^M$). Their profits are reduced by area *DEGHJKOPQ*.

Both the removal of transaction costs and the elimination of imperfect competition increase market rent. As a result, landowners gain from the reform.[20] The rent, as shown in figure 4 for transaction costs t_2, increases from r_{t2}^M to r^*. The landowners gains are equal to area *DEGHJKOPQNUVY*.

The effect of the reform on IF depends on the size of initial transaction costs.[21] First, consider the case when initial transaction costs equal t_2, where $t_2 > t^*$ (figure 4). Reforms which reduce transaction costs t_2 to zero and impose perfect competition create gains to IF. Without transaction costs the IF rental costs decrease. They can offer higher rent and rent more land. On the other hand, competition decreases IF land renting and increases the rent, because with the elimination of imperfect competition CF no longer push down land rent to

[18] With fixed land supply land productivity also increases.

[19] This follows from the proof shown in appendix A2 part b. Because CF gained from market imperfections, then they must lose from removing them.

[20] This follows from the proof shown in appendix A2 part b. Because landowners lost from market imperfections, then they must gain from removing them.

[21] This follows from the proof shown in appendix A2 part b. If IF lost from market imperfections, then they must gain from removing them. If IF gain from market imperfections, then they must lose from removing them.

maximize profits. The transaction costs effect is stronger than the market imperfection effect. In equilibrium IF use more land after the reform ($A^T - A^* > A^T - A_{t2}^M$), and their rental costs decrease ($r^* < r_{t2}^M + t_2$) leading to net gains for IF equal to area *MS*.

However, if initial transaction costs are lower then t^*, such as with t_0 in figure 4 where $t_0 < t^*$, IF lose with reforms. The equilibrium with imperfect competition and transaction costs t_0 is (A_{t0}^M, r_{t0}^M). Now after the reform the first effect (the transaction costs effect) is smaller than the second effect (the market imperfection effect). In equilibrium IF land renting declines ($A^T - A^* < A^T - A_{t0}^M$) and the IF rental costs rise ($r^* > r_{t0}^M + t_0$). As a result, IF lose area *HONU*.

The effect of partial reform (reduction of transaction costs but imperfect competition)

In reality, transaction costs seem to be falling in many countries. In contrast, large corporate farms persist and continue to dominate the land market (table 1). In fact, in several countries a re-concentration has occurred recently. For example in Russia and Kazakhstan huge farming companies, often using more than 100,000 hectares of land have emerged since 1998 (Swinnen, 2005). The welfare and output effects can be quite different in this situation compared to the reform effects analyzed in the previous section.

Productivity and welfare may increase or may decrease with partial reform

The output and welfare effect of partial reform depend on the size of initial transaction costs. To show this, assume first that initial transaction costs are smaller than t^*. To earn monopoly profits, CF push the land market rent down by reducing renting. This shifts the renting equilibrium to (A^M, r^M) (figure 3). In equilibrium CF rent less land than the socially optimal level. However, transaction costs increase CF renting. Transaction costs smaller than or equal to t^* shift the CF renting closer to (A^*, r^*). In the special case when transaction costs are equal to t^* then the equilibrium is ($A_{t^*}^M$, $r_{t^*}^M$), where $A^* = A^M_{t^*}$.

In this case, a reform which reduces transaction costs but which keeps imperfect competition unchanged moves the land allocation equilibrium away from the efficient land allocation, (A^*, r^*). IF can rent more land with reduced transaction costs because their rental costs decline with the reform. However, CF still affect the land market rent. They adjust their renting: to earn monopoly profits they decrease renting because of stronger competition from IF. Marginally more productive CF use less land. For example, with the reduction of transaction costs from t^* to zero the equilibrium shifts from the pre-reform equilibrium ($A_{t^*}^M$, $r_{t^*}^M$), where $A_{t^*}^M = A^*$, to a new equilibrium (A^M, r^M), where $A^M < A^*$ (figure 3). Hence, with partial reform a new less efficient land allocation is achieved.

Figure 3 illustrates the effects. CF production declines by area *BEFJL*. IF use more land so their production increases by area *FJL*. The total production effect is output loss equal to area *BE*.[22] Area *BE* is actually a monopoly loss caused by a distortion of the monopolistic behavior of CF with transaction costs zero. This monopoly loss is the maximum possible output loss of restructuring. On the other hand, because transaction costs are reduced to zero, positive welfare gains are realized equal to area *GK*. The transaction costs gains, area *GK*, plus the output loss, area *BE*, implies that the direction of change of total welfare could be negative or positive depending on which area is larger. (This result is formally derived in appendix A3 part a).

Now consider the alternative case that initial transaction costs t_2 are larger than t^* ($t_2 > t^*$). The equilibrium with t_2 and imperfect competition is given by (A_{t2}^M, r_{t2}^M). This is shown in figure 5. The reform that reduces transaction costs by $\Delta t = \left| t^* - t_2 \right|$ or by a smaller amount but keeps imperfect competition shifts the land allocation equilibrium closer to the competitive land allocation equilibrium (A^*), and the restructuring will be accompanied with output increase. For example, the reduction of transaction costs t_2 to t_1 ($t^* < t_1 < t_2$) shifts the equilibrium to (A_{t1}^M, r_{t1}^M). The restructuring results in reallocation of land from less to more

[22] Land productivity declines too, see appendix A3 part b.

efficient users. The CF renting declines while renting of IF increases. CF produce less by area *FGH*, and IF produce more by area *DEFGH*. The total production effect is output gain equal to area *DE*. Because of the reduction of transaction costs there is a welfare gain equal to area *KL*. However, IF use more land by $A_{t2}^{M} - A_{t1}^{M}$. For this land transaction costs are incurred because the land must be withdrawn from the CF. These losses equal area *EF*. Hence, the total net welfare effect is equal to the output effect (gain in area *DE*) plus the transaction costs effect (gain in area *KL* minus loss in area *EF*), i.e. area *DKL – F*.

With further reduction of transaction costs (for $\Delta t > \left| t^{*} - t_2 \right|$), the effect on productivity is ambiguous. The land allocation equilibrium moves beyond the competitive land allocation equilibrium (A^{*}). Consider the case when transaction costs t_2 are reduced to zero. This is shown in figure 7. The total output effect can be split in two parts. First, the reduction of transaction costs to t^{*} results in output gains equal to area *C*. Second, for the reduction of transaction costs from t^{*} to zero ($\Delta t = \left| 0 - t^{*} \right|$) the output effect is negative and is equivalent to area *B* in figure 7 (which is equal to area *BE* in figure 3).

The combined output effect of transaction costs reduction from t_2 to zero, is output change equal to area *C – B* (figure 7). The sign of the net total output effect depends on the magnitudes of the two areas[23] (see appendix A3 part a for a formal derivation).

The total welfare effect is equal to the output effect (area *C – B*) plus the transaction costs gains (area *DK*) (figure 7). The net effect on welfare with partial reform can be positive or negative (see also appendix A3 part a).

In summary, we have shown that the effect of partial reform can lead to welfare gains or losses. The later may result because removing one imperfection while keeping the other one may cause an inefficient allocation of resources. Removing transaction costs increases total welfare. However, if the market power of CF is maintained, this leads to a misallocation

[23] The same holds for land productivity. See appendix A3 part b.

of land resources and the total effect of reform may result in lower welfare and land productivity.

CF lose, while IF and landowners gain from partial reform

Partial reform, which removes transaction costs but keeps imperfect competition, also has important income distributional effects. Beneficiaries are IF and landowners, while CF lose (see proof in appendix A2 part a). The removal of transaction costs benefit IF. Their rental costs decline and they can compete for more land. In equilibrium their renting increases and the rental costs that they pay decline. Consider transaction costs t_2 in figure 7. With the partial reform the equilibrium shifts from (A_{t2}^M, r_{t2}^M) to (A^M, r^M). IF incur lower rental costs ($r^M < r^M_{t2} + t_2$) and they rent more land ($A^T - A^M > A^T - A_{t2}^M$) Their profits increase by area *CDEF*.

CF lose from the partial reform. With the reduction of transaction costs, land withdrawal is cheaper for IF. In equilibrium CF renting is lower and the rent they pay is higher. In the case shown in figure 7 after the reform the CF rent increases from r_{t2}^M to r^M, while CF renting declines from A_{t2}^M to A^M. CF losses equal area *BEFGHJ*.

Landowners gain. Stronger competition between IF and CF due to reduced transaction costs pushes the market rent up. The rent increases from r_{t2}^M to r^M and the landowners' gains equal area *GHJK*.

Factors affecting the impacts: Land demand elasticities and relative farm productivity

As shown above, with partial reform, the reduction of transaction costs may increase output (such as area *DE* in figure 6 for the reduction of transaction costs from t_2 to t^*), while other reductions in transaction costs may reduce output (such as area *BE* in figure 3 for the reduction of transaction costs from t^* to 0). The total welfare change is crucially dependent on the sizes of these output effects, because the total welfare change additionally to gains

obtained from transaction costs reduction also depends on the output change.

As discussed above, one important factor that affects the size of these output effects is the level of transaction costs. Two other relevant factors are land demand elasticities and relative farm productivity.

Land demand elasticities

Land demand elasticity measures the size of the adjustment in farms' land rental demand when land rent changes. If CF land demand elasticity is high any land rent adjustment induces large changes in CF land renting, while if CF land elasticity is small any land rent adjustment induces small changes in CF land renting. In other words, with small land demand elasticity the CF land marginal product value (or the rent that CF is willing offer to landowners) changes greatly with respect to a change in land renting. The reverse holds for high elasticity.

When the CF has market power it adjust land renting to equalize its land marginal value product with marginal costs (equation(11)) and not with the market rent as in the case of perfect competition (equation (9)). With high (low) CF elasticity the land adjustment from the competitive equilibrium to imperfect competition equilibrium is higher (smaller). This implies high land allocation distortions with high CF land demand elasticity and small land allocation distortions with small CF land demand elasticity. As shown in figure 3 the partial reform that removes transaction costs t^* shifts the equilibrium from ($A_{t^*}^M$, $r_{t^*}^M$) to (A^M, r^M). The land allocation distortions that arises because of CF market power is, equal to $A^* - A^M$ and increases with CF land demand elasticity. This implies that the output loss of the partial reform, given by area *BE*, also increases with the CF elasticity. Similarly, when there is an output gain (such as area *DE* in figure 6 for the reduction of transaction costs from t_2 to t^*) with partial reform, everything else equal, the higher the CF elasticity, the higher the output gain.

The IF land demand elasticity also affects the outcomes. The potential output loss that a partial reform can induce decreases with the IF elasticity. If partial reform reduces transaction costs t^* to zero but keeps imperfect competition, the land allocation equilibrium shifts from A^* to A^M (figure 3). The smaller the IF elasticity is, the higher land allocation distortion are, and A^M is moved further away from A^*. This implies a higher output loss as given by area *BE*. Similarly, (potential) output gains of partial reform increase with the IF elasticity. For example if transaction costs t_2 are reduced to t^* the land allocation with partial reform shifts from $A_{t2}{}^M$ to A^* (figure 6). Land allocation distortions decrease with IF elasticity. This implies that with high IF elasticity the land allocation equilibrium with imperfect competition and t_2, $A_{t2}{}^M$, is closer to the equilibrium with perfect competition and t_2, $A_{t2}{}^*$, but further away from the equilibrium without market imperfections A^*. This implies that the output gain given by area *DE* increases with IF elasticity.

Figures 8 and 9 illustrate the impact of elasticities on output changes with reforms based on simulation results.[24] Figure 8 shows the output loss (such as given by area *BE* in figure 3 with the reduction of t^* to 0 with partial reform) for different IF and CF land demand elasticities. Everything else equal, the output losses increase with the CF land demand elasticity and decreases with the IF land demand elasticity. Figure 9 shows simulation results for output gains with partial reform (such as given by area *DE* in figure 6 for the reduction of transaction costs from t_2 to t^*). The output gains are larger with larger CF and IF elasticities.

In summary, it is more likely that partial reform leads to net output loss and hence to total welfare loss when the IF elasticity is small. CF market power causes larger land allocation distortions with smaller IF demand elasticity. Hence, the output loss which can arise from partial reform increases, while the output gain decreases with smaller IF elasticity. In the case of CF elasticity, the pattern in total output change and total welfare change is not

[24] The simulations are not based on real data from a transition country. The CF and IF land demands are assumed to be linear. Total agricultural land is assumed to be equal to 100 hectares and transaction costs are assumed to be constant ($\partial t / \partial A^I = 0$).

clear, because both output loss and output gain that can arise from a partial reform move in the same direction with the CF land demand elasticity.

Relative farm productivity

Another factor that affects the outcome is the relative productivity of the farms. This is shown in figure 10. Assume initial CF demand as given by D_1^C. The equilibrium with transaction costs t and imperfect competition is (A_{1t}^M, r_{1t}^M). If CF productivity increases, its land demand shifts upwards.[25] The CF demand shifts from D_1^C to D_2^C and the equilibrium shifts to (A_{2t}^M, r_{2t}^M). CF rent more land in equilibrium, $A_{2t}^M > A_{1t}^M$. With low CF productivity the reform shifts the equilibrium from (A_{1t}^M, r_{1t}^M) to (A_1^M, r_1^M), while with higher CF land productivity the reform shifts the equilibrium from (A_{2t}^M, r_{2t}^M) to (A_2^M, r_2^M). Distortions in land allocation are smaller in the former case than in the latter case: $A_1^* - A_1^M < A_2^* - A_2^M$. The reform then induces higher output loss the more productive CF are. [26] In figure 10 this output loss is given by areas B_1 and B_2, respectively for low and high CF relative productivity. It is clear that where area B_2 is larger than area B_1.

[25] Higher CF productivity implies that CF can produce more from the same input. Total production increases for any amount of land they rent. This implies that for any area they rent, say A^T $pf_2^C\left(A^T\right) > pf_1^C\left(A^T\right)$, where f_2^C represents production function with higher productivity as compared to production function f_1^C. Define relative farm productivity as the ratio of CF and IF land productivity with A^T, $\frac{pf^C\left(A^T\right)/A^T}{pf^I\left(A^T\right)/A^T} = \frac{pf^C\left(A^T\right)}{pf^I\left(A^T\right)}$. Every thing else equal, the CF productivity relative to IF is higher with $pf_2^C\left(A^T\right)$ than with $pf_1^C\left(A^T\right)$: $\frac{pf_2^C\left(A^T\right)}{pf^I\left(A^T\right)} > \frac{pf_1^C\left(A^T\right)}{pf^I\left(A^T\right)}$.

[26] In monopsony, CF equalize the land marginal value product with marginal cost as given by equation (11). With perfect competition the optimal CF renting decision is were land marginal product value is equal to land market rent given by equation (9). With higher CF productivity CF renting, A^M, increases. This implies that the second term on the right hand side of equation (11) also increases with CF productivity. Compared to perfect competition equilibrium, then with market power CF must decrease more land renting with high productivity than with low productivity in order to equal marginal value product $p\frac{\partial f^C}{\partial A^C}$ with marginal cost $r + A^M \frac{\partial r}{\partial A^C}$. This implies that land distortions increase with CF land productivity.

Inversely, similar logic applies to output gain as given by the areas *C* in figure 10. The output gain is lower with higher CF productivity. This output gain occurs if initial transaction costs *t*, larger than t^* ($t>t^*$), are reduced to t^*. With higher CF productivity the land allocation distortions are smaller and hence smaller output gains are obtained from the reform which reduces the transaction costs *t* to t^*.

There are also gains in reduced transaction costs. These gains decrease with CF productivity. With low relative CF productivity, transaction costs gains equal area *EF*, while with higher CF efficiency, transaction costs gains equal area *DF*, where area *EF* > area *DF*.

Figure 11 summarizes simulations results for these effects. The horizontal axis shows relative CF productivity. The vertical axis shows the three effects as graphically shown in figure 10 (area *B*, area *C* and transaction costs gains as shown in figure 10) and the net welfare effect (net welfare = area *C* + transaction costs gains - area *B*). All results are represented as the share of total production.

In summary, it is more likely that partial reform will cause net output loss and hence net welfare loss the higher CF land productivity is relative to IF. This is because land allocation distortions are more likely to increase after the partial reform the higher CF relative land productivity is.

Conclusions

This paper used a model with transaction costs and imperfect competition in the land market to analyze the efficiency and welfare effects of reforms which reduce transaction costs as large farms continue to dominate the land market. The implications are important. The results show that the continuation of imperfect competition mitigates efficiency gains and welfare benefits that would otherwise result from reforms that reduce transaction costs. In extreme cases, partial reforms can actually lead to welfare losses. Removing one imperfection while keeping the other one may cause an inefficient allocation of resources. When removing

transaction costs, total welfare increases. However, if market power of CF is maintained, this leads to a misallocation of land resources and the total effect of reform may result in lower welfare and land productivity. These welfare effects are strongly affected by the size of transaction costs, relative farm productivity and farm land demand elasticities.

Partial reforms also have important income distribution effects. IF gain because their rental costs decline due to a reduction in transaction costs. CF lose because of higher rents and stronger competition from IF. Higher land market rents lead to gains to landowners.

Appendix

A1. Perfect competition and welfare effect of transaction costs

To show: $\frac{d\prod^I}{dt} < 0$, $\frac{d\prod^C}{dt} > 0$, $\frac{d\prod^L}{dt} < 0$, $\frac{dW}{dt} < 0$, where $W = \prod^I + \prod^C + \prod^L$.

In equilibrium with perfect competition and transaction costs conditions (8) and (9) must be satisfied as well as:

(A1.1) $A^T = A^I + A^C$

Totally differentiating equations (8) (9) and (A1.1) yields:

(A1.2) $pf^I_{AA} dA^I = dr + dt$

(A1.3) $pf^C_{AA} dA^C = dr$

(A1.4) $dA^I + dA^C = 0$

Solving for $\frac{dA^I}{dt}$ and for $\frac{dr}{dt}$ yields:

(A1.5) $\frac{dA^I}{dt} = \frac{1}{pf^C_{AA} + pf^I_{AA}} < 0$

(A1.6) $\frac{dr}{dt} = \frac{-pf^C_{AA}}{pf^C_{AA} + pf^I_{AA}} < 0$

IF renting and land market rent decline with transaction costs.

Totally differentiating equations (3), (4) and (5) and using equations (8), (9) and (A.1.6) yields:

(A1.7) $\frac{d\Pi^I}{dt} = \frac{-pf^I_{AA} A^I}{pf^C_{AA} + pf^I_{AA}} < 0$

(A1.8) $\frac{d\Pi^C}{dt} = \frac{pf^C_{AA} A^C}{pf^C_{AA} + pf^I_{AA}} > 0$

(A1.9) $\frac{d\Pi^L}{dt} = \frac{-pf^C_{AA} A^T}{pf^C_{AA} + pf^I_{AA}} < 0$

(A1.10) $\frac{dW}{dt} = \frac{-pf_{AA}^{I}A^{I}}{pf_{AA}^{C} + pf_{AA}^{I}} + \frac{pf_{AA}^{C}A^{C}}{pf_{AA}^{C} + pf_{AA}^{I}} - \frac{pf_{AA}^{C}A^{T}}{pf_{AA}^{C} + pf_{AA}^{I}} = -A^{I} < 0$

IF and landowners lose while CF gains. Total welfare effect is negative.

Q.E.D.

A2. Imperfect competition and welfare effect of transaction costs

Part a: *this part shows the effect of transaction costs on welfare and profits when there is imperfect competition.*

To show: $\frac{d\prod^{I}}{dt} < 0$, $\frac{d\prod^{C}}{dt} > 0$, $\frac{d\prod^{L}}{dt} < 0$, $\frac{dW}{dt} <> 0$.

In equilibrium with imperfect competition and with transaction costs condition (8) and (A1.1) must be satisfied, as well as:

(A2.1) $pf_{A}^{C} = r + A^{C}\frac{\partial r}{\partial A^{C}}$

From (8) and (A1.1.) $\frac{\partial r}{\partial A^{C}}$ can be derived:

(A2.2) $\frac{\partial r}{\partial A^{C}} = -pf_{AA}^{I}$

Define transaction costs t^{*} such that in equilibrium $pf_{A}^{I} = pf_{A}^{C}$ (or $f_{A}^{I} = f_{A}^{C}$), hence from (8), (A2.1) and (A1.1.) it follows that in equilibrium:

(A2.3) $t^{*} = A^{C}\frac{\partial r}{\partial A^{C}} = -pf_{AA}^{I}A^{C}$

In words, t^{*} (which is the cost that IF pay above *r*) exactly matches the murk-up of CF, i.e. t^{*} exactly matches the amount by which CF land marginal value product exceeds the equilibrium land market rent *r*.

Totally differentiating equations (8) (A1.1) and (A2.1) and using equation (A2.2) (with $\frac{\partial^{3} f^{I}(A^{I})}{\partial A^{I^{3}}} = f_{AAA}^{I}$) yields (A1.2) and (A1.4), as well as:

(A2.4) $\left(pf_{AA}^{C} + pf_{AA}^{I}\right)dA^{C} + A^{C} pf_{AAA}^{I} dA^{I} = dr$

Solving for $\frac{dA^{I}}{dt}$ and for $\frac{dr}{dt}$ yields:

(A2.5) $\frac{dA^{I}}{dt} = \frac{1}{pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I}} < 0$

(A2.6) $\frac{dr}{dt} = -\frac{\left(pf_{AA}^{C} + pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)}{\left(pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)} < 0$

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

(A2.7) $pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I} < 0$

IF renting and market rent decreases with the increase of transaction costs.

Totally differentiating equations (3), (4) and (5) and using equations (8), (A2.1), (A.2.7) and (A2.6) yields:

(A2.8) $\frac{d\prod^{I}}{dt} = \frac{-A^{I}\left(pf_{AA}^{I}\right)}{\left(pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)} < 0$

(A2.9) $\frac{d\prod^{C}}{dt} = A^{C}\frac{\left(pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)}{\left(pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)} = A^{C} > 0$

(A2.10) $\frac{d\prod^{L}}{dt} = -\frac{\left(pf_{AA}^{C} + pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)}{\left(pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)} A^{T} < 0$

IF and landowners lose, while CF gain if transaction costs increase.

Next solving for $\frac{dW}{dt}$ yields:

(A2.11) $\frac{dW}{dt} = \frac{A^{C} pf_{AA}^{I}}{\left(pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)} - A^{I} <> 0$

Total welfare effect is ambiguous with imperfect competition. The first term on the right hand side of equation (A2.11), $\frac{A^{C} pf_{AA}^{I}}{\left(pf_{AA}^{C} + 2pf_{AA}^{I} - A^{C} pf_{AAA}^{I}\right)}$, is positive. The second one, A^{I}, is also

positive. $A^C pf_{AA}^I$ is the amount by which CF land marginal value exceeds in equilibrium the land market rent *r* (see (A2.1) and (A2.2)). With perfect competition, land marginal value equals the land market rent *r*. Hence the total welfare effect will collapse to $\frac{dW}{dt} = -A^I$, which is the same as given by equation (A1.10) for the perfect competition case.

Q.E.D. part a.

Part b: *this section compares profits and total welfare obtained with imperfect competition and transaction costs,* ***relative to*** *profits and total welfare obtained with perfect competition and zero transaction costs.*

To show: $W\big|_{t>0}^{M} < W\big|_{t=0}^{*}$; $\Pi^C\big|_{t>0}^{M} > \Pi^C\big|_{t=0}^{*}$; $\Pi^L\big|_{t>0}^{M} < \Pi^L\big|_{t=0}^{*}$;

for $t < t^*$ $\Pi^I\big|_{0<t\le t^*}^{M} > \Pi^I\big|_{t=0}^{*}$;

for $t > t^*$ $\Pi^I\big|_{t>t^*}^{M} < \Pi^I\big|_{t=0}^{*}$.

In equilibrium with perfect competition and zero transaction costs condition (A1.1) must be satisfied as well as:

(A2.13) $pf_A^I = r$

(A2.14) $pf_A^C = r$

Equations (A2.13) and (A2.14) imply that in equilibrium with perfect competition and zero transaction costs $f_A^I = f_A^C$.

From equation (A2.3), from imperfect competition and transaction costs equilibrium conditions (8), (A2.1), (A1.1), and from perfect competition and zero transaction costs equilibrium conditions (A2.13), (A2.14), and (A1.1) it follows that:

I. For *t* such that $t = t^*$ it follows that in equilibrium with imperfect competition $pf_A^I = pf_A^C$. The same holds for perfect competition and zero transaction costs,

implying $A_t^M = A^*$ and $A^T - A_t^M = A^T - A^*$, hence $pQ^T\big|_{t=t^*}^M = pQ^T\big|_{t=0}^*$, where $pQ^T = pf^I(A^I) + pf^C(A^C)$, $Q^T\big|_{t=t^*}^M$ is total output with imperfect competition and transaction costs $t = t^*$, and $Q^T\big|_{t=0}^*$ is total output with perfect competition and zero transaction costs. Because $pf_A^I = pf_A^C$ total output is maximal at the land allocation equilibrium $A_t^M = A^*$. Any land reallocation causes $pf_A^I \neq pf_A^C$ leading to output fall.

II. For any t such that $0 < t < t^*$ ($t > t^*$) it follows that in equilibrium with imperfect competition $pf_A^I < pf_A^C$ ($pf_A^I > pf_A^C$) implying $A_t^M < A^*$, $A^T - A_t^M > A^T - A^*$ ($A_t^M > A^*$, $A^T - A_t^M < A^T - A^*$), hence $pQ^T\big|_{0<t<>t^*}^M < pQ^T\big|_{t=0}^*$. Land allocation equilibrium with higher total output can be found.

III. Total transaction costs for t equal to $\left(A^T - A_t^M\right)t$.

From I, II, and III it follows that for any t, total welfare with imperfect competition and transaction costs is lower relative to total welfare with perfect competition and zero transaction costs, $W\big|_{t>0}^M < W\big|_{t=0}^*$, where $W\big|_{t=0}^* = pQ^T\big|_{t=0}^*$ and $W\big|_{t>0}^M = pQ^T\big|_{t>0}^M - \left(A^T - A_t^M\right)t$.

CF gain with imperfect competition and transaction costs relative to the perfect competition and zero transaction costs equilibrium:

First, imperfect competitive behavior of CF implies $\Pi^C\big|_{t=0}^M > \Pi^C\big|_{t=0}^*$ otherwise behaving as a dominant player in the land market is not an optimal choice for CF. Second, with imperfect competition in place transaction costs increase CF profits, $\frac{d\Pi^C}{dt} > 0$; this follows from equation (A2.9), hence $\Pi^C\big|_{t>0}^M > \Pi^C\big|_{t=0}^M > \Pi^C\big|_{t=0}^*$.

In equilibrium with imperfect competition and transaction costs, CF gain relative to the perfect competition and zero transaction costs equilibrium.

IF gains/losses

From equation (A2.3), from imperfect competition equilibrium and transaction costs conditions (8), (A2.1), (A1.1), and from perfect competition and zero transaction costs equilibrium conditions (A2.13), (A2.14), and (A1.1) it follows that:

IV. For any *t* such that $0 < t \le t^*$ it follows that in equilibrium with imperfect competition, $p f_A^I\big|_{0<t<t^*}^M \le p f_A^I\big|_{t=0}^*$ implying, $A^T - A_t^M \ge A^T - A^*$ hence $r_t^M + t \le r^*$, yielding $\Pi^I\big|_{0<t<t^*}^M \ge \Pi^I\big|_{t=0}^*$. With imperfect competition and transaction costs *t*, such that $0 < t \le t^*$ IF gain relative to the perfect competition and zero transaction costs equilibrium, because they have lower rental costs and rent more land.

V. For any *t* such that $t > t^*$ it follows that in equilibrium with imperfect competition, $p f_A^I\big|_{t>t^*}^M > p f_A^I\big|_{t=0}^*$ implying $A^T - A_t^M < A^T - A^*$, hence $r_t^M + t > r^*$, yielding $\Pi^I\big|_{t>t^*}^M < \Pi^I\big|_{t=0}^*$. With imperfect competition and transaction costs *t*, such that $t > t^*$ IF lose relative to the perfect competition and zero transaction costs equilibrium because they pay higher rental costs and rent less land.

Landowners lose with imperfect competition and transaction costs relative to the perfect competition and zero transaction costs equilibrium:

From imperfect competition equilibrium and transaction costs conditions (8), (A2.1), (A1.1), and from perfect competition and zero transaction costs equilibrium conditions (A2.13), (A2.14), and (A1.1) it follows that $r_t^M < r^*$, hence $\Pi^L\big|_{t>0}^M < \Pi^L\big|_{t=0}^*$, where $\Pi^L\big|_{t>0}^M = r_t^M A^T$ and $\Pi^L\big|_{t=0}^* = r^* A^T$.

Q.E.D. part b.

A3. Welfare and land productivity with partial reform

To show: Part a: $\left.\frac{dW}{dt}\right| <> 0$

Part b: $\gamma|_{0<t\le t^*}^{M} > \gamma|_{t=0}^{M}$ and $\gamma|_{t>t^*}^{M} <> \gamma|_{t=0}^{M}$

Part a:

With imperfect competition and transaction costs from (A2.11) it follows that $\frac{dW}{dt} <> 0$.

The total welfare effect is ambiguous.

From equations $\prod^I = pf^I(A^I) - (r+t)A^I$, $\prod^C = pf^C(A^C) - rA^C$, $\prod^L = rA^T$,

$W = \prod^I + \prod^C + \prod^L$ it follows:

(A3.1) $W = pf^I(A^I) + pf^C(A^C) - tA^I = pQ^T - tA^I$

When transaction costs are altered, total welfare is affected through 1) change in total output value (pQ^T) and 2) through the change in the level transaction costs incurred (tA^I).

Totally differentiating pQ^T and dividing by dt yields:

(A3.2) $p\frac{dQ^T}{dt} = p\left(f_A^I - f_A^C\right)\frac{dA^I}{dt}$

From equation (A2.5) and from I and II in appendix A2 part b, it follows that for any t such that $0 < t \le t^*$, $\frac{dA^I}{dt} < 0$ and $pf_A^I \le pf_A^C$, respectively, hence

(A3.3) $p\left.\frac{dQ^T}{dt}\right|_{0<t\le t^*}^{M} = p\left(f_A^I - f_A^C\right)\frac{dA^I}{dt} \ge 0$

Equation (A3.3) implies that:

(A3.4) $pQ^T\big|_{0<t\le t^*}^{M} > pQ^T\big|_{t=0}^{M}$

The partial reform that eliminates only transaction costs (for $0 < t \le t^*$) causes total output decline.

Equation (A3.4) implies that the effect of the removal of transaction costs *t*, such that $0 < t \le t^*$, on welfare is ambiguous:

(A3.5) $W\big|_{t=0}^{M} - W\big|_{0<t\le t^*}^{M} > 0$ if $pQ^T\big|_{0<t\le t^*}^{M} - pQ^T\big|_{t=0}^{M} < tA^I$

(A3.6) $W\big|_{t=0}^{M} - W\big|_{0<t\le t^*}^{M} < 0$ if $pQ^T\big|_{0<t\le t^*}^{M} - pQ^T\big|_{t=0}^{M} > tA^I$

The term tA^I (given by area *GK* in figure 3 for transaction costs t^*) represents transaction cost gains and the term $pQ^T\big|_{0<t\le t^*}^{M} - pQ^T\big|_{t=0}^{M}$ (given by area *BE* in figure 3 for transaction costs t^*) represents output loss resulted from the removal of transaction costs.

From equation (A2.5) and from II in appendix A2 part b, it follows that for any *t* such that $t > t^*$ $\frac{dA^I}{dt} < 0$ and $pf_A^I > pf_A^C$, respectively, hence

(A3.7) $p\frac{dQ^T}{dt}\Big|_{t>t^*}^{M} = p\left(f_A^I - f_A^C\right)\frac{dA^I}{dt} < 0$

Equation (A3.7) implies that:

(A3.8) $pQ^T\big|_{t>t^*}^{M} < pQ^T\big|_{t=t^*}^{M}$

The partial reform that elimination transaction costs *t* (for $t > t^*$) to t^* increases total output.

From equation (A3.8) and from equations (A3.4) - (A3.6) it implies that the effect of the removal of transaction costs *t* (for $t > t^*$) on welfare is ambiguous:

(A3.9) $W\big|_{t=0}^{M} - W\big|_{t>t^*}^{M} > 0$ if $pQ^T\big|_{t=t^*}^{M} - pQ^T\big|_{t=0}^{M} < tA^I + pQ^T\big|_{t=t^*}^{M} - pQ^T\Big|_{t>t^*}^{M}$

(A3.10) $W\big|_{t=0}^{M} - W\big|_{t>t^*}^{M} < 0$ if $pQ^T\big|_{t=t^*}^{M} - pQ^T\big|_{t=0}^{M} > tA^I + pQ^T\big|_{t=t^*}^{M} - pQ^T\Big|_{t>t^*}^{M}$

The term tA^I (given by area *DK* in figure 7 for transaction costs t_2) represents transaction costs gains, the term $pQ^T\big|_{t=t^*}^{M} - pQ^T\Big|_{t>t^*}^{M}$ (given by area *C* in figure 7 for transaction costs t_2) represents output gain caused by the reduction of transaction costs from t to t^*, and the term $pQ^T\big|_{t=t^*}^{M} - pQ^T\big|_{t=0}^{M}$ (given by area *B* in figure 7 for transaction costs t_2) represents output loss caused by the reduction of transaction costs from t^* to $t = 0$

Q.E.D. part a.

Part b:

From equation (A3.4), it follows that for any t such that $t \le t^*$

(A3.11) $$\gamma\big|_{0<t\le t^*}^{M} = \frac{pQ^T\big|_{0<t\le t^*}^{M}}{A^T} > \gamma\big|_{t=0}^{M} = \frac{pQ^T\big|_{t=0}^{M}}{A^T}$$

Land productivity is larger with positive transaction costs, such that $0 < t \le t^*$, than with zero transaction costs.

From equation (A3.4) and (A3.8), it follows that for any t such that $t > t^*$:

(A3.12) $$\gamma\big|_{t>t^*}^{M} <> \gamma\big|_{t=0}^{M}$$

Where

(A3.13) $$\gamma\big|_{t>t^*}^{M} = \frac{pQ^T\big|_{t>t^*}^{M}}{A^T}$$

(A3.14) $$\gamma\big|_{t=0}^{M} = \frac{pQ^T\big|_{t=0}^{M}}{A^T} = \frac{pQ^T\big|_{t>t^*}^{M}}{A^T} + \left[\frac{pQ^T\big|_{t=t^*}^{M}}{A^T} - \frac{pQ^T\big|_{t>t^*}^{M}}{A^T}\right] + \left[\frac{pQ^T\big|_{t=0}^{M}}{A^T} - \frac{pQ^T\big|_{t=t^*}^{M}}{A^T}\right]$$

Equations (A3.13) and (A3.14) imply that:

(A3.15) $$\gamma\big|_{t>t^*}^{M} > \gamma\big|_{t=0}^{M} \text{ if } \left[\frac{pQ^T\big|_{t=t^*}^{M}}{A^T} - \frac{pQ^T\big|_{t>t^*}^{M}}{A^T}\right] < \left[\frac{pQ^T\big|_{t=0}^{M}}{A^T} - \frac{pQ^T\big|_{t=t^*}^{M}}{A^T}\right]$$

(A3.15) $\gamma\big|_{t>t^*}^{M} < \gamma\big|_{t=0}^{M}$ if $\left[\frac{pQ^T\big|_{t=t^*}^{M}}{A^T} - \frac{pQ^T\big|_{t>t^*}^{M}}{A^T}\right] > \left[\frac{pQ^T\big|_{t=0}^{M}}{A^T} - \frac{pQ^T\big|_{t=t^*}^{M}}{A^T}\right]$

The term $\left[\frac{pQ^T\big|_{t=t^*}^{M}}{A^T} - \frac{pQ^T\big|_{t>t^*}^{M}}{A^T}\right]$ is land productivity gain caused by the reduction of transaction costs from t to t^*, and the absolute value of the term $\left[\frac{pQ^T\big|_{t=0}^{M}}{A^T} - \frac{pQ^T\big|_{t=t^*}^{M}}{A^T}\right]$ represents land productivity loss caused by the reduction of transaction costs from t^* to t =0. The land productivity may increase or may decreases with the removal of transaction costs t, for $t > t^*$.

Q.E.D. part b.

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Tables and Figures

Table 1. Farm structures in transition countries

	Individual farms		Corporate farms		Year
	Share in TAA (%)	Average size (ha)	Share in TAA (%)	Average size (ha)	
Albania*	96		4		1998
Bulgaria	44	1	55	861	1997
Czech Republic	28	20	72	937	2003
Hungary	59	4	41	312	2000
Poland	87	8	13		2003
Romania	55	2	45	274	2002
Slovakia	12	42	88	1185	2003
Slovenia	94		6		2000
CEECs	**59**		**41**		
Estonia	63	2	37	327	2001
Latvia	90	12	10	297	2001
Lithuania	89	4	11	483	2003
Baltic States	**81**		**19**		
Armenia	100	1			1999
Azerbaijan	9		91		1997
Belarus	12	1	88	3 130	2000
Georgia	66	1	34	100	2000
Kazakhstan	29	15	71	11 248	2000
Kyrgyzstan	23		77		1997
Moldavia	49		51		2003
Russia	14		86	5 400	2000
Tajikistan	7		93		1997
Turkmenistan	0.3		99.7		1997
Uzbekistan	4		96		1997
Ukraine	41		59		2004
CIS	**30**		**77**		

Sources: Bulgaria: Bulgarian Ministry of Agriculture and Forestry; Czech Republic: Czech Statistical Office; Estonia: Statistical Office of Estonia; Hungary: European Commission; Poland: Central Statistical Office; Latvia: Statistical Office of Latvia; Lithuania: Statistical Office of Lithuania; Slovenia: Statistical Office of the Republic of Slovenia; Moldova: Lerman and Sutton (2006); Russia: Koester (2003); Ukraine: Lerman and Sedik (2007); Armenia, Belarus, Georgia, Kazakhstan: FAO (2002); Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan: Lerman, Csaki, and Feder (2002); Albania: Albanian Ministry of Agriculture; Slovakia: Ministry of Agriculture; Romania: Romanian National Institute of Statistics.

Notes:
TAA – Total Agricultural Area
* for arable land only

Table 2. Land rents in the Czech Republic and Slovakia

(the value of rents are in local currencies)

	Individual farms	*Corporate farms*	*IF Mark-Up*
	A	*B*	*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
Average 2003	875	660	133
Average 2004	944	759	124
Slovakia			
2001	795	242	329
2002	816	333	245
2003	732	393	186
2004	845	498	170
2005	923	638	145

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

Figure 1. Equilibria in the land market with transaction costs

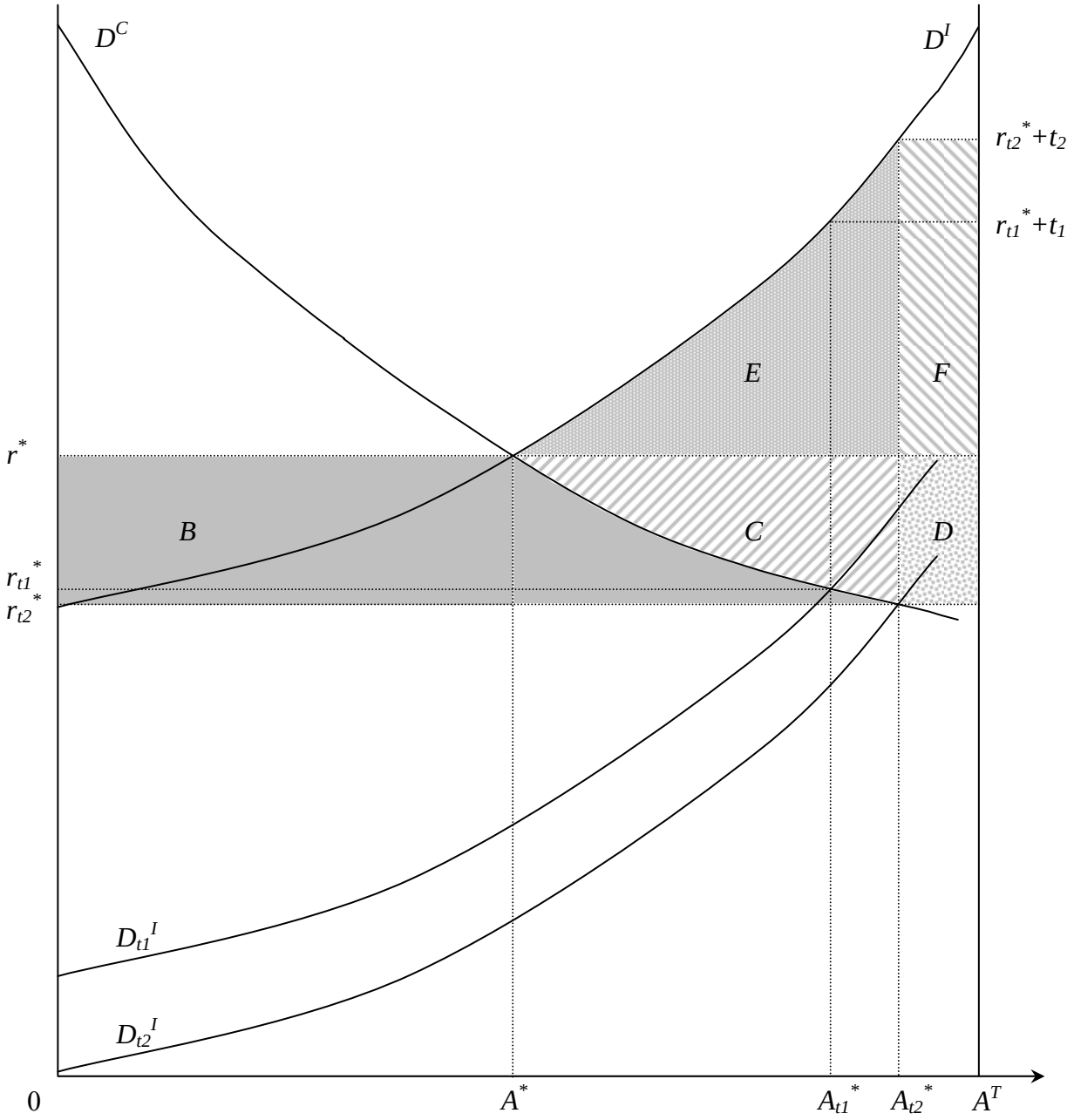


Figure 2. Effect of imperfect competition and transaction costs in the land market

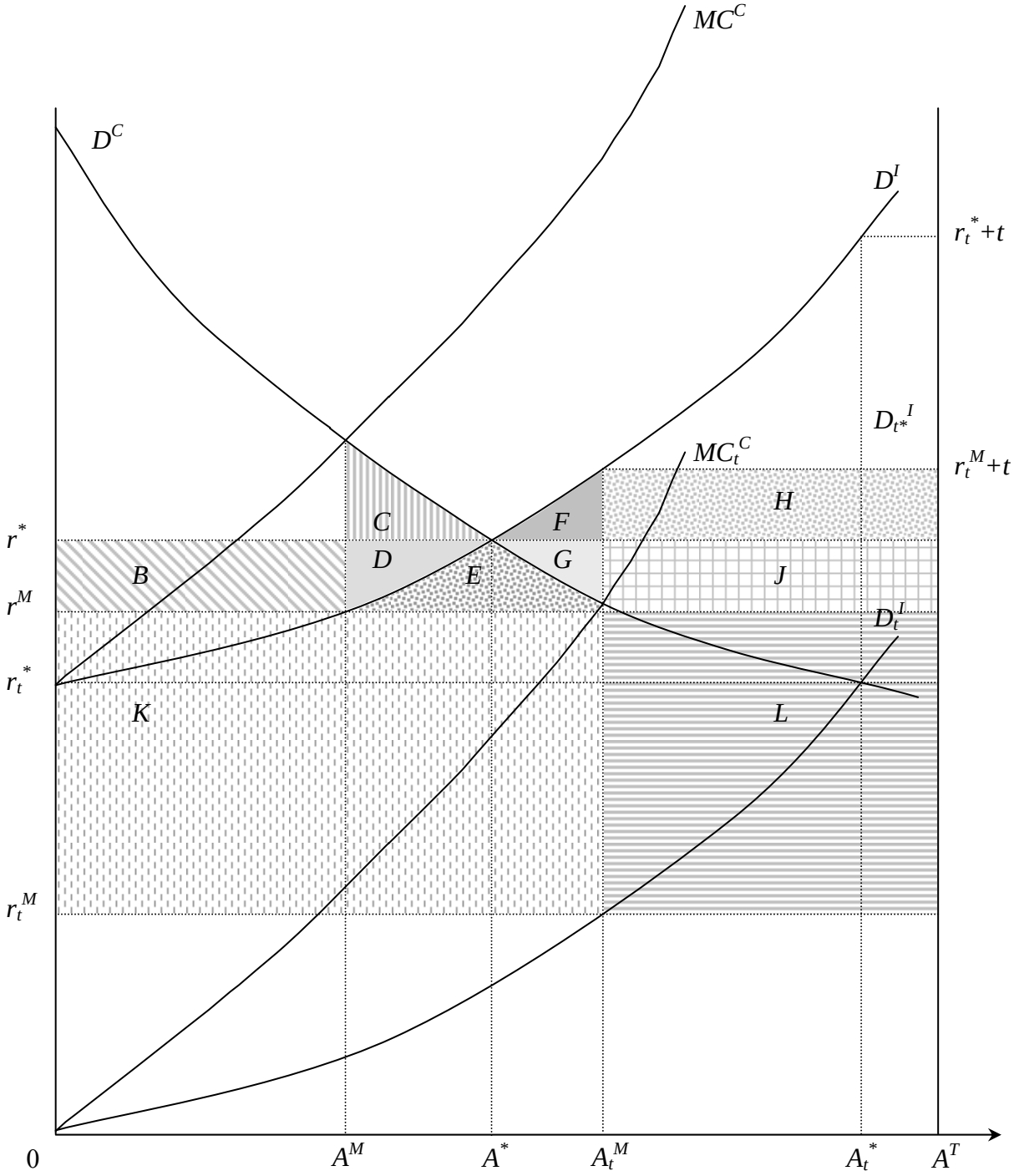


Figure 3. Effect of transaction costs t^* and imperfect competition in the land market

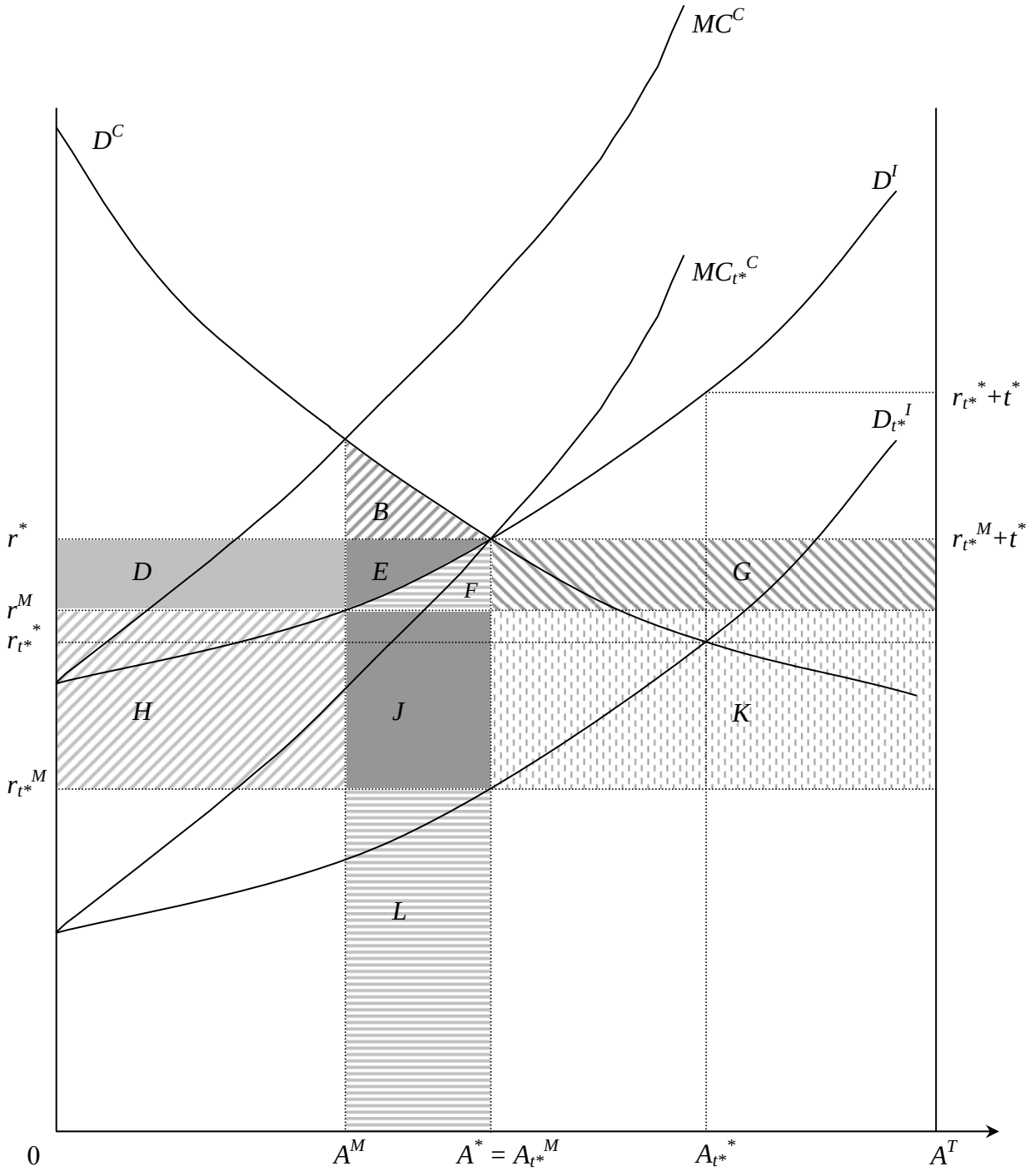


Figure 4. Effect of reform on welfare and incomes

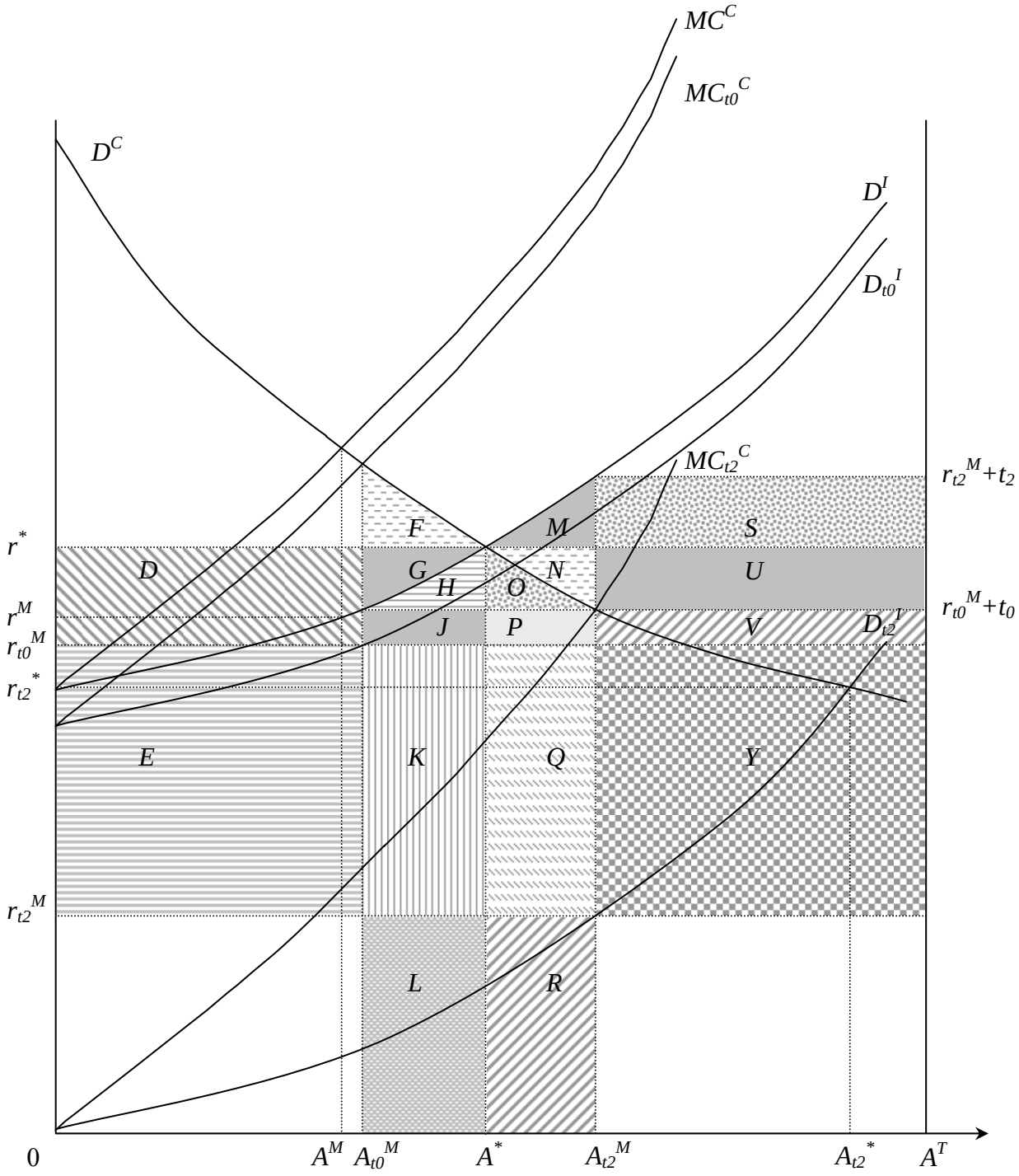


Figure 5. Effect of transaction costs reduction on output and welfare with imperfect competition in the land market

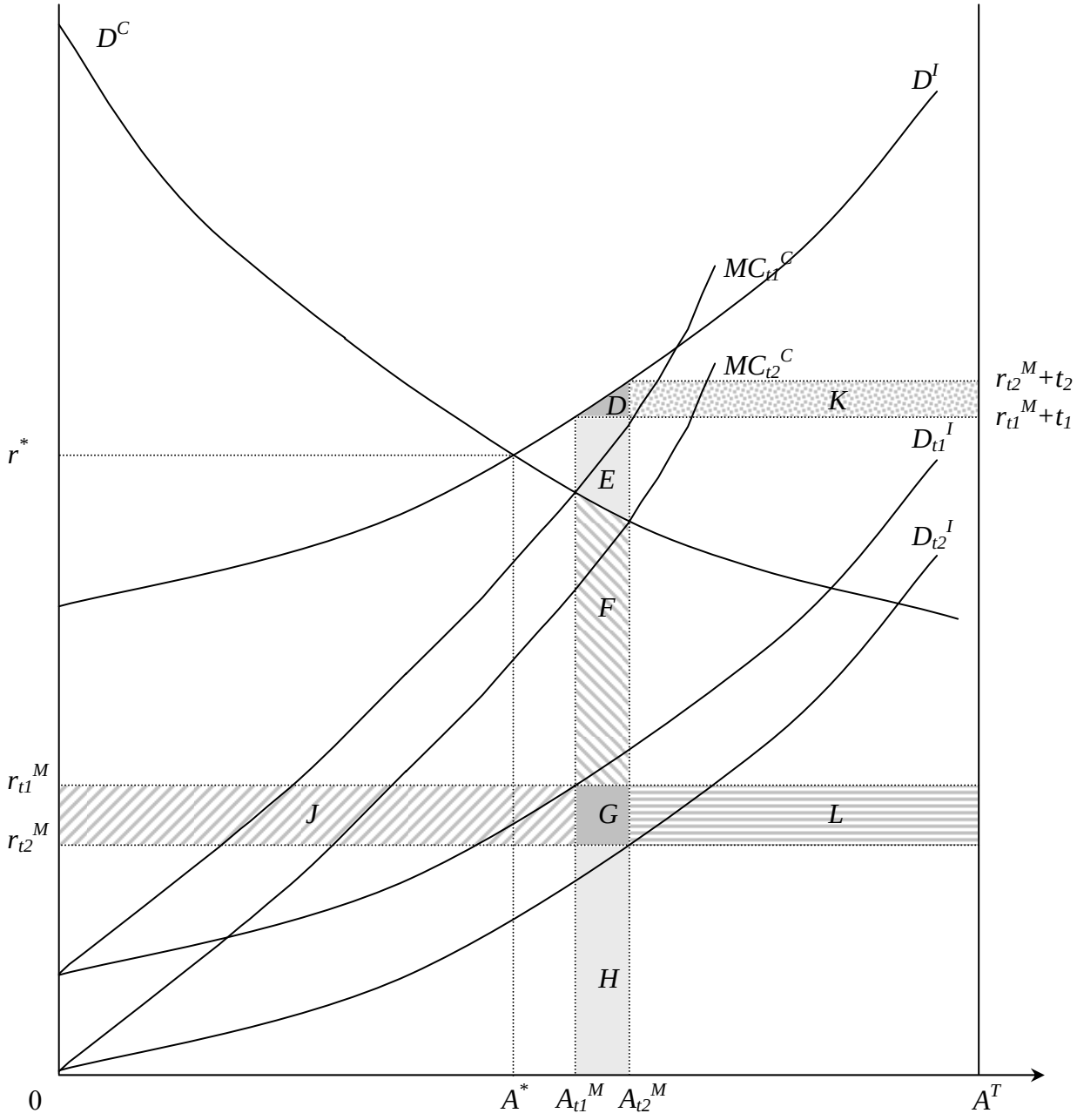


Figure 6. Effect of transaction costs reduction on output and welfare with imperfect competition in the land market

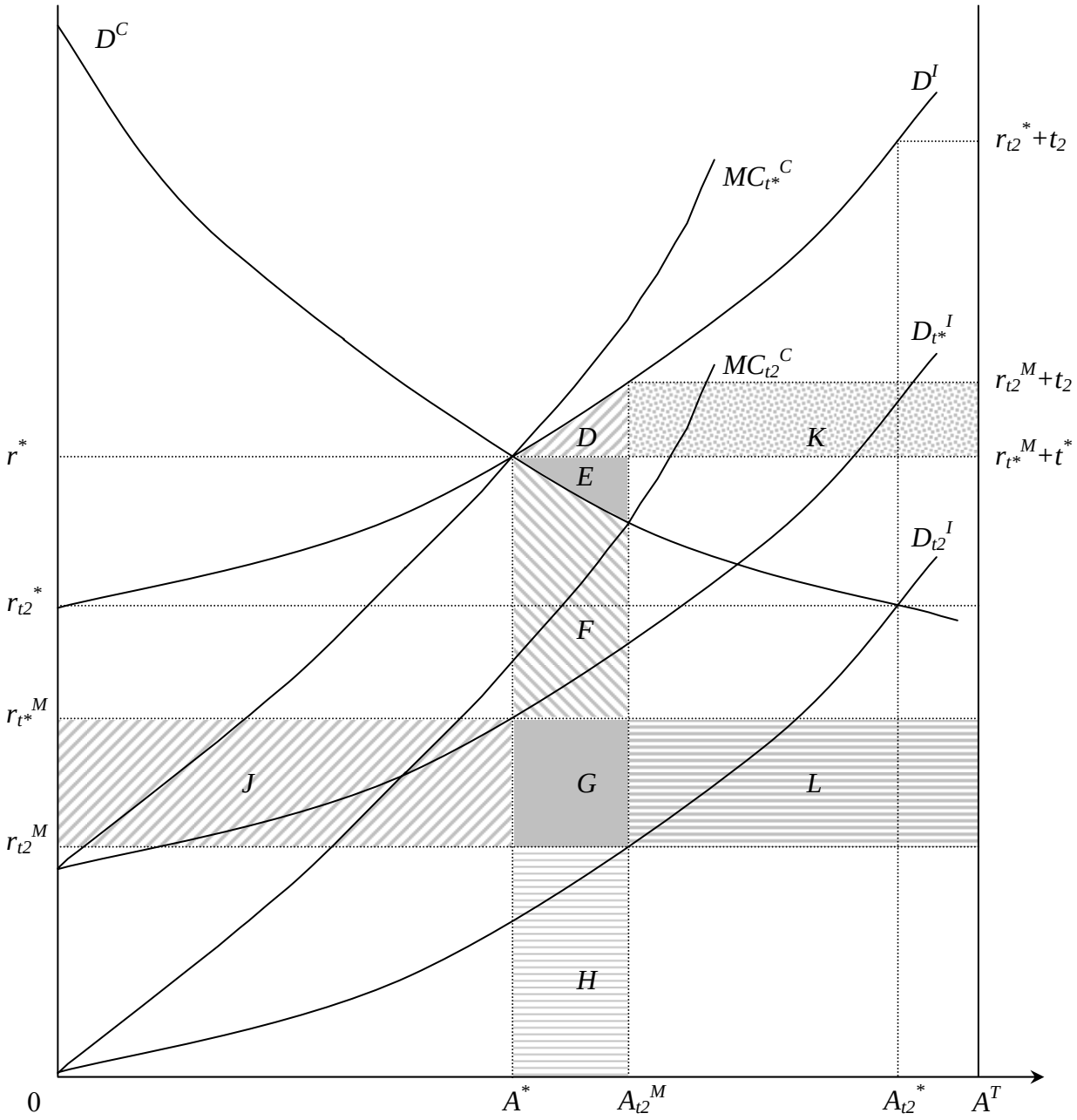


Figure 7. Effect of transaction costs elimination on output and welfare with imperfect competition in the land market

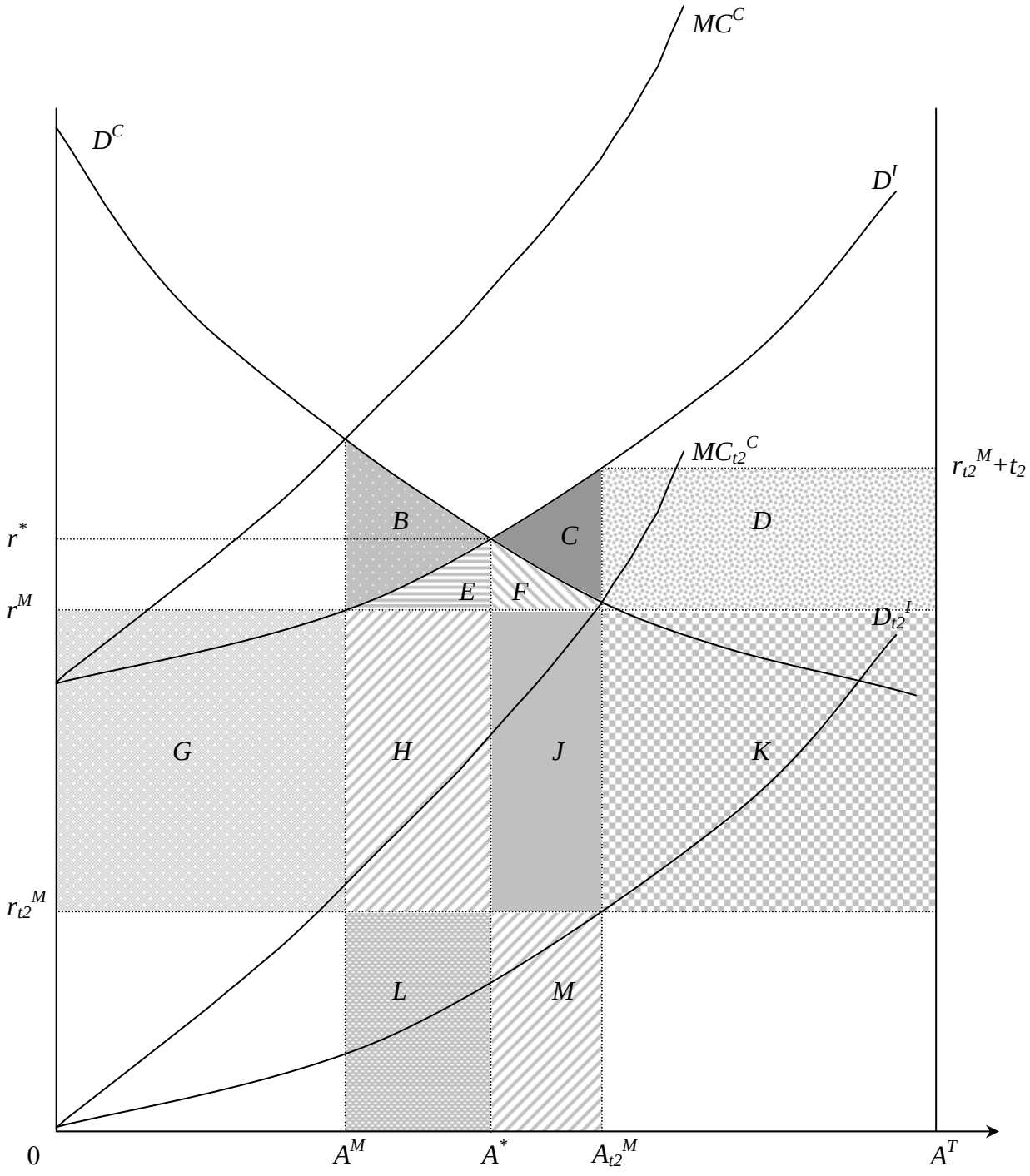


Figure 8. The effect of land demand elasticities on output loss (shown in % change of total output) induced by the reduction of initial transaction costs t^* to zero

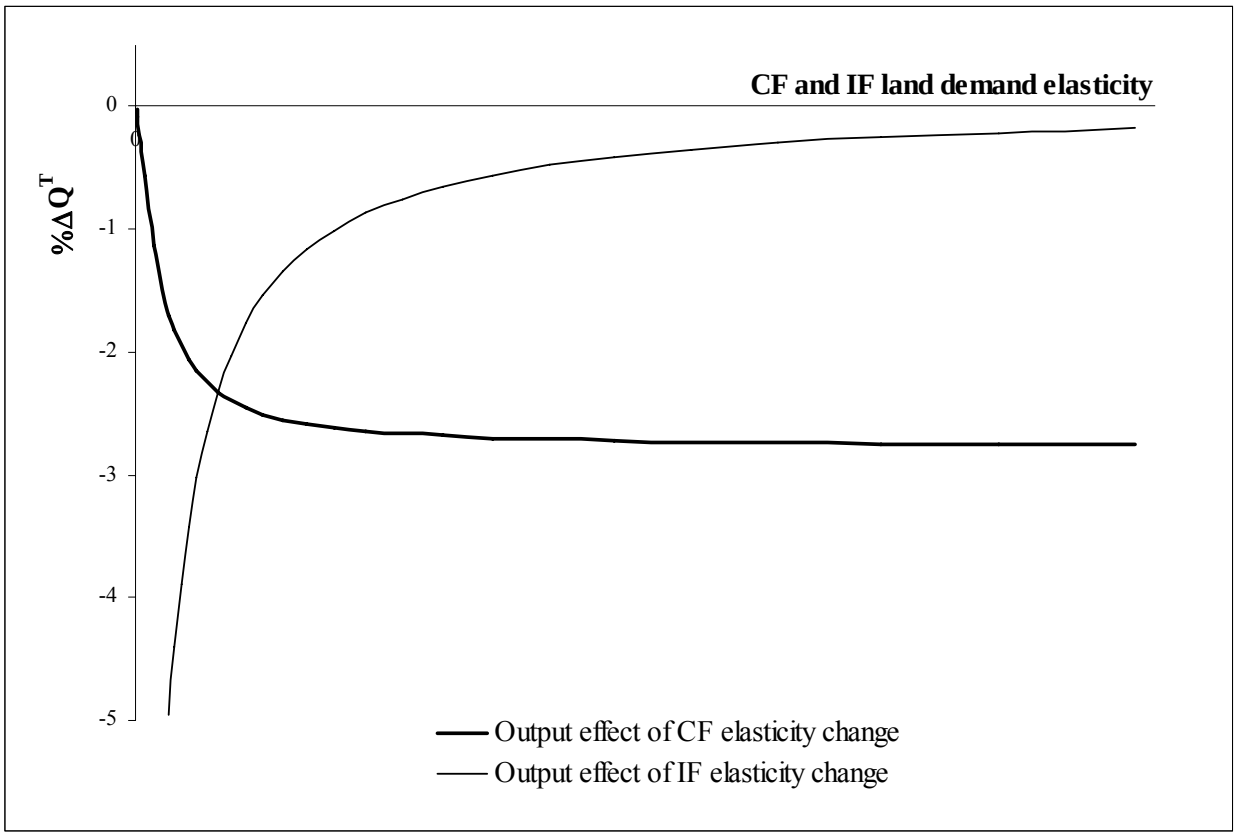


Figure 9. The effect of land demand elasticities on output gain (shown in % change of total output) induced by the reduction of initial transaction costs to t^*

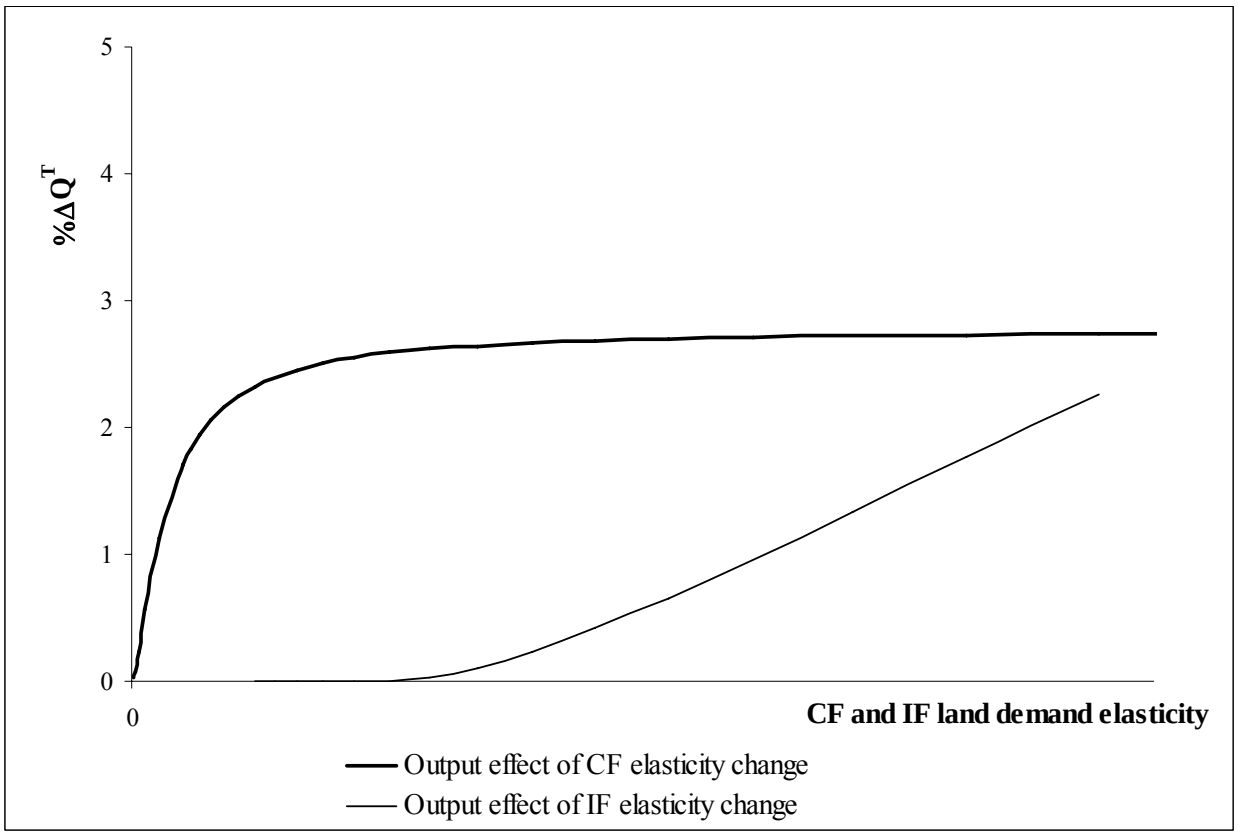


Figure 10. Relative farm productivity and total welfare effects of transaction costs elimination with imperfect competition in the land market

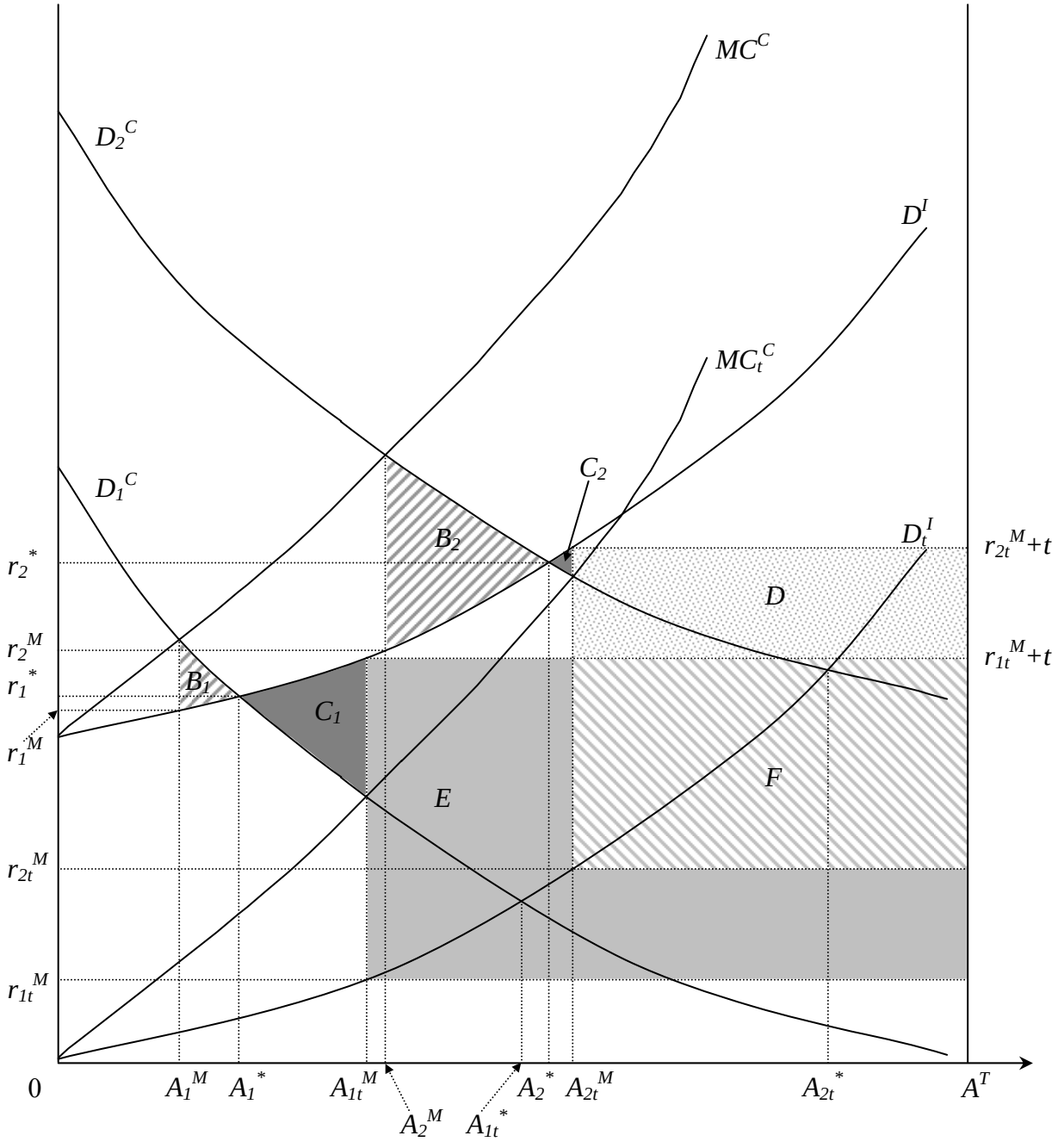
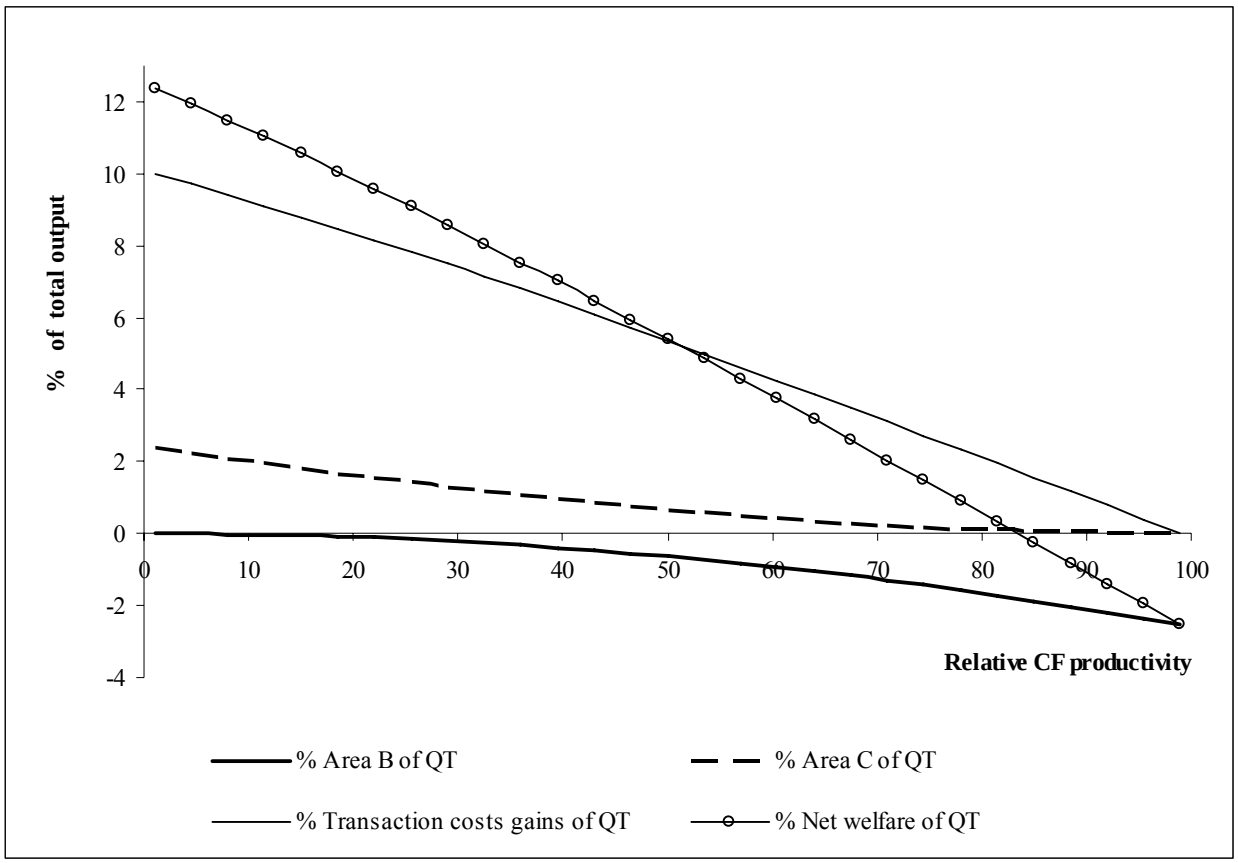


Figure 11. Relative farm productivity and the effect of the removal of transaction costs on output, transaction costs gains, and welfare



Note:
Q^T – total output