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The Capitalisation of Area Payments into Farmland Rents: Theory and Evidence from the New EU Member States*

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Abstract

This study investigates the impact of the SAPS (Simplified Area Payment Scheme) on farmland rental rates in seven new EU Member States (NMS). Using a unique FADN farm level panel data with 20,930 observations from 2004 and 2005 we are able to control for unobserved heterogeneity, simultaneity, and omitted variable bias. According to our results, the SAPS has a positive and statistically significant impact on land rents in the NMS. However, the estimated incidence is smaller than theoretically predicted. Land rents capture only 0.19 of the marginal SAPS Euro. Taking into account the level of land renting in the NMS, around 10 percent of the total SAPS payments benefit non-farming land owners through higher farmland rental prices. Because the share of rented land is higher for corporate than for individual farms, family farms benefit more from the SAPS than corporate farms.

Keywords: Area payments, land capitalisation, land market.
JEL classification: Q11; Q12; Q15; Q18; P32.

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1 Introduction

In 2004 and 2007 ten Central and Eastern European (CEE) countries joined the European Union (EU). Since the accession, the farm income support is implemented through the Simplified Area Payment Scheme (SAPS) in most of the New EU Member States (NMS)[1]. However, the evidence from other countries, e.g. USA, shows that not all subsidy payments reach farmers. For example, area based subsidies in the USA benefit also land owners (Goodwin, Mishra and Ortalo-Magné 2003).

The capitalisation of the SAPS into land values has important policy implication for the NMS, where farmland renting is rather important. On average, 52% of agricultural land is rented in the NMS. However, there is a sizeable variation in the share of rented land between countries and between different types of farms. The share of rented farmland varies between 28% in Poland and 96% in Slovakia. In the same time, the dual farm structure - a characteristic feature of the NMS agriculture - and the fact that large corporate farms (CF) tend to rent most of the agricultural land while smaller individual farms (IF) mostly own the land they use leads to a differentiated effect of the SAPS between IF and CF. This implies that the income effect of the SAPS will likely differ between CF and IF and across the NMS.

In light of the existing evidence of are payment capitalisation in developed countries and policy relevance in the NMS, the main objective of the present study is to empirically estimate the share the SAPS payments that flows to non-farming land owners in the NMS. In addition, we also calculate the total leakage of the SAPS payments both by farm type and by member state.

Theoretical models have shown that due to inelastic land supply area payments may get capitalised into land values and benefit land owners instead of farms (Floyd 1965; and Alston and James, 2002; Guyomard, Mouël, and Gohin 2004). According to Alston (2007); Kirwan (2005); Latruffe and Le Mouël (2006); Plantinga et al. (2002), the share of subsidies which gets capitalised into land values depends on many factors, such as, subsidy implementation details, expectations about changes in future policies, non-agricultural land demand, market imperfections and formal and informal land institutions.

The empirical attempts to estimate the impact of agricultural support policies on land values can be regrouped into two broad categories: *land price* and *land rental studies*. Generally, land rents may be superior for investigating the effects of domestic support on land values for several reasons. One of the main advantage using land rental data is that rents are less affected by farmers' expectation about future effects of subsidies and market returns. Hence, land rents may more precisely reflect the incidence of the contemporaneous marginal subsidy euro and returns (Alston 2007; Kirwan 2005). In contrast, land prices are based upon expectations about the long-run stream of net returns to production and subsidies tied to land (Kirwan 2005).

[1] In this study the NMS include the Czech Republic, Estonia Latvia, Lithuania, Hungary, Poland and Slovakia.

Second, land rental studies typically use farm-level variation in subsidy payments and farm revenues to explain variation in farmland rental rates. This allows controlling for observable covariates and fixed effects when panel data are available (Alston 2007). Third, rental rates are observed in the market while land value is often stated by the owner and therefore subjective (Whitaker 2006). Fourth, rental rates are less affected by urban pressures and other non-agricultural factors, if contracts are for short periods of time, and may therefore reflect the value of agricultural activity on the land (Whitaker 2006). Usually, however, the main reason why authors use one instead of the other approach is data-driven: the availability of either land prices (typically from regional data sets) or rental data (typically from farm-level surveys) generally determines the choice of the dependent variable. The unique FADN farm-level data set available in the present study allows us to exploit the advantages of farmland rental model.

In addition to studying rents versus land prices, the existing literature differs also according to the *type of agricultural subsidies* studied. Whereas some studies consider aggregate farm support (e.g. Kirwan 2005; Roberts, Kirwan, and Hopkins 2003; Shaik, Helmers and Atwood 2005), others study a particular type of subsidy (e.g. e.g., Goodwin et al., 2003; Patton et al 2008; Taylor and Brester 2005). With few exceptions (Kuchler and Tegene 1993; Patton et al. 2008), only studies on the US Production Flexibility Contracts (PFC) analyse the capitalisation of area based subsidies (Goodwin, Mishra and Ortalo-Magné 2003). In general, all existing studies conclude that agricultural subsidies do affect farmland prices. However, there is little consensus on the capitalisation rate of different subsidies. Depending on the study, the capitalisation of the PFC, which are decoupled but still area based, varies between 0.2 and 0.9. Kuchler and Tegene (1993) estimate the impact of land tax on land rents using data from seven states in US.[2] Kuchler and Tegene 1993 find that all tax costs are incurred by land owners which implies their full (negative) capitalisation into land rents. Patton et al. (2008) investigate the impact of various types of the CAP direct payments on rental values in Northern Ireland for the period 1994 - 2002. In the case of less favoured area payments they find that it is fully capitalised into land rents.[3] Patton et al. also show that area based subsidies lead to higher land capitalisation than other types of subsidies. Studies on non-area based coupled subsidies find that the capitalisation rate usually varies between 0.2 and 1 (Goodwin, Mishra and Ortalo-Magné 2003, 2005; Lence and Mishra 2003; Roberts, Kirwan, and Hopkins 2003; Taylor and Brester 2005). Hence, according to previous studies, area based subsidies do not have a significantly different impact on land values from non-area based subsidies. The second contribution of our paper is to quantify the capitalisation rate of a particular type of area based subsidies - the SAPS area payments. In addition, we also estimate the capitalisation rate of coupled subsidies

[2] A land tax is similar to an area payment except that it represents a cost.

[3] The less favoured area payment is an area payment based and paid to farmers located in less productive regions.

and compare it with the SAPS.

Further, we can regroup the empirical studies according to the *geographic area* of investigation. Most of the existing research study subsidy capitalisation in North America (the US and Canada). Only few authors consider subsidy capitalisation in the EU (Goodwin and Ortalo-Magné, 1992; Duvivier, Gaspart and de Frahan, 2005; Latruffe et al. 2006; Patton et al. 2008). However, none of these studies measure the impact of the CAP in the NMS. The third contribution of our paper is to provide the first estimates of the SAPS capitalisation rate in the new EU Member States. These estimates are important both for the CAP health check and for future (post-SAPS) policy design in the NMS.

The main objective of our paper is to analyse the SAPS capitalisation into land rents in the NMS. First, we theoretically investigate the effect of the SAPS payments on land rents under different assumptions of market structure. Second, using a unique FADN farm-level data set, we test empirically the derived theoretical predictions of subsidy capitalisation. The panel structure of the farm-level data allows us to address several econometric issues, which often could not been addressed in the previous literature. Third, we calculate the total leakage of the SAPS payments to non-farming landowners in each of the seven NMS.

The paper is organised as follows. The second section provides a short overview of rural land markets in the NMS. The third section presents the theoretical effects of the SAPS and discusses the most important drivers of agricultural land values. In section 4 we empirically test the effects of the SAPS on land rents in the NMS. The final section discusses policy implications and concludes.

2 Rental markets and area payments in the NMS

The capitalisation of subsidies into land values depends on peculiarities of rural land markets, the type and amount of policy support implemented and other factors. This section summarises the key characteristics of the farmland rental markets and the SAPS implementation in the NMS.

2.1 Farmland rental market

Farmland renting is important in all NMS but particularly in Slovakia and the Czech Republic, where rented farmland represents more than 90% of the total UAA use. Also in Hungary, Estonia and Lithuania land renting is dominant, where farms rent more than 60% of the total UAA. In Poland and Latvia farms rent less than 50% of the total land they use.

There are also sizeable differences in renting behaviour between different types of farms. CF tend to rent most of the land they use, while IF tend to use both owned and rented land. On average, CF rent 92% and IF rent 36% of the UAA (Table 4). The dual farm structure in the NMS and the sizeable differences in the renting behaviour between IF and CF suggest that the gains from the SAPS may vary substantially between countries and farm types in the NMS.

Compared to the old EU member states (OMS), the level of agricultural land rents (and prices) was significantly lower in the NMS in the nineties. In the period 2000-2006 there was a significant increase in land rents (FADN 2009, Eurostat 2009). The increase in land rents was exceptionally strong around the period of the EU accession. For example, from 2003 to 2005 land rents grew by 15% to 45% in Hungary, the Czech Republic, Poland, Slovakia and Lithuania (Swinnen and Vranken 2009).

In the NMS land rents are generally paid at the end of the season (after harvest), and usually are paid in cash. Usually, cash rents are calculated based on market conditions at the end of the season. Rental contracts stipulate that when production is low due to the unfavourable whether or market conditions, land rent is reduced or not paid at all (Swinnen and Vranken 2009). Effectively, this implies that land rents are paid after harvest and hence depend on the observable land productivity.

In several NMS land rents are also paid in kind or through sharecropping. For example, in Poland more than 20% of the land rents in 2005 were paid in kind rather than in cash (Swinnen and Vranken 2009). In Slovakia, only half of the farms paid rents exclusively in cash, while the other half of the farms paid part of the rent in cash and part of the rent in kind in 2006. Usually, the in-kind payments depend on the yields, which implies that the rent is directly linked to the contemporaneous land productivity.

This particular setting of rent payments in the NMS has implications for the empirical analysis. Because rents in the NMS are paid at the end of the season and the rental price depends on the current land productivity, the bias that may arise from the measurement error of expectations are less likely to occur in the NMS.

2.2 The SAPS policy framework

Since the 1992 MacSharry reform and the Agenda 2000 reforms, the vast majority of the CAP subsidies in the EU are the so-called direct payments (DPs). In 2008, 36.8 billion euro was spent in the EU on DPs alone (EUR-Lex 2008). They make up around two-thirds of the CAP budget and were a hotly disputed issue during the NMS accession negotiations. Due to an unprecedented high budgetary burden, which would arise in the case of full CAP payments, the NMS and OMS agreed that direct payments will start at 25% of the OMS level in the first year of the accession and then continuously increase over 10 years reaching the full (OMS) level. In addition to the SAPS, the national budgetary resources are used to increase the DPs by some additional 30%.

Regarding the CAP policy instruments, the initial plan was to fully implement the Agenda 2000. However, administrative complexity made a full implementation of the Agenda 2000 difficult in a short period of time for most of the NMS. It was therefore agreed that a simplified version of the CAP will be implemented in the NMS

(Simplified Area Payment Scheme - SAPS) under which farmers receive a per hectare payment. With the exception of Slovenia, all New Member States from Eastern Europe adopted the SAPS from the first year of the accession.

Figure 1 shows the development of national SAPS's ceilings and the SAPS area payments by country. The total SAPS payments will increase from around 1.6 billion in 2004 to around 6.2 billion in 2013 in the NMS while the per hectare payments will increase from 53 to 213 Eur/ha. As shown in Table 5, there is a significant variation in the SAPS payments among the NMS. The lowest rate is in Latvia (around 45% of the NMS average) followed by Estonia (55%) and Lithuania (68%). The highest SAPS area payment rate is in Hungary and the Czech Republic (about 125% of the NMS average).

These differences in the value of the SAPS area payments among the NMS are because the total value of the SAPS payments allocated to each country were calculated based on historical agricultural production levels. More precisely, the total value of direct payments per country was calculated as a sum of crop and animal direct payments, which farmers would receive under the Agenda 2000. Different periods between 1995 and 2001 were used as the reference period for different products in the NMS.[4] The total value of direct payments then represented the country total ceiling for the SAPS, which was divided by the utilised agricultural area to obtain the per hectare SAPS payment.

This implies that the current levels of the SAPS payments are determined by past production - the higher was agricultural production in the reference period, the more support a country could obtain from the EU budget. This mechanism for calculating area based subsidies in the NMS has important implications for econometric estimations. Given that the SAPS payments are based on historical production levels, they are exogenous for individual farms. Farms can adjust the total SAPS payment they receive only by adjusting the rented area, because the payment is coupled to land use. However, farms cannot affect the per hectare value of the SAPS.

After a transition period of ten years, all NMS which adopted the SAPS will have to switch to the Single Farm Payments (SFP) introduced by the 2003 CAP reform in the OMS.[5] Under the SFP, subsidies will be given as a fixed set of payments per farm. The SFP for a specific farm depends on the area cultivated in the reference period. The area cultivated in the reference period determines the total number of entitlements which give rights to the per hectare payments. Under the current regulation, the reference period for the NMS is 2005-2007. Hence, the SFP is an entitlement, the size of which depends on the eligible area.

[4] Initially, the NMS wanted to use the reference period from the end of 1980s, when production was high because of high subsidisation of agricultural sector during the Communist period. This period was not accepted by the European Commission because it would significantly increase the CAP expenditures and create huge market distortions in the NMS.

[5] According a European Commission's regulation from 2008, the NMS can keep the SAPS until 2013, after which they have to switch to the SFP.

3 Theoretical framework

The theoretical framework of the present study is based on Ciaian and Swinnen (2006). We extend the theoretical land market model of Ciaian and Swinnen to study the effect of the SAPS on land rents. More precisely, we reformulate the land market model from land transaction costs to subsidy capitalisation into land values and, instead of analysing welfare effects (as in Ciaian and Swinnen), we analyse the distribution of the SAPS rents.

3.1 The model

The production structure in the NMS is heavily influenced by the Soviet past. During the Soviet-time farm production decisions, factor allocations and property rights in the CEE were largely controlled by the state. Most of the agricultural land was cultivated by large-scale state-owned and collective farms.

In the early 1990s the land reform reallocated most land property rights to individual households. In the model we will refer to them as "*land owners*". Simultaneously with the land reform, a significant farm restructuring took place, which included privatisation and restructuring of collective and state-owned farm management.[6] We will refer to them as "*corporate farms*" (CF), which are typically large-scale. The most extreme form of restructuring was the break-up of collective and state-owned farms into small household plots and family farms. We will refer to these as "*individual farms*" (IF).
Following this stylised pattern of the CEE's agriculture, we model two types of farms, which are representative for IF and CF, respectively.

The production of each farm type is assumed to depend on the amount of land (A^i) and the available technology (T) with $f^i_A > 0$, $f^i_{AA} < 0$, and $f^i_T > 0$ for $i = I, C$, where I stands for IF and C stands for CF. We assume that land availability is fixed at A^T. The profits of farm i are equal to:

$$\Pi^i = pf^i(A^i) - rA^i \tag{1}$$

where p is price of the final product, and r is rental rate of land. We assume that the NMS economies are small and open, which implies that the output price is fixed. The FOCs of IF and CF for the optimal use of land are:

$$p\frac{\partial f^I(A^I)}{\partial A^I} = r \tag{2}$$

$$p\frac{\partial f^C}{\partial A^C} = r + A^M\frac{\partial r}{\partial A^C} \tag{3}$$

[6] With management restructuring we mean the reorganisation of collective and state-owned farms into private cooperatives and farming companies.

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

Conditions (2) and (3) determine the rental rate, which farms are willing to pay for land. Condition (2) defines the IF demand for land, D^I. Condition (3) defines the CF's land demand. If CF does not have market power, then $\partial r/\partial A^C = 0$. This implies that condition (3) reduces to $p\frac{\partial f^C}{\partial A^C} = r$ and determines the CF's land demand, D^C in a competitive market situation. This is illustrated in Figure 2. Without market power of CF, the land market equilibrium is at (A^*, r^*). The land used by CF equals A^* and the land used by IF is $A^T - A^*$.

We allow for the possibility that CF may not be price takers in the land rental market. For example, in countries such as Slovakia, where CF cultivate around 90% of the agricultural land, CF have important market power. To model this, we assume that with their land renting decisions CF can influence the rental price in the region. Given that there is a group of (potential) individual farms, who are price takers in the rental market, we assume that CF is not a monopolist on the land rental market.

If, however, CF have market power, then $\partial r/\partial A^C > 0$. The left hand side of condition (3) represents the marginal benefits, i.e. the marginal value product of land, and the right hand side is the marginal cost of land for CF. The marginal cost of land includes both the rental rate and changes in the rental rate when CF rent more or less land. CF choose the renting area, where the marginal cost equals the marginal benefits. Graphically, this is represented in Figure 2. MC^C represents the marginal cost function of land renting for CF. The equilibrium land use of CF is where MC^C equals D^C, i.e., at A^M. The resulting CF rental price is r^M. Compared to a competitive market equilibrium (A^*, r^*), CF's market power leads to a reduction of land use by the CF ($A^M < A^*$), and a corresponding increase of land use by IF. The rental price is lower for all farms ($r^M < r^*$).

These theoretical results imply that in econometric estimations we have to control for the CF market power. Otherwise, the estimation results would be biased downwards, as CF market power reduces land rents, while the SAPS payments increase land rents. In the estimations we control for the CF market power with a regional share of land used by CF.

3.2 The impact of the SAPS on land rents

Define s as the SAPS payment per unit of land and assume that the entire land qualifies for the SAPS. In presence of the SAPS area payments farm i's objective function (1) changes to

$$\begin{aligned} \prod^{i} &= pf^i(A^i) - (r-s)A^i \\ for\ i &= I, C. \end{aligned} \qquad (4)$$

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

$$
\begin{aligned}
p\frac{\partial f^I(A^I)}{\partial A^I} &= r - s \\
p\frac{\partial f^C}{\partial A^C} &= r - s + A^M\frac{\partial r}{\partial A^C}
\end{aligned} \tag{5}
$$

Equation (5) implies that rent, r_s^M, which farms pay in equilibrium, is a function of output price, production characteristics, subsidies, and market power of CF (given by $\frac{\partial r}{\partial A^C}$), technology, and the total supply of land:

$$
r_s^M = z(p, s, \frac{\partial r}{\partial A^C}, T, A^T) \tag{6}
$$

Proposition 1: The *SAPS area payments are fully capitalised into land rents both with perfect and imperfect competition in the land market.*

Proof: see Appendix A2.

This effect is shown in Figure 3. The IF and CF land demand functions with subsidies are D_s^I and D_s^C, respectively, and the perfect competition equilibrium shifts from (A^*, r^*) to (A_s^*, r_s^*). The rent increases by the size of the subsidy $(r_s^* = r^* + s)$ and the land allocation does not change: A^*, r_s^*. The surplus of neither CF nor IF is affected. All gains go to land owners: their total gains equal to area E, $sA^T = (r_s^* - r^*)\, A^T$.

This result holds also with imperfect competition in the land market. The subsidy is fully capitalised into land rents and all policy benefits go to land owners. As illustrated in Figure 3, the subsidy shifts the marginal cost function from MC^C to MC_s^C and causes the equilibrium to shift from (A^M, r^M) to (A_s^M, r_s^M). The equilibrium land allocation does not change: $A^M = A_s^M$. Rental prices increase from r^M to r_s^M, where the increase equals the subsidy $(s = r_s^M - r^M)$. Subsidies get fully captured by land price increases. Hence, all SAPS subsidies flow to land owners, which is equal to $sA^T = \left(r_s^M - r^M\right) A^T$.

3.3 Other determinants of subsidy capitalisation

The theoretical results derived in the previous section are subject to many factors. Policy related factors (determinants) are policy implementation details, policy risk, and accompanying policy measures. Land market related determinants include market imperfections, farm heterogeneity, land market institutions and regulations, land supply and inter-sectoral production substitution possibilities (land use alternatives), as well as market transactions costs. In addition, all these effects are different between land prices and land rents and over time.

Uncertainty about future policies. The SAPS is implemented in the NMS for ten years - from 2004 to 2013. By the end of 2013 the SAPS will be replaced by the SFP, which is currently implemented in the OMS. At the time of the SAPS introduction, the exact implementation date and the reference period for payment calculations was not known by farmers because of frequent changes in future policy design. Initially, the NMS had to switch to the SFP by 2008 at latest. Later this date was shifted to 2011. Finally, in 2008 it was agreed to postpone the SFP implementation to 2013.

Farmer expectations about the future CAP changes may have affected farms' land use decisions. Because the future SFP subsidies will depend on the current use of land, farms may have been motivated to accumulate more land than currently optimal, creating in such a way additional land demand and leading to higher land values than without knowledge about future policy changes.

In our estimations expectations about future policy (changes) might bias the SAPS estimates on land rents upward. However, since the SFP reference period and the exact date of the SFP introduction was unknown until 2008, the bias is expected to be small for 2004 and 2005. In addition, to make land allocation based on future subsidies causes additional costs, which are particularly high if the date of the SFP introduction is uncertain and if the date is expected to be far in the future. This reduces farm willingness to rent more land than currently optimal.

On the other hand, the fact that the SAPS is implemented for a fixed period has negative pressure on land prices. According to the current regulations, the SAPS will run until 2013. As a result, agricultural land values may eventually decrease after 2013. These expectations may reduce the SAPS effect on land prices below the theoretically predicted. Given that land prices depend on the future stream of rental returns from land, future changes in land rents have an impact on contemporaneous land prices.[7] However, this bias is expected to affect mainly land prices but not necessarily land rents. For land rents the bias is of lower importance as land rents are annual payments.

In the empirical analysis we account for these future policy expectations by proxying the future policy returns with full SAPS payments the NMS will receive in 2013. Although, this is a very approximate information about farm-specific future payments, it represents the best knowledge that farms had about the future payments, as farmers did not have exact knowledge either on the date of the reference period or on the per hectare payment rate.

Farm heterogeneity. Farm heterogeneity has an important impact on subsidy capitalisation into land values. First, the access to the SAPS subsidies may be hindered for less productive farms because of costly administrative and sustainable-farming related requirements. This may lead to an asymmetric farm access to subsidies and

[7] However, the contemporaneous land price may depend on the expectation of land market agents about the size of the SFP capitalisation in land rents. Ciaian, Kancs and Swinnen (2008) analyse the impact of SFP on land rents. They show that in general the capitalisation of SFP in land rents may be smaller than in the case of area payments. However, these results depend on the implementation details of SFP. In certain circumstances the SFP may be fully capitalised in land values (Ciaian, Kancs, and Swinnen 2008). If lower capitalisation of SFP in land rents coincides with the expectations of land market agents, then this also reduces contemporaneous land prices as land prices depend on the future stream of rental returns from land.

hence distort (reduce) capitalisation of the SAPS (see Appendix A1).[8]

Second, farm heterogeneity may also affect the contemporaneous land allocation driven by changes in future policies. If farms are heterogenous and land markets are in equilibrium today, only those farms making positive profits are able to increase the rented area, as marginally, the increase in farm size yields negative profits and only the most profitable farms are able to compensate these short run losses. In addition, the allocation of farmland today based on future subsidies causes uncertainty costs, which are particularly high if the date of subsidy introduction is uncertain (as in the case of the SFP in 2004-2005) and if the date is expected to be far in the future. Given that the SFP reference period and the exact date of the SFP introduction was unknown until 2008, only the most productive farms were able to pay the risk-premium and adjustment costs in 2004 and 2005. Because it is costly to adjust the current land allocation decisions based on future policy expectations, the amount of future subsidies depends on the current farm productivity. Given that more productive farms have lower adjustment costs than less productive farms, we control for this by adjusting the country-average payment by farm productivity.

Accompanying policy measures. Whether subsidy payments are fully reflected in land rents may depend also on other policy instruments (Alston 2007). Generally, the SAPS provides for a flat-rate, per-hectare payment to farmers paid once a year, irrespective of the crops produced, or even whether any crops are produced at all. However, in order to be eligible for the SAPS, farmers are required to maintain land in good agricultural conditions.[9] If maintaining land in good agricultural condition results in additional costs to farms, then the effect of the SAPS on land rents will be smaller than theoretically predicted. However, this bias is expected to be small in the NMS. The cost of keeping land in good agricultural condition may arise only in less productive areas, where land would be abandoned in the absence of the SAPS. In productive agricultural regions it is profitable to keep land in agriculture production even without the SAPS, which implies no additional costs to farms.

Land supply elasticity. The exact effect of the SAPS on land values depends also on the land supply elasticity. In proposition 1 we have shown that with zero supply elasticity the SAPS is fully capitalised into land rents. However, with positive land supply elasticity, the SAPS area payments will not be fully capitalised into land rents. In empirical studies the land supply elasticity is usually found to be positive, though rather low, mostly due to natural constraints. E.g. Salhofer (2001) reports between 0.1 and 0.4 for the EU. This implies that most likely the capitalisation of the SAPS will not be affected significantly by additional farmland supply in the NMS. In the

[8] A typical requirement is so-called "cross-compliance", which means that to get subsidies, among others, farms need to fulfill some agri-environmental conditions (e.g. to keep land in good agricultural conditions). Another criterion may be the minimum farm size. In Estonia, Hungary and Lithuania the average IF farm size is between 1 and 4 hectares (Ciaian and Swinnen 2006).

[9] The main objective of this requirement is to ensure that if land is kept fallow but used to claim the SAPS area payment then this land is maintained such that it can be brought into agricultural production at minimum costs.

empirical analysis the region specific land supply elasticity is captured through the regional effects.

Land use alternatives. Usually, land can be used not only in agriculture but also in other sectors of the economy. If there is such an opportunity, land value will reflect this potential alternative land use. In a competitive market land value reflects returns form the most profitable use of land. If the most profitable use of land is non-agricultural, (e.g. urban housing), then land value will be determined by the profitability of urban housing. Land rents and land prices are affected differently by non-agricultural pressures. Whereas, land rents are mainly driven by contemporaneous non-agricultural land use alternatives, land prices are driven both by contemporaneous and future non-agricultural land use pressures. For example, if the non-agricultural use of land is expected to be profitable in future, then the current land price will reflect the sum of the discounted stream of rents from agriculture up to the time of conversion plus the discounted stream of expected rents from non-agricultural use from that time onward (Livanis et al. 2006; Plantinga et al. 2002). In order to control for non-agricultural pressures we include regional effects in the estimations.

Market imperfections and transaction costs. In the presence of market imperfections, the realised policy impacts might be different than predicted by models with perfect competition (Ciaian and Swinnen 2006; Mishra, Moss and Erickson 2008). Ciaian and Swinnen have shown that land transaction costs related to land withdrawal from corporate farms in transition countries do not affect the general result that area payments increase land rents and benefit land owners instead of farmers (Ciaian and Swinnen 2006). However, transaction costs depress land prices both with and without area payments. In the estimations we include regional dummy variables and the share of CF in land use to partially control for this effect.

According to Ciaian and Swinnen (2006), also credit market imperfections have important implications for land markets and hence for the capitalisation of area payments. Imperfect farm access to credit reduces land profitability and equilibrium land rents. Further, Ciaian and Swinnen show that in a model with land as a fixed factor and credit market imperfections, area payments increase land rents by more than the size of the area payment. This is the case if area payment increases farm credit. Higher farm credit then stimulates land productivity and enhances the effect of area payments on land rents. Therefore, in the empirical analysis a variable capturing farm access to credit is included among the RHS explanatory variables.

Land market institutions and regulations. The effect of subsidies on land value can also be affected by land market regulations. For example, the duration of rental contracts is regulated in several OMS and influences the rental market responsiveness to agricultural policies.[10] According to Ciaian, Kancs and Swinnen (2008), there are

[10] The length of rental contracts is regulated by government in Belgium and France (minimum 9 years), the Netherlands (minimum 6) and Spain (minimum 5). In several OMS (e.g. France), the renewal/inheritance of rental contracts is also regulated. In these countries, formal rental markets

three types of land tax regulations which affect market participants' decisions to sell, buy and own agricultural land: sales taxes, purchase taxes and ownership taxes.[11] Latruffe and Le Mouël (2006) and Kilian et al (2008) show that they may affect either land demand, land supply or both.

Generally, land taxes differ substantially across the NMS. However, there are no important rental market regulations which would restrict the rental price adjustments in the NMS (Swinnen and Vranken 2009). Hence, we do not expect that our empirical results would be significantly affected by land market regulations in the NMS.

Time scale and dynamics. The impact of the SAPS on land markets may vary over time. For example, both formal and informal land rental contracts imply that the transmission of changes in policy into rental prices and asset prices for land is not instantaneous. In addition, rental arrangements are typically multi-year in their nature and often reflect long-term personal relationships, sometimes among members of the same family. Competitive pressures might not take full and immediate effect in such a setting (Gardner 2002). Sluggish adjustment of rental rates implies that the short- and intermediate-run incidence of policies will be different from the long-run outcome with complete adjustment. Moreover, even without contracting, land markets involve lags and dynamics, uncertainty and expectations.

The evidence from Slovakia and Poland shows that with the EU accession, the duration of the land rental contracts increased. In Slovakia before EU accession, contracts tended to be shorter (up to five years). After the accession, contracts became longer to allow farms to use European funds such as those for rural development. A rise in the number of long-term rental contracts was observed also in Poland. Long term contracts (of duration more than 10 years) increased from 46% to 66% in 2005 relative to 2000 (Swinnen and Vranken 2009).

The existence of long-term formal and informal rental arrangements may bias downward the estimated effects of the SAPS on land rents. However, the bias is expected to small, as most rental prices are determined by contemporaneous productivity, even if the contract is signed for several years. The remaining regional differences in rental contract duration are partially captured through regional dummies.

are stickier and the time lag is longer in adjusting to policy changes. The importance of land renting is typically higher in countries with strong rental market regulations, such as Belgium and France. Belgium and France have the highest minimum lengths of rental contracts (9 years) and have the highest share of rented area (77% and 75% in 2006, respectively) among all the OMS.

[11] Land transaction tax rates are rather heterogeneous across the OMS, ranging from 1% for low value land in the United Kingdom to 18% for high value farmland in Italy. Similarly, ownership taxes for agricultural land are highly heterogeneous across countries, ranging from a 0% tax rate on farmland in Finland to over 15% in the Southern EU countries.

4 Empirical analysis

4.1 Data

The main source of data is the Farm Accountancy Data Network (FADN), which is compiled and maintained by the European Commission. The FADN is a European system of sample surveys that take place each year and collect structural and accountancy data on the EU farms. In total there is information about 150 variables on farm structure and yield, output, costs, subsidies and taxes, income, balance sheet, and financial indicators. The yearly FADN sample covers approximately 18,000 agricultural farms in the seven NMS, which implemented the SAPS. In 2004 they represented a population of almost 1,000,000 farms in the seven NMS, covering approximately 90% of the total utilised agricultural area and accounting for more than 90% of the total agricultural production in the NMS. Farm-level data are confidential and, for the purposes of this study, accessed under a special agreement. However, the aggregate FADN data are publicly available.

The FADN is unique in sense that it is the only source of micro-economic data that is harmonised (the bookkeeping principles are the same across all EU Member States) and is representative of the commercial agricultural holdings in the EU. Holdings are selected to take part in the survey on the basis of sampling plans established at the level of each region in the EU. The survey does not, however, cover all the agricultural holdings in the Union (universe defined by Community surveys on the structure of agricultural holdings), but only those which are of a size allowing them to rank as commercial holdings.

In the present study we use an FADN sub-sample, which covers seven NMS implementing the SAPS. From the FADN data for two years (2004 and 2005) we create a balanced panel of farming operations. For each year the FADN data contains information of approximately 18,000 farms in the seven NMS. Although, the total number of farms is roughly equal over the two years, this masks a great deal of turnover. The population of interest are those farms surveyed in both years. This leaves us with 10,465 farms observed over two years, which yields 20,930 observations in total. A summary statistics is provided in Table 1.

4.2 Econometric specification

The theoretical land market model presented in section 3 (equation 6) suggests the following relationship between the farmland rental rate and the SAPS payments:

$$r_{it} = \beta_0 + \beta_1 s_{it} + \beta_2 X_{it} + \eta_{it} \tag{7}$$

where r_{it} is rent on hectare i at time t, s_{it} is the amount of the SAPS payments associated with hectare i at time t, X_{it} is a vector of observable covariates such as market return, yield, sectoral specialisation, farm size, revenue and expenditures, and farm access to credit. As usual, η_{it} is the residual. The η_{it} are assumed to have finite moments and in particular, $E(\eta_{it}) = E(\eta_{it}\eta_{is}) = 0$ for $t \neq s$.

The estimation of equation (7) is subject to several econometric issues. More precisely, we identify three key sources of potential bias: unobserved heterogeneity, simultaneity bias and omitted variable bias. Without addressing these issues, s_{it} will be correlated with η_{it}, and the resulting OLS estimate of β_1 will be biased.

Usually, the capitalisation of agricultural subsidies into farmland values is estimated at regional level, under the assumption of farm homogeneity within the geographic unit of observation (e.g. Duvivier, Gaspart and de Frahan 2005). However, differences in farm size, structure and productivity within a region, which are particularly sizeable in the CEE accession countries, serve to confound the aggregate analysis. Even using farm-level data, not all farm characteristics, such as farm-level soil properties, farmer human capital and managerial skills can be observed by the economist, although, many of these unobservable farm characteristics affect both subsidies and farmland rental rates. Hence, *unobserved heterogeneity* is an important issue in both aggregate and farm level cross-sectional studies.

In order to control for permanent farm-level characteristics that cause β_1 to be inconsistent, we follow Kirwan (2005) and include time-invarying farm fixed effects, which yields:

$$r_{it} = \beta_0 + \beta_1 s_{it} + \beta_2 X_{it} + f_i + \eta_{it} \tag{8}$$

where f_i is the fixed effect for farm i, which captures time-invarying farm-specific characteristics. This fixed effect represents farm heterogeneity. It could reflect different technologies for different farms, it could reflect different managerial skills or it could reflect some other unobservable fixed farm specific characteristic.

In addition to unobserved heterogeneity, endogeneity may also be caused by simultaneity. One potential source of *simultaneity bias* arises if unobserved land characteristics that enhance productivity of farmland may simultaneously raise value added in that region and raise the cost of labour and land in that region. Another source of simultaneity bias may arise if the unobserved characteristics, such as productivity, positively influence both subsidies and rental rates. This positive correlation between subsidies and the unobserved factors that influence productivity might result in an upward bias to capitalisation estimates and confound β_1 as a measure of the effect of subsidies on rental rates.

In our analysis the simultaneity is controlled for in two ways. First, we rely on the fact that the SAPS are calculated based on past and not contemporaneous productivity. This implies that the SAPS are strictly exogenous to farm renting decisions. Second, we include region fixed effects in order to control for unobserved productivity differences between regions. Including the time-varying region specific effects and rewriting equation (8) in first differences yields an empirically estimable time-varying fixed-effects model:[12]

$$\triangle r_i = R + \beta_1 \triangle s_i + \beta_2 \triangle X_i + \triangle \eta_i \tag{9}$$

where R_t is the time-varying region-specific effect, which captures localised effects that might affect farmland rents, and allows for transient shocks, such as whether or pests that affect all farms within a localised region. Hence, in contrast to regional studies on coupled subsidy capitalisation into land values (e.g. Duvivier, Gaspart and de Frahan 2005), the time-varying fixed-effects model presented in equation (9) is resistant to simultaneity bias.

A further potential source of bias is due to *omitted variables*, which arises when common factors that affect both the rental rate and subsidies are excluded from the analysis. For example, soil quality may confound the rental rate and subsidies. Previous studies (e.g. Livanis et al 2006) have attempted to overcome the omitted variable bias by using observable soil characteristics as controls. However, because of a highly non-linear relationships between soil characteristics and productivity, using soil characteristics as controls cannot fully overcome the omitted variable bias. In the present study we avoid the inherently non-linear relationships between soil characteristics and productivity by using farm-level fixed effects.

Another potential source of omitted variable bias is farmer expectations about changes in future policies (see section 3.3). As detailed in section 3.3, in 2013 the current SAPS payments in the NMS will switch to the SFP, which is implemented in the OMS. These policy changes in future payments have two characteristics, which are important for the empirical analysis: (i) the eligible area per farm will be calculated based on the current land use; and (ii) approximate information about changes in future policies is available to farmers already now. Hence, in order to increase their subsidies in the post-2013 period, profit maximising farmers (and land owners) might adjust their current renting behaviour. This implies that change in the rented area and change in the rental rate may be affected by future subsidies, leading to upward biased estimates of the parameter of subsidy capitalisation, β_1.

This source of bias can be addressed by including future subsidies as additional explanatory variable on the RHS. At country level, the post-2013 subsidies which will be implemented in the NMS are approximately known - the average subsidy per farm will be at the SFP level. Therefore, in order to account for expected policy changes in subsidy payments, we include variable $\triangle g$ as a control variable in equation (9). In the empirical analysis we use year 2005 to capture policy changes $\triangle g_{2005-2013}$.[13]

Due to farm heterogeneity and market imperfections, such as credit constraints, not all farms are equally able to adjust their rented area subject to the post-2013 profit maximisation. Assuming that currently land markets are in equilibrium, only

[12] Note that in a panel with $t = 2$, the coefficients estimated from first difference data will be identical to those obtained by including the individual fixed effects.

[13] As a robustness test, we also experiment with year 2004 and the average of 2004 and 2005. The obtained results are similar both in terms of sign and coefficient magnitude and hence not reported.

those farms making positive profits are able to increase the rented area, as marginally, the increase in farm size has negative profits and only the most profitable farms are able to compensate these short run losses stemming from the increase in the rented area. This implies that g_i is farm-specific. In addition to farm productivity, also the regional productivity matters, as usually, farms compete for land within a localised area (region). The higher is the average productivity in a region, the more farms will compete for additional land, the higher will be upward pressure on rents, and the less competitive will be a particular farm on the land market within a region. This implies that farm-level productivity is positively correlated, and regional productivity is negatively correlated with the post-2013 subsidies, g_i.

In order to account for farm-level and regional productivity, which determine farm ability to adjust their current renting behaviour with respect to future subsidies, we condition the country-level future subsidies on the relative farm productivity, $g_i = g\frac{\phi_i}{\phi_r}$ (and $\triangle g_i = \triangle g\frac{\phi_i}{\phi_r}$). Variables ϕ_i and ϕ_r are farm-level and regional total factor productivity (TFP) measures, respectively.

$$\triangle r_i = R + \beta_1 \triangle s_i + \beta_2 \triangle X_i + \beta_3 \triangle g_i + \triangle \eta_i \tag{10}$$

Equation (10) is the final empirical model which we estimate. The coefficient of interest is β_1, which tells the percentage of each marginal SAPS euro that is capitalised into land values. In the estimation of (10) we also include sector, farm-type and dummies and sixty six regional dummies, referring to the FADN regions in the NMS. The regional dummies capture the various development stages in the NMS regions, geographic, climatic and other conditions. We also experiment with including country variables, but their magnitude turns out to be insignificant.

4.3 Variable construction

The dependent variable - farmland rental rate - is constructed from the FADN data. The FADN does not report the rental rate. However, it reports the total amount of rent paid for farm land and rental charges (SE375) and the utilised agricultural areas rented by the holder under a tenancy agreement for a period of at least one year (SE030). From these two variables we construct the per-hectare rental rate by dividing the total rent paid by the hectares rented.

The explanatory variable - the SAPS payments - is also constructed from the FADN data. Every agricultural producer in the FADN sample is asked to report both the total subsidies received as well as to specify the amount by subsidy type received. Among the different types of subsidies farmers in all NMS but Malta and Slovenia report also the Singe Area Payments (SE632). As above, we obtain the per-hectare SAPS payments by dividing the total SAPS payments by total hectares. According to the FADN data, in 2004 the SAPS accounted for 23 percent of total the subsidies in the NMS.

Similarly, the covariates are constructed from the FADN data. All regressors but ratios are measured on a per-hectare basis.[14] The FADN reports the total output (SE131), which is constructed by adding to total sales and own use of crop and livestock products and livestock the change in stocks of products, the change in valuation of livestock, and subtracting the total purchases of livestock. We construct the market return variable by dividing the total output (SE131) by the total utilised agricultural area (SE030). A variable for other subsidies is directly available in the FADN data (SE605), which we divide by the total area. Similarly, a variable capturing the economic size of the farms is also available in the FADN data (SE005). Economic size of holding is expressed in European size units (on the basis of the Community typology). The ratio of family labour/hired labour is constructed by dividing unpaid labour input (SE015) by paid labour input (SE020). Both are directly available in the FADN data. Finally, in order to account for credit constraints, in the regressions we include a ratio of fixed own assets to total liabilities. Total fixed assets (SE441) capture agricultural land and farm buildings and forest capital, buildings, machinery and equipment, and breeding livestock. The variable long and medium term loans (SE490) captures all loans contracted for a period of more than one year. In order to construct the fixed own asset variable, we subtract from total fixed assets the long and medium term loans. Dividing this by total liabilities (SE485), which represent the value at closing valuation of total of (long- , medium- or short-term) loans still to be repaid, we obtain the asset/debt variable of interest. In addition, in order to account for farmer adjustments with respect to the future SFP payments we construct a variable Future SFP payments. From the Eurostat and Agra Europe (2007) we extract approximate future SFP payments by country. As explained in section 2.2, at farm-level the adjustment of current behaviour with respect to the future SFP payments depends on the relative farm productivity. Both farm-level and regional productivity measures are obtained by estimating TFP using the FADN data (see Appendix). Multiplying the relative farm productivity by the future SFP payments yields variable Future SFP payments. A summary of key variables is provided in Table (1).

In addition, we construct six regional variables: wheat yield, total factor productivity, share of CF on total land use, total utilised agricultural area, population density and GDP growth. The last three variables are extracted from the Eurostat database. The rest of the regional variables are constructed from the FADN data. These variables are not included in the main regressions, where region-specific effects are captured through regional dummies. Instead, we use these variables for robustness test by estimating alternative specifications with time-varying regional variables.

To control for regional specific effects we introduce regional dummies. According to the FADN classification of the European Union, the seven NMS (Czech Republic,

[14] The per-hectare form is chosen as it allows for a more natural interpretation of the coefficients. As a robustness test, we also perform the analysis using log-levels. The obtained results are similar to those presented in the paper.

Table 1: Definition and summary of variables, NMS, 2004-2005

Variable	Definition	Source	Year	Mean	Stdev
Dependent variable					
r_{it}	Farmland rent (EUR/ha)	FADN	2004	24.91	17.85
			2005	28.56	18.30
Explanatory variable					
s_{it}	SAPS payment (EUR/ha)	FADN	2004	40.02	16.36
			2005	49.47	19.06
Covariates					
m_{it}	Market return (EUR/ha)	FADN	2004	814.39	353.43
			2005	818.36	318.30
o_{it}	Other subsidies (EUR/ha)	FADN	2004	127.37	29.53
			2005	162.76	37.34
g_i	Future policy changes	EC, FADN[†]	2004	34.98	23.16
			2005	33.72	24.71
z_{it}	Farm size (class)	FADN	2004	57.25	187.02
			2005	57.43	186.47
h_{it}	Family labour/hired labour	FADN	2004	1.77	2.29
			2005	1.80	2.27
c_{it}	Fixed assets/total liabilities	FADN	2004	7.57	8.98
			2005	6.19	6.20

Notes: The data are from the 2004 and 2005 confidential FADN microfiles. [†]Own estimations based on the Eurostat and FADN data. All monetary values are adjusted to 2004 EUR.

Estonia, Hungary, Latvia, Lithuania, Poland and Slovakia) are divided into 65 FADN regions. Regional dummies capture regional unobserved heterogeneity which represent common characteristics for all farms in the region but may differ between regions such as informal and formal land institutions, differences in climatic conditions, and market imperfections. We use two variables to measure productivity: wheat yield and total factor productivity. The variable wheat yield is directly available in the FADN data (SE110) and is calculated as a weighted average wheat yield for each region. We use this variable to capture productivity differences arising from differences in weather, climatic and other conditions between regions over time. The total factor productivity is estimated using the Olley and Pakes estimator and is averaged by region controls for technological change.

In section 3.3 we discussed that CF market power has important impact on land rents. To proxy the market power of CF, we calculate the weighted average CF shares in total land use for each region. To measure the shift in land supply, we calculate country level percentage change in total utilised area. The total utilised area is extracted from the Eurostat database, which is consistent with weighted FADN data.

Finally, in order to account for non-agricultural pressures on land rental markets, in the regressions we include population density at regional level and regional GDP growth. Both these variables are extracted from the Eurostat.

4.4 Results

The theoretical analysis in section 3 offers two testable hypothesis: (i) the contemporaneous SAPS coefficient is around unity; and (ii) the coefficient on future SFP subsidies should have positive impact on contemporaneous land rents. We estimate equation 10 using panel data data estimators. The estimation results are reported in Tables 2 and 3. Table 2 reports panel data estimates in levels, where the dependent variable is farmland rental rate and Table 3 reports first difference estimates.

All estimated models suggest that both present (SAPS payments and other subsidies) and future subsidies (future SFP payments) drive up land rents. The estimates are relatively stable across all models. When accounting for future change in subsidies in the NMS (future SFP payments), the estimated incidence of subsidies reported in Table 2 reduces stronger for other subsidies than for the SAPS. These estimates imply that when accounting for the expected future change in subsidies, the rental price increases between 0.23 EUR and 0.26 EUR for each SAPS payment Euro.

As expected, market returns have a positive and significant impact on land rents (Table 2). The same holds for the variable measuring the relative share of family and hired labour (family/hired labour), though the significance level is smaller. The rent paid by farms increases in the share of family labour. This may be due to productivity differences between family and hired labour (e.g. Pollak 1985; Allen and Lueck 1998). Family labour enhances farm productivity and leads to higher land rents. The results reported in Table 2 show that market return and subsidies are more significant than other variables.

Farms size has negative impact on land rents. This variable may reflect the effect of market power of large farms on land rental markets shown in section 3. In the same time, this variable may account for productivity differences between different classes of farm size.[15] The coefficients of farm size reported in Table 2 are significant

[15] There is ongoing debate in the literature on the relationship between farm size and productivity. The early literature finds inverse relationship between farm size and output per hectare suggesting that small farms are more productive than large ones (Sen 1962; Feder 1985). This relationship is explained by credit market imperfections, asymmetric access to land and differences in family labour endowment. Family labour has higher incentive to work than hired labour because it is residual claimant hence leading to more efficient use of farm recourses if more family labour is employed at farm. More recent literature finds evidence against this hypothesis. Several studies showed that when taking into account, among others, adoption of new technology, soil quality, regional characteristics, and development level, the inverse relationship between farm size and productivity is reduced or disappears (e.g. Bhalla and Roy 1988; Newell, Pandya, and Symons 1997; Deolalikar 1981; Fan and Chan-Kang, 2003). Studies focusing on Eastern Europe mainly analyse the productivity difference between IF and CF. In general the studies are also inconclusive. The studies typically find that the

Table 2: Panel data estimates, dependent variable: farmland rental rate

	RE	FE	RE SFP control	FE SFP control
	(1)	(2)	(3)	(4)
SAPS payments	0.3234***	0.2963***	0.2555***	0.2314***
	(0.0447)	(0.0705)	(0.0340)	(0.0508)
Market return	0.2101***	0.2076***	0.1530***	0.1501***
	(0.0018)	(0.0057)	(0.0013)	(0.0045)
Other subsidies	0.4503***	0.4265***	0.2034***	0.1763***
	(0.0028)	(0.0068)	(0.0014)	(0.0031)
Future SFP payments	-	-	0.1153***	0.1032***
	-	-	(0.0231)	(0.0206)
Farm size	-0.0495**	-0.0207	-0.0237***	-0.0127*
	(0.0110)	(0.0990)	(0.0018)	(0.0137)
Family/hired labour	0.0632*	0.0935*	0.0178	0.1282*
	(0.0784)	(0.1045)	(0.1099)	(0.1486)
Own fixed assets/total liabilities	-0.0038	-0.0071	-0.0254*	-0.1584***
	(0.0116)	(0.0162)	(0.0144)	(0.0061)
N	20,930	20,930	20,930	20,930
R^2	0.45	0.48	0.49	0.52
Hausman test	25.96		38.04	
p-value	0.00020		0.00029	

Notes: Panel data estimates, robust standard errors in parenthesis. All estimations contain also region, sector dummies and farm type dummies. RE - random effects, FE - fixed effects. *significant at 10% level, **significant at 5% level, and ***significant at 1% level.

in all models but model 2. The coefficient associated with the variable share of CF in land use at regional level (not reported) is negative and significant. Two effects may have been captured here: land transaction costs related to land withdrawal from CF and CF market power. Ciaian and Swinnen (2006) showed that both effects reduce land rents. We cannot measure transaction costs directly. However, the higher the share of CF in land use in a particular region, one may expect higher land withdrawal transaction costs. Also the assets-to-liabilities ratio tends to reduce land rents which implies that credit constraint affects land rents. More credit per farm (the smaller the ratio fixed assets/total liabilities) implies higher land rents.

Table 3 reports the first-difference estimates with farm fixed effects. In general,

relative efficiency depends on various factors, including the types of activities (eg grain, livestock, vegetables, ...), institutions, infrastructure and economic conditions (e.g. Mathijs and Swinnen 2001; Gorton and Davidova 2004).

the results reported in Table 3 are consistent with those in Table 2. The estimated incidence of subsidies shown in Table 3 is slightly smaller than the estimated incidence in models 3 and 4 reported in Table 2. However, controlling for future subsidies does not affect the results, which was not the case in Table 2. This could be due to the fact that the variable measuring the future SFP payments captured other effects in the models reported in Table 2. This bias was likely reduced when estimating the first-difference model, because the results reported in Table 3 account also for unobservable farm-level heterogenous effects.

Table 3: First-difference estimates with farm fixed effects. Dependent variable: Change in farmland rental rate

		SFP control
	(1)	(2)
SAPS payments	0.1790***	0.1869***
	(0.0268)	(0.0374)
Market return	0.1187***	0.1128***
	(0.0095)	(0.0299)
Other subsidies	0.0785***	0.0759***
	(0.0059)	(0.0134)
Future SFP payments	-	0.0523***
	-	(0.0105)
Farm size	-0.0396**	-0.0430***
	(0.0149)	(0.0025)
Family/hired labour	0.0347**	0.0306*
	(0.0241)	(0.0407)
Fixed assets/total liabilities	-0.1235***	-0.1149***
	(0.0545)	(0.0909)
N	10465	10465
R^2	0.57	0.63

Notes: OLS estimates, robust standard errors corrected for heteroscedasticity in parenthesis. All estimations contain also region, sector dummies and farm type dummies. *significant at 10% level, **significant at 5% level, and ***significant at 1% level.

The expected change in future subsidies in the NMS (future SFP payments) induces a positive and significant impact on land rents. This implies that future subsidies affect contemporaneous farmland allocation decisions. Various studies have argued that future subsidies may affect current farm decisions hence farmers reacting differently to policies than expected (e.g. OECD 2001).

The estimation results suggest that the SAPS payments are only partially capitalised into land rents. The estimates reported in Table 3 indicate that when accounting for future change in subsidies, land rents would increase by around 0.19 EUR per SAPS payment EUR. The capitalisation of the SAPS is higher than the capitalisation of other subsidies. This result is in line with our expectations, as land-based subsidies directly increase the profitability of land and increase competition for land resources leading to higher land rents.

The estimated incidence of the SAPS payments is smaller than theory suggests as well as smaller than the estimates of Kuchler and Tegene (1993) and Patton et al. (2008). From the theoretical models one would expect that land-based subsidies get fully capitalised into land rents. Kuchler and Tegene (1993) and Patton et al. (2008) find that land tax in US and less favoured area payment in Northern Ireland, respectively, are fully captured in land rents. The comparably low estimates of the SAPS capitalisation in the NMS could be due to other factors, which constrain the adjustment of land rents (see section 3.3). For example, the presence of long term rental contracts and informal institutions in the land rental markets in the NMS. In the same time, the investigated years 2004 and 2005 were the first two years of the SAPS implementation in the NMS and land market agents were not familiar with this type of subsidies. Further, there were delays in the distribution of the SAPS payments to farmers, which might have increased their uncertainty and/or delayed subsidy capitalisation into land values. These issues shall be addressed in future research, when more recent data becomes available.

5 Conclusions

In this paper we analyse the incidence of area payments in the new EU Member States. The SAPS are calculated on the per hectare basis of the agricultural land they use and they will gradually increase during a transition period of ten years. According to the theoretical predictions, in well functioning land markets, area payments would get incorporated into land values and thereby benefit mainly non-farming land owners and lead to increasing input costs for farmers. However factors such as farm heterogeneity, unequal access to the SAPS payments, formal and informal land market institutions, accompanying policy measures and positive land supply elasticity may affect the SAPS capitalisation and lead to a reduced capitalisation into land values.

This paper estimates empirically the size of the SAPS capitalisation into land values in the NMS. Using the FADN farm-level panel data with 20,930 observations from 2004 and 2005 allows us to account for unobserved farm heterogeneity and future policy change. As expected, the estimation results indicate a positive and statistically significant impact of the SAPS area payments on land rents in the NMS. However, the effect is smaller than theoretically predicted under perfect competition. We find that one Euro of the SAPS payments increase land rents by 19 cents. This implies that there are important constraints which prevents a full adjustment of land rents in the NMS. This could be particularly due to information asymmetries, long-term rental contracts, informal rural institutions, and the short time period since the SAPS implementation.

Table 4: Farm size, land renting and non-farming landowner gains from the SAPS

	Farm size, ha		Rental share, %			Landowner gains, %		
	IF	CF	Total	IF	CF	Total	IF	CF
Czech Republic	79	1349	91	76	96	17	14	18
Estonia	88	859	62	55	80	12	10	15
Hungary	34	1089	67	48	99	13	9	19
Lithuania	36	1151	62	55	91	12	10	17
Latvia	52	799	42	38	68	8	7	13
Poland	16	700	28	25	71	5	5	13
Slovakia	164	1459	96	90	97	18	17	18
NMS	21	1126	52	36	92	10	7	17

Notes: Landowner gains, % - non-farming land owner gains in percent of the SAPS payments. Source: own calculations based on Table 3 and the FADN data.

Based on the estimated SAPS incidence and on the FADN data on land renting, we calculate aggregate non-farming land owner gains from the SAPS. The results are reported in Table 4. On average, 10% of the total SAPS payments are channelled to non-farming land owners through higher rental prices in the NMS. The highest leakages of the SAPS payments are in the Czech Republic and Slovakia, where non-farming land owners gain approximatively 18% of the total SAPS value. They are followed by Estonia, Hungary and Lithuania, were around 12% of the SAPS flow to non-farming land owners. In Poland and Latvia the leakages are the smallest, 5% and 8% of the SAPS payments, respectively. The results reveal that, except for Slovakia, the SAPS leakages are stronger for CF than for IF, because on average the share of rented land is larger for CF than IF. On average, CF transfer to non-farming land owners 17% of the total SAPS payments they receive, whereas IF transfer on average only 7% of the total SAPS payments. This implies that IF benefit more from the SAPS than CF. However, the size of CF and IF gains from the SAPS depend on the impact of the SAPS on output and input prices. We did not investigate these effects in this paper, they are a promising avenue for future research.

References

[1] Agra Europe 2007. "Threat of SFP Cuts Rises as NMS Accede", Agra Europe Weekly, January 12.

[2] Allen, A. and D. Lueck. 1998 "The Nature of the Farm." Journal of Law and Economics 41: 343-386.

[3] Alston, J.M. (2007). "Benefits and Beneficiaries from U.S. Farm Subsidies.' AEI Agricultural Policy Series: The 2007 Farm Bill and Beyond. American Enterprise Institute. http://www.aei.org/farmbill.

[4] Alston, J.M. and J.S. James (2002). "The Incidence of Agricultural Policy.' in: B. L. Gardner and G. C. Rausser (ed.), Handbook of Agricultural Economics, Volume 2B, pp. 1689-1749 Elsevier.

[5] Bhalla, S.S. and P. Roy. 1988. "Mis-Specification in Farm Productivity Analysis: The Role of Land Quality.' Oxford Economic Papers 40: 55-73.

[6] Barnard, C.H., G. Whittaker, D. Westenbarger, and M. Ahearn. 1997. Evidence of Capitalization of Direct Government Payments into U.S. Cropland Values. American Journal of Agricultural Economics 79: 642-1650.

[7] Ciaian, P., and J.F.M. Swinnen. 2006. "Land Market Imperfections and Agricultural Policy Impacts in the New EU Member States: A Partial Equilibrium Analysis.' American Journal of Agricultural Economics 88(4): 799-815.

[8] Ciaian, P., and J.F.M. Swinnen. "Credit Market Imperfections and the Distribution of Policy Rents' American Journal of Agricultural Economics Forthcoming.

[9] Ciaian, P., D. Kancs, and J.F.M. Swinnen. 2008. "Static and Dynamic Distributional Effects of Decoupled Payments: Single Farm Payments in the European Union." LICOS Discussion Paper 207/2008.

[10] Deolalikar, A.B. 1981. "The Inverse Relationship between Productivity and Farm Size: A Test Using Regional Data From India.' American Journal of Agricultural Economics 63: 275-279

[11] Duvivier, D., F. Gaspart and B.H. de Frahan (2005). "A Panel Data Analysis of the Determinants of Farmland Price: An Application to the Effects of the 1992 CAP Reform in Belgium.' Paper presented at the XIth EAAE Congress "The Future of Rural Europe in the Global Agri-Food System.' Copenhagen, Denmark, August 23-27, 2005.

[12] EUR-Lex. 2008. "2008 General budget: Title 05 – Agriculture and rural development." http://eur-lex.europa.eu/budget/www/index-en.htm, 05/03/2008.

[13] European Commission. 2002. Analysis of the Impact on Agricultural Markets and Incomes of EU Enlargement to the CEECs. Brussels.

[14] European Commission 2007. Agriculture in the European Union - Statistical and economic information 2007. European Commission, Brussels.

[15] Fan S. and C. Chan-Kang. 2005. "Is small beautiful? Farm Size, Productivity, and Poverty in Asian Agriculture.' Agricultural Economics 32(s1): 135-146.

[16] Feder, G. 1985. "The Farm Size and Farm Productivity: the Role of Family Labour, Supervision and Credit Constraints.' Journal of Development Economics 18: 297-313.

[17] Floyd, J.E. (1965). "The Effects of Farm Price Supports on Returns to Land and Labour in Agriculture", Journal of Political Economy, 73, pp. 148-158.

[18] Gardner, B.L. (2002). "U.S. Commodity Policies and Land Prices.' WP02-02, Department of Agricultural and Resource Economics, University of Maryland, College Park, 2002.

[19] Goodwin, B.K., Mishra, A.K., Ortalo-Magné, F. 2005. "land owners' Riches: The Distribution of Agricultural Subsidies." University of Wisconsin-Madison School of Business, Department of Real Estate and Urban Land Economics, February 2005.

[20] Goodwin, B.K., and F.N. Ortalo-Magné. (1992). "The Capitalisation of Wheat Subsidies into Agricultural Land value.' Canadian Journal of Agricultural Economics 40: 37–54.

[21] Goodwin, B.K., A.K. Mishra and F.N. Ortalo-Magné (2003). "What's Wrong with Our Models of Agricultural Land Value?' American Journal of Agricultural Economics 85: 744-752.

[22] Gorton, M., and S. Davidova. 2004. "Farm Productivity and Efficiency in the CEE Applicant Countries: A Synthesis of Results.' Agricultural Economics 30:1-16.

[23] Guyomard, H., C.L. Mouël, and A. Gohin (2004). "Impacts of Alternative Agricultural Income Support Schemes on Multiple Policy Goals." European Review of Agricultural Economics 31(2): 125-148.

[24] Hartell, J., and J.F.M. Swinnen, eds. 2000. Agriculture and East-West European Integration. Aldershot: Ashgate.

[25] Kilian, S., J. Antón, N. Röder, and K. Salhofer (2008). Impacts of 2003 CAP reform on land prices: From theory to empirical results. Paper presented at the 109th EAAE Seminar, Viterbo, Italy, November 20-21st, 2008.

[26] Kirwan, B. (2005). "The Incidence of U.S. Agricultural Subsidies on Farmland Rental Rates.' Working Paper 05-04. Department of Agricultural and Resource Economics, University of Maryland.

[27] Kuchler, F. and A. Tegene (1993). "Asset Fixity and the Distribution of Rents from Agricultural Polices.' Land Economics 69(4): 428-437.

[28] Latruffe, L., T. Doucha, C. Le Mouël, T. Medonos, V. Voltr (2006). "Capitalisation of government support in agricultural land prices in the Czech Republic." Paper presented at the 93rd EAAE Seminar, Prague, 22-23 September 2006.

[29] Latruffe, L., Le Mouël, C. (2006), How and to what Extent Support to Agriculture Affect Farmland Markets and Prices: A Literature Review. Report for the OECD, Directorate of Agriculture, Paris.

[30] Lence, S.H., and A.K. Mishra. 2003. "The Impacts of Different Farm Programs on Cash Rents", American Journal of Agricultural Economics, 85, pp. 753-761.

[31] Livanis, G., C.B. Moss, V.E. Breneman, and R.F. Nehring. 2006. "Urban Sprawl and Farmland Prices." American Journal of Agricultural Economics 88(4): 915-929.

[32] Mathijs, E. and J. Swinnen. 2001. "Production Organization and Efficiency during Transition: An Empirical Analyses of East German Agriculture.' Review of Economics and Statistics 83:100-107.

[33] Mishra, A.K., C.B. Moss, and K.W. Erickson. 2008. "The Role of Credit Constraints and Government Subsidies in Farmland Valuations in the US: An Options Pricing Model Approach." Empirical Economics 34:285–297.

[34] Newell, A., K. Pandya, and J. Symons. (1997), "Farm Size and the Intensity of Land Use in Gujarat.' Oxford Economic Papers 49: 307-315.

[35] OECD. 2001. Decoupling: A Conceptual Overview. Paris: OECD.

[36] Patton, M., P. Kostov, S. McErlean, and J. Moss. 2008. "Assessing the Influence of Direct Payments on the Rental Value of Agricultural Land." Food Policy 33: 397–405.

[37] Plantinga, A. J., R.N. Lubowski, and R.N. Stavins. 2002. The effects of potential land development on agricultural land prices. Journal of Urban Economics, 52: 561-581.

[38] Pollak, R. A.1985. "A Transaction Costs Approach to Families And Households." Journal of Economic Literature 23: 581-608.

[39] Roberts, M.J., B. Kirwan, and J. Hopkins. (2003). "The Incidence of Government Program Payments on Land Rents: The Challenges of Identification.' American Journal of Agricultural Economics 85: 762-769.

[40] Salhofer, K. (2001). "Elasticities of Substitution and Factor Supply Elasticities in European Agriculture: A Review of Past Studies." In OECD Market Effects of Crop Support Measures. Paris, 89-119.

[41] Sen, A. K. 1962. “An Aspect of Indian Agriculture.’ Economic Weekly, Annual Number.

[42] Shaik, S., G.A. Helmers, and J. A. Atwood. 2005. "The Evolution of Farm Programs and their Contribution to Agricultural Land Values." American Journal of Agricultural Economics 87(5): 1190–1197

[43] Swinnen, J.F.M., and L. Vranken. 2009. Land and EU Accession: Review of the Transitional Restrictions by New Member States on the Acquisition of Agricultural Real Estate. Centre for European Policy Studies (Ceps): Brussels.

[44] Taylor, M.R., and G.W. Brester. 2005. "Noncash Income Transfers and Agricultural Land Values." Review of Agricultural Economics 27(4): 526–541.

A1. Appendix

Farm heterogeneity and asymmetric access to subsidies

An important assumption behind the results in Proposition 1 is that both corporate farms and individual farms receive the same amount of subsidies per hectare. In reality, however, access to the CAP subsidies may be hindered for small individual farmers because of costly administrative and sustainable-farming related requirements. A typical requirement is so-called "cross-compliance", which means that to get subsidies, among others, farms need to fulfill some agri-environmental conditions (e.g. to keep land in good agricultural conditions). Another criterion may be minimum size. In Estonia, Hungary and Lithuania the average IF farm size is between 1 and 4 hectares (Ciaian and Swinnen 2006). The presence of additional (fixed and per-unit) costs implies that some individual farms may not get access to the SAPS payments.

Proposition 2 : *With heterogenous farms and asymmetric farm access to subsidies, the SAPS are partially capitalised into land rents.*

Proof: see Appendix A3.

To analyse this, assume an extreme case where IF do not get the subsidy s. Figure 4 illustrates this situation under perfect competition. The result of unequal access to subsidies is that the IF demand curve D^I is not affected by subsidies, while the CF demand is still represented by D_s^C. The new equilibrium is now at (A_u^*, r_u^*). Notice that land allocation changes now: A_u^* is to the right of $A^* = A_s^*$. Corporate farms use more land, whereas individual farms use less. The increase in rent is smaller than the size of the subsidy: $r_u^* - r^* < s$.

A2. Proof of Proposition 1

To show: $\frac{dr}{ds} = 1$.

A2.1. Perfect competition

Profits of IF, and CF, respectively, are $\prod^I = pf^I(A^I) - (r - s)\,A^I$ and $\prod^C = pf^C(A^C) - (r - s)\,A^C$.

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

First order condition of a representative IF:

$$pf_A^I = r - s \tag{11}$$

CF' first order condition:

$$pf_A^C = r - s \tag{12}$$

Land equilibrium condition:

$$A^T = A^I + A^C \tag{13}$$

Total differentiating equations (11- 13) yields:

$$pf^I_{AA} dA^I = dr - ds \tag{14}$$

$$pf^C_{AA} dA^C = dr - ds \tag{15}$$

$$dA^I + dA^C = 0 \tag{16}$$

Using (A1.4–A1.6), it follows that:

$$\frac{dr}{ds} = \frac{pf^C_{AA} + pf^I_{AA}}{pf^C_{AA} + pf^I_{AA}} = 1 \tag{17}$$

A2.2. Imperfect competition

With imperfect competition and transaction costs, condition (13) must be satisfied, as well as:

First order condition of a representative IF

$$pf^I_A = r - s \tag{18}$$

CF' first order condition

$$pf^C_A = r - s + A^C \frac{\partial r}{\partial A^C} \tag{19}$$

From (13) and (18) $\frac{\partial r}{\partial A^C}$ can be obtained:

$$\frac{\partial r}{\partial A^C} = -pf^I_{AA} \tag{20}$$

Totally differentiating equations (13), (18) and (19) and using equation (20) (with $\frac{\partial^3 f^I(A^I)}{\partial A^{I3}} = f^I_{AAA}$) yields (16), as well as:

$$pf^I_{AA} dA^I = dr - ds \tag{21}$$

$$\left(pf^C_{AA} + pf^I_{AA}\right) dA^C + A^C pf^I_{AAA} dA^I = dr - ds \tag{22}$$

Using (16), (21) and (22), it follows that:

$$\frac{dr}{ds} = \frac{-pf^C_{AA} - 2pf^I_{AA} + A^C pf^I_{AAA}}{-pf^C_{AA} - 2pf^I_{AA} + A^C pf^I_{AAA}} = 1 \tag{23}$$

Q.E.D.

A3. Proof of proposition 2

To show: $0 < \frac{dr}{ds} < 1$, if $s^I = \alpha s$ and $0 < \alpha < 1$, where s^I is the subsidy received by IF with $s^I < s$.

A3.1. Perfect competition

With perfect competition and no transaction costs, (12) and (13) must be satisfied, as well as:

$$pf_A^I = r - \alpha s \tag{24}$$

Totally differentiating (12), (13) and (24) yields (15) and (16) as well as:

$$pf_{AA}^I dA^I = dr - \alpha ds \tag{25}$$

Combining (15), (16) and (25) it follows that:

$$\frac{dr}{ds} = \frac{pf_{AA}^I + \alpha pf_{AA}^C}{pf_{AA}^C + pf_{AA}^I} \tag{26}$$

and $0 < \frac{dr}{ds} < 1$.

A3.2. Imperfect competition

Now conditions (13), (19) and (24) must be satisfied. Totally differentiating equations (A1.3), (A1.9) and (A2.1) and solving for dr/ds yields:

$$\frac{dr}{ds} = \frac{-(1+\alpha)\, pf_{AA}^I + \alpha(-pf_{AA}^C + A^C pf_{AAA}^I)}{-pf_{AA}^C - 2pf_{AA}^I + A^C pf_{AAA}^I} \tag{27}$$

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

$$-pf_{AA}^C - 2pf_{AA}^I + A^C pf_{AAA}^I > 0 \tag{28}$$

This implies that the denominator and the numerator in equation (A2.4) are positive. Hence, unequal subsidies lead to partial capitalisation of s into the land rent ($0 < dr/ds < 1$).

Q.E.D.

Table 5: Development of the SAPS payments in the NMS (2005-2013) (Eur/ha)

	2005	2010	2013
Czech Republic	66	185	259
Estonia	28	85	121
Latvia	23	68	95
Lithuania	36	103	146
Hungary	71	186	262
Poland	51	154	215
Slovakia	54	150	210
NMS	53	152	213

Source: Calculated base on data from European Commission (2007) and Agra Europe (2007)

Table 6: First-difference estimates with farm fixed effects and time-varying country effects. Dependent variable: Change in farmland rental rate

		SFP control
	(1)	(2)
SAPS payments	0.1999***	0.1769***
	(0.0263)	(0.0357)
Market return	0.1184***	0.1135***
	(0.0104)	(0.0314)
Other subsidies	0.0805***	0.0818***
	(0.0058)	(0.0139)
Future policy changes	-	0.0526***
	-	(0.0105)
Farm size	-0.0073**	-0.0030***
	(0.0054)	(0.0018)
Family/hired labour	0.0171	0.0521*
	(0.1658)	(0.1185)
Fixed assets/total liabilities	-0.0868**	-0.0265*
	(0.0530)	(0.0604)
Czech Republic	-0.0058***	-0.0058***
	(0.0005)	(0.0004)
Estonia	-0.0021***	-0.0021***
	(0.0007)	(0.0007)
Hungary	-0.0035***	-0.0034***
	(0.0011)	(0.0008)
Latvia	-0.0009***	-0.0010***
	(0.0004)	(0.0004)
Poland	-0.0002***	-0.0002**
	(0.0001)	(0.0002)
Slovakia	-0.0061***	-0.0065***
	(0.0026)	(0.0025)
N	10465	10465
R^2	0.61	0.67

Notes: OLS estimates, robust standard errors corrected for heteroscedasticity in parenthesis. All estimations contain also region, sector dummies and farm type dummies. *significant at 10% level, **significant at 5% level, and ***significant at 1% level.

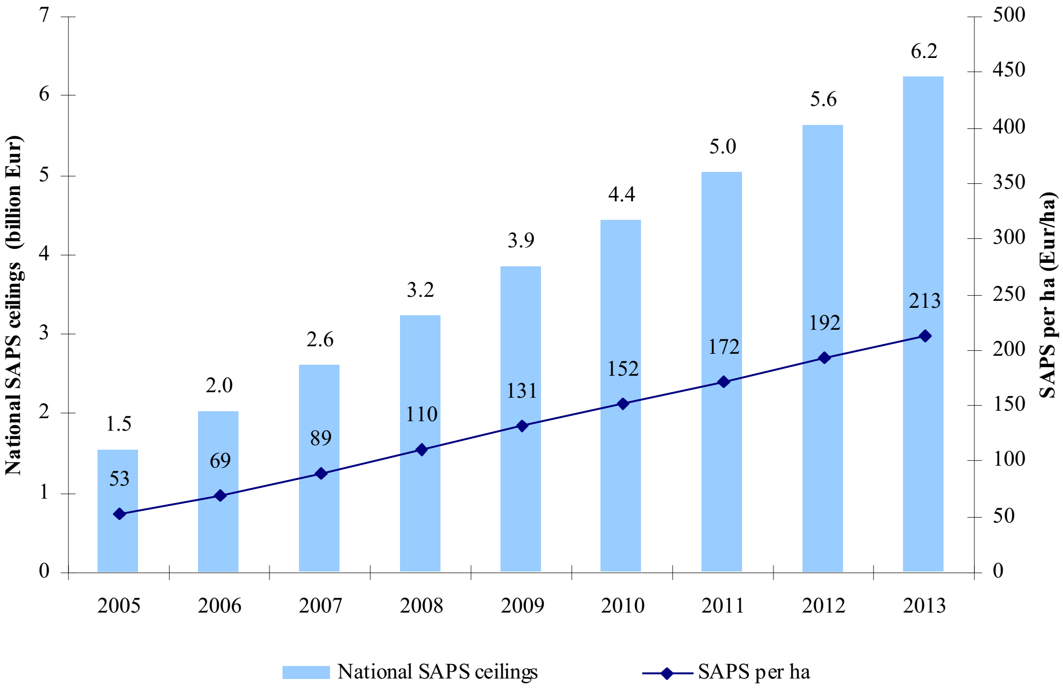

Figure 1: The development of the SAPS in the NMS (2005-2013). Notes: The NMS includes Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland and Slovakia. Source: Own calculations based on the European Commission (2007) and Agra Europe (2007) data.

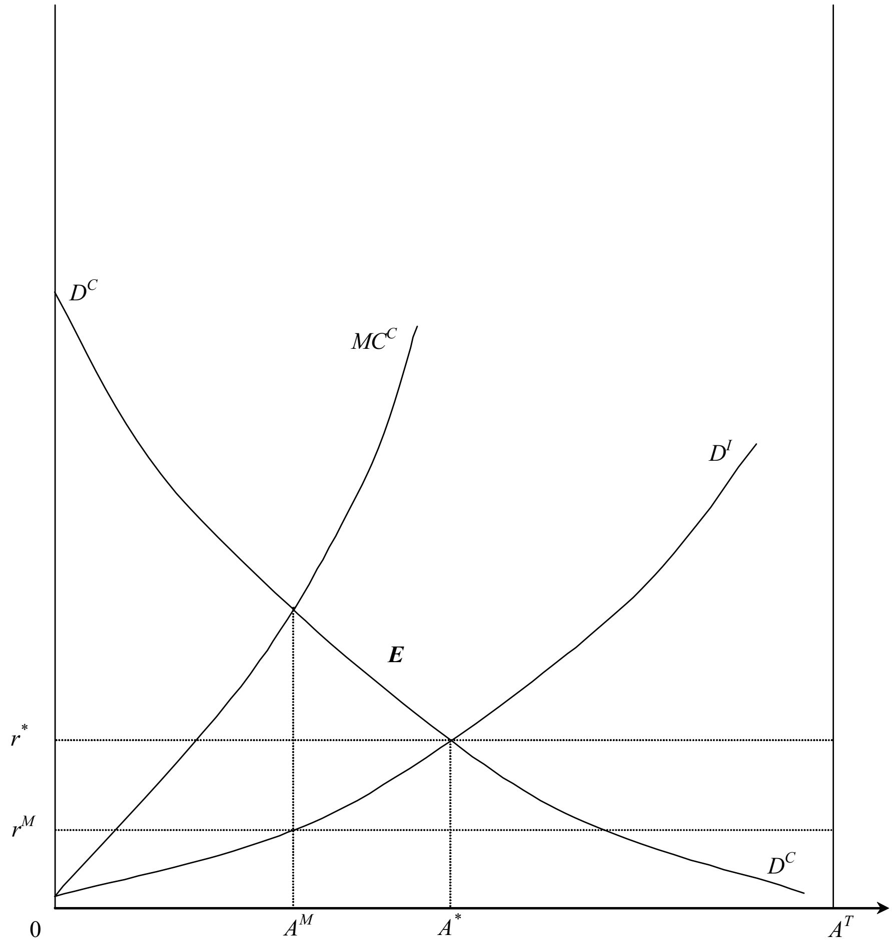

Figure 2: The income effect of imperfect competition on land market

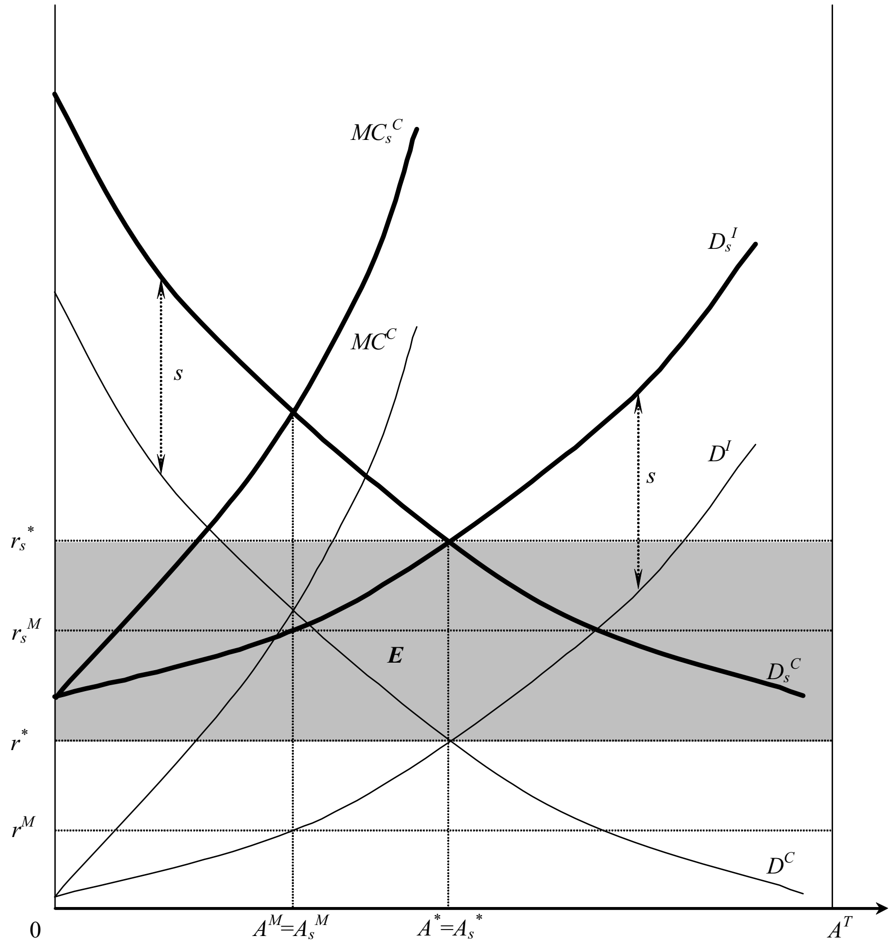

Figure 3: The effect of subsidies under imperfect competition on land market

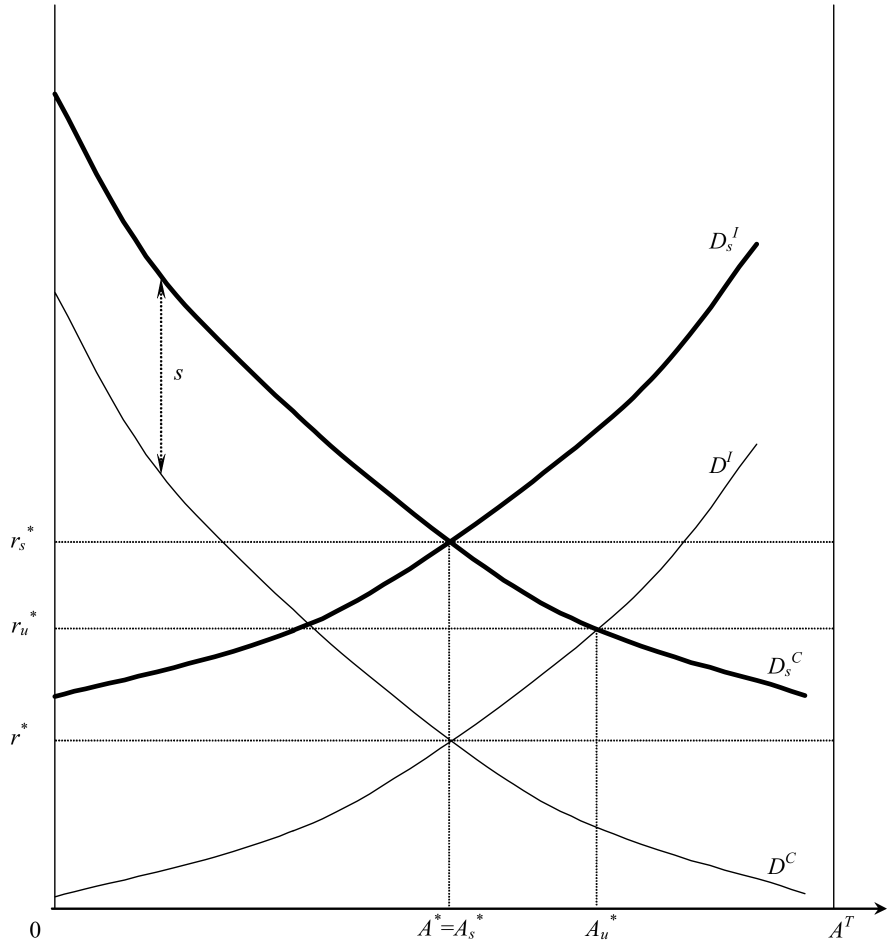

Figure 4: The effect of subsidies under asymmetric farm access to subsidies