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

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Abstract

This study investigates the impact of the SAPS (Single Area Payment Scheme) on farmland rental rates in the New EU Member States. Using a unique set of farm level panel data with 20,930 observations for 2004 and 2005 we are able to control for important sources of endogeneity. According to our results, the SAPS has a positive and statistically significant impact on land rents in the EU. However, the estimated incidence is smaller than predicted theoretically. Land rents capture only 0.19 of the marginal SAPS Euro, implying that around 10 percent of the SAPS 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: Agricultural policy, decoupled subsidies, capitalisation, land value.

JEL classification: F12, L11, Q11, Q12, Q15, Q18, P32, R12, R23.

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1 Introduction

Since the accession to the EU in 2004, the New EU Member States (NMS)[1] are receiving considerable amounts of farm income support through the Single Area Payment Scheme (SAPS). The SAPS brought two major changes to farmers in the NMS. First, the switch to the SAPS decoupled policy support from farm production. Second, it increased the average payments per farm (Ciaian, Kancs and Swinnen 2010). In addition, due to the SAPS-induced changes in agricultural input and output markets, the income distributional effects may be different than targeted by policy makers. For example, an influential study of OECD (2001) came to the conclusions that only 20% of all market and price support in the OECD countries resulted in net farm surplus gains; the rest was dissipated to others, including the owners of production factors.

The distributional effects of agricultural policy, which Alston and James (2002) refer as the 'incidence of agricultural policy', have been studied extensively in the literature. 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, Le Mouël, and Gohin 2004; Ciaian, Kancs and Swinnen 2008). The empirical evidence confirms the theoretical predictions that agricultural subsidies do affect farmland prices. Studies on area-based subsidies find a capitalisation rate between 0.2 and 1.0 (Kuchler and Tegene 1993; Barnard et al. 1997; Patton et al. 2008). Kuchler and Tegene estimate the impact of land tax on land rents using data from seven states in the US.[2] Kuchler and Tegene find that all tax costs are incurred by land owners, which implies their full (negative) capitalisation into land rents. Patton et al. investigate the impact of various types of the CAP direct payments on land rental values in Northern Ireland for the period 1994 - 2002. They find that less favoured area payments are fully capitalised into land rents.[3] Patton et al. also find that area based subsidies lead to a higher capitalisation rate into land values than other types of subsidies. Studies on non-area based subsidies also find a capitalisation rate between 0.2 and 1.0 (Goodwin, Mishra and Ortalo-Magné 2003, 2005; Lence and Mishra 2003; Roberts, Kirwan, and Hopkins 2003; Taylor and Brester 2005). According to Alston (2007); Kirwan (2009); Plantinga et al. (2002), the share of subsidies which gets capitalised into land values depends, among others, on policy implementation details, expectations

[1] In the present study the NMS are referred to as the Czech Republic, Estonia Latvia, Lithuania, Hungary, Poland and Slovakia.

[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 it is paid to farmers located in less productive regions.

about changes in future policies, market imperfections, and formal and informal land institutions.

Given that most of the existing studies focus on North America (the US and Canada), and only few authors consider subsidy capitalisation in the EU (Goodwin and Ortalo-Magné, 1992; Duvivier, Gaspart and Henry de Frahan, 2005; Patton et al. 2008), the main objective of the present study is to analyse the distributional effects of the SAPS in the NMS. More precisely, we attempt to assess the capitalisation rate of the SAPS into farmland rental prices in the NMS. Our main contribution to the literature is to provide the first estimates on the SAPS capitalisation rate into farmland rental prices in the NMS. Using a large panel of firm level data for the NMS, we are able to address important econometric issues, such as unobservable heterogeneity, which cannot be dealt with in regional or cross-section studies.

The distributional effects of the SAPS have very important policy implication for the NMS, where farmland renting is considerably more important than in developed countries. On average, 52% of agricultural land is rented (the share of rented farmland varied between 28% in Poland and 96% in Slovakia in 2010). 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 small individual farms (IF) mostly own agricultural land (Ciaian et al 2011), 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 hence across countries in the NMS.

2 Agriculture in the NMS

2.1 Rental market for agricultural land

Land is one of the main inputs in agricultural production. Compared to the old EU member states (OMS), farmland renting is considerably more important in the NMS. A particularly large share of farmland is rented in Slovakia and the Czech Republic, where the rented farmland represents more than 90% of the total utilised agricultural area (UAA). Also in Hungary, Estonia and Lithuania land renting dominates (more than 60% in 2005). In Poland and Latvia farms rent less than 50% of the total land they use (Ciaian et al 2011).

There are also sizeable differences in renting behaviour between different types of farms. On average, CF tend to rent most of the land they use, while IF tend to use both owned and rented land (CF rent 92% whereas IF rent 36% of the UAA in the NMS). 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 in the NMS, if land owners absorb part of the subsidies, e.g. through higher rental rates.

Usually, in the NMS land rents are paid at the end of the season (after harvest) in cash. Given that land rents are calculated based on market conditions at the end of the season, they depend on the observable land productivity.[4] When production is low, e.g. due to unfavourable weather or market conditions, the rent is reduced or not paid at all (Ciaian, Kancs and Swinnen 2010).

2.2 Single Area Payment Scheme (SAPS)

Since the 1992 MacSharry reform and the Agenda 2000, the vast majority of the CAP subsidies in the EU are the so-called direct payments (DPs). In 2010, 39.3 billion euro were spent on DPs in the EU (EUR-Lex 2010). They made up to two-thirds of the CAP budget and hence were a central issue in the NMS accession negotiations. During the negotiations the NMS and OMS agreed that the direct payments will start at 25% of the OMS level in the first year after the accession and continuously increase over 10 years reaching the OMS level in 2013.[5]

Given the administrative complexity of the CAP, which made a full implementation of the Agenda 2000 infeasible in a short time period, it was agreed that a simplified version of the CAP will be implemented in the NMS (SAPS), under which farmers receive a per hectare payment. With the exception of Slovenia, all other NMS from Eastern Europe adopted the SAPS from the first year of the accession.[6]

According to EUR-Lex (2008), the total SAPS payments will increase from around 1.6 billion in 2004 to around 6.2 billion Eur in 2013 in the NMS, while per hectare payments will increase from 53 to 212 Eur/ha in the same period. There is a significant variation in the SAPS payments between countries. On average in the period

[4] In several NMS land rents are also paid in kind or through sharecropping. For example, in Poland more than 20% of land rents in 2005 were paid in kind rather than in cash. 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 (Ciaian et al 2011).

[5] In addition to the SAPS, the national budgetary resources (the so-called top-ups) are used to increase the DPs by some additional 30%. In general, these payments are coupled to crop and animal production.

[6] Slovenia introduced the Single Farm Payments (SFP) and for this reason it was not considered in the paper. The SFP differs from the SAPS with respect to its implementation (see further) and with respect to its impact on land markets (see for example Ciaian and Swinnen 2006; Ciaian, Kancs and Swinnen 2008).

2004-2013, 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) (Agra Europe 2007; European Commission 2010; EUR-Lex 2010).

These differences in the value of the SAPS area payments between 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 the crop and animal direct payments, which farmers would receive under the Agenda 2000. Different years between 1995 and 2001 were used as a reference period for different products in different NMS.[7] The total value of direct payments represented the country's 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 CAP.

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.[8] Under the SFP, the subsidies will be given as a fixed set of payments per farm. In other words, the SFP is an entitlement, the size of which depends on the eligible area. For an individual farm the size of the SFP depends on the cultivated area in the reference period. Under the current regulation if the NMS would decide to implement the SFP, their reference period would be 2005-2007.

3 Theoretical framework

3.1 The model

The conceptual framework of the present study builds on extensive theoretical work on the distributional effects of agricultural subsidies (Floyd 1965; Alston and James 2002; de Gorter and Meilke 1989; Gardner 1983; Guyomard, Le Mouël, and Gohin 2004; Salhofer 1996; Ciaian and Swinnen 2006; Ciaian, Kancs and Swinnen 2010). Most studies apply partial equilibrium models either assuming representative farm

[7] 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.

[8] According EU regulations, the NMS can keep the SAPS until 2013, after which they have to switch to the SFP (EUR-Lex 2003a 2003b; European Commission 2008; EUR-Lex 2009).

models or by considering supply-demand market representation of the analysed sectors.

Following Ciaian and Swinnen (2006), who analyse the income distributional effects of the SAPS in a partial equilibrium model, the representative farm's output, $f(A/T)$, depends on the amount of land, A, and the non-increasing to scale production technology, T, with $f_A > 0$, $f_{AA} < 0$ and $f_T > 0$.[9] The entire land is assumed to be owned by land owners, which rent it to the farm.[10] The maximisation of profit function, $\prod = pf(A/T) - (r - s)A$, together with market clearing conditions yields:

$$pf_A = r - s \tag{1}$$

$$A = S(r) \tag{2}$$

$$f = D(p) \tag{3}$$

where p is the price of farm output, r is the rental rate of land, s is the SAPS, $S(r)$ is the land supply, and $D(p)$ is the output demand. Equation (1) is farm marginal equilibrium condition of land derived from profit maximisation. Equations (2) and (3) are market clearing conditions for land and output, respectively.

Totally differentiating equilibrium conditions (1) – (3) yields the following capitalisation effect of the SAPS:

$$dr = ds \left(1 - pf_{AA} - p\frac{f_A^2}{f}\frac{1}{\varsigma}\right)^{-1} \frac{1}{\epsilon}\frac{r}{A} \tag{4}$$

where ϵ is land supply elasticity, and ς is output demand elasticity. With $f_{AA} < 0$, $\epsilon > 0$ and $\varsigma < 0$, the product of the second and third term on the right hand side of equation (4) is positive, implying that the capitalisation rate is between zero and one, $0 \leq dr/ds \leq 1$.

Equation (4) suggests that the capitalisation of the SAPS into land rent, r, is increasing in the SAPS.[11] In addition, the capitalisation of the SAPS also depends

[9] f_i and f_{ii} are first and second derivatives of the production function with respect to its arguments, respectively.

[10] This distinction between land owners and farmers is convenient for our explanation but is not essential for the analysis and the derived results (Ciaian, Kancs and Swinnen 2008).

[11] Ciaian and Swinnen (2006) have shown that these results also hold in imperfectly competitive land markets. In several NMS the farm sector is dominated by large corporate farms. For example, in countries such as the Czech Republic and Slovakia large corporate farms cultivate more than 70% of the agricultural land. The dominance of corporate farms may allow them to exercise market power on the land market by being able to alter the market rental price.

on output price, output demand, and land supply. The output demand elasticity, ς, which measures the rate of output price adjustment to farm production change, stimulates land use by increasing output supply, and exerting downward pressure on output price, and thus resulting in income losses to the agricultural sector. The output price decline decreases in the demand elasticity, implying an inverse relationship between the SAPS and land rate: the capitalisation rate of the SAPS is increasing in demand elasticity. The land supply elasticity, ϵ, reduce land owners' gains, whereas with fixed land supply, $\epsilon = 0$, land owners benefit the full value of the SAPS ($dr/ds = 1$).

3.2 Other determinants of the SAPS capitalisation

In addition to the relative elasticities of land supply and demand, the capitalisation rate of the SAPS depends also on other factors. For example, whether the price adjustment is perfect or not and/or whether the SAPS is conditional on other requirements or not.

The capitalisation of the SAPS may be affected by the *conditionality* on fulfilling certain farm management criteria. 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.[12] 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 conditions 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.

The effect of the SAPS on land rents is affected also by *land rental contracts and rural institutions*. Both formal and informal land rental contracts imply that the transmission of changes in policy into land rental prices is not instantaneous. Rental arrangements are typically multi-year in their nature and cover either written contractual arrangements between farmers and land owner or reflect long-term personal relationships in rural communities, sometimes among members of the same family (Ciaian, Kancs and Swinnen 2010). Competitive pressures might not take full and

[12] 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.

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 presence of long-term formal and informal rental arrangements might yield lower capitalisation rates than predicted by the theoretical literature. Moreover, the size of the bias may be country-specific, because the types of rental contracts vary considerably between different types of farms. Big commercial type farms tend to apply written multi-year types of rental contracts. Family type farms tend to use both written and informally arranged contracts (e.g. oral) but with latter being more common. The evidence from Slovakia and Poland shows that with the EU accession, the duration of the land rental contracts has increased (Ciaian et al 2011). 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 CAP rural development payments. A rise in the number of long-term rental contracts was also observed in Poland. Long term contracts (of duration more than 10 years) increased from 46% to 66% in 2005 relative to 2000 (Ciaian, Kancs and Swinnen 2010).

The current farm behaviour may be subject to uncertainties about policy changes (OECD 2001; Shaik, Helmers, and Atwood 2005). When farmers, land owners and other market participants make their decisions, they take into consideration the policy risk related to uncertainty about future subsidies. 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, it was agreed to postpone the SFP implementation to 2013 (EUR-Lex 2003a 2003b; European Commission 2008; EUR-Lex 2009; Bureau and Witzke 2010).

Farmer expectations about future CAP changes may have affected farms' land use decisions in the period of our analysis. Because the future SFP subsidies will depend on the current land use, farms may have been motivated to accumulate more land than currently optimal,[13] creating in such a way additional land demand and leading to higher land rents than without future policy change. This implies that

[13]Note that all land qualifies for SAPS including that which farms decide to rent beyond the optimal level.

expectations about future policy shift to SFP might result in higher land rates in the current period. However, since the SFP reference period and the exact date of the SFP introduction was unknown until 2008, the bias is expected to be rather small for the period of our analysis (2004 and 2005).

4 Empirical analysis

4.1 Econometric specification

According to the theoretical model (4), changes in land rental rates are determined by the SAPS, output price, output demand, and land supply. In addition, also farm specific characteristics, such as market return, yield, sectoral specialisation, farm size, revenue and expenditures, and farm access to credit affect the rental price for land:

$$\triangle r_i = \beta_1 \triangle s_i + \beta_2 \triangle X_i + \triangle \eta_i \tag{5}$$

where, as above, r_i is land rent for farm i, s_{it} is the amount of the SAPS payment per hectare, X_{it} is a vector of observable covariates. The selection of covariates is based on findings of Ciaian, Kancs and Swinnen (2010) and Ciaian et al (2011), which study the determinants of agricultural land values in the EU. Similar covariates were used by other studies on capitalisation of subsidies into farm land rents (e.g. Lence and Mishra 2003; Patton et al. 2008; Kirwan 2009). As usual, η_{it} is the residual, which is assumed to have finite moments: $E(\eta_{it}) = E(\eta_{it}\eta_{is}) = 0$ for $t \neq s$.

The estimation of the SAPS capitalisation is subject to several econometric issues. First, omitted variables, such as unobserved productivity factors, may bias the subsidy-rental rate relationship. Second, a significant number of farms in the Farm Accountancy Data Network (FADN) data set do not rent any land. Excluding them from the estimations may result in sample selection bias.

Many farm characteristics that influence both subsidies and farmland rental rates cannot be observed. 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. Given that unobserved productivity factors may confound the rental rate and subsidies, this positive correlation between subsidies and the unobserved factors that influence productivity might result in an upward bias of capitalisation estimates and confound β_1 as a measure of the effect of subsidies on rental rates.[14] Without addressing the unobserved farm heterogeneity, s_{it} would be corre-

[14] Previous studies (e.g. Livanis et al 2006) have attempted to overcome the omitted variable bias by including observable soil characteristics as controls. However, because of a highly non-linear

lated with η_{it}, and the resulting OLS estimate of β_1 would be biased. We control for permanent farm-level characteristics that cause β_1 to be inconsistent, by employing panel properties of the FADN data, and as Kirwan (2009) include time-unvarying farm fixed effects as explanatory variable. In our model the farm effect is absorbed by first-differencing the data.[15]

A further potential source of omitted variable bias is farmer expectations about changes in future policies. As detailed in the previous section, 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) information about most likely changes in future policies is available to farmers already now. 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.

This source of bias can be addressed by including future subsidies as explanatory variable on the right hand side. At country level, the post-2013 SFP subsidies are approximately known - they will be at the SAPS level in 2013. Therefore, in order to account for the expected policy changes in future subsidies, we include variable g_i as a control variable in equation (5). In the empirical analysis we use the SAPS change in 2013 relative to 2005 adjusted by productivity to capture policy changes (see below).[16]

Due to farm heterogeneity and market imperfections, such as credit constraints, not all farms are equally able to adjust their rented area subject to long-run (post-2013) profit maximisation. Assuming that land markets are in equilibrium, only those farms making positive profits would be able to increase the rented area, as marginally, any increase in farm size would yield negative profits, which can be compensated only by the most productive farms. 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 the same 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, in relative terms, the less competitive will be a particular farm on the

relationship between soil characteristics and productivity, using soil characteristics as controls cannot fully overcome the omitted variable bias.

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

[16] 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 magnitude and therefore not reported.

land market within that region. This implies that farm-level productivity is positively whereas 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.

Next, we need to address the selection bias. A significant number of farms in the FADN data set do not rent any land. Because of missing left hand side variables, these farms are excluded from our sample. If the farm rental decision is non-random, then the standard estimation approach would result in biased estimates. Indeed, one may expect that more dynamic farms and/or those with limited own land resources may be more inclined to participate on rental markets compared to less dynamic, part-time and/or subsistence farms. Similarly, more productive and dynamic farms received higher per hectare subsidy as, on average, they cultivate more productive, non-marginal land and have a higher share of 'subsidy hectares' in the total cultivated area. Given that farms with zero rentals drop out from equation (5) (as their land rental prices do not exist), the farm rental selection might potentially bias the subsidy coefficient.

To control for the selection bias related to farms' rental market participation decisions, we employ the Heckman's sample selection model (Heckman 1979), and adopt a two stage estimation approach. In the first stage, we examine the determinants of farms' decision to rent agricultural land using a Probit model.[17] The first stage includes both land characteristics and characteristics of the farm, which likely influence the propensity to rent land. The farm covariates are as follows: whether the farm is a family farm, whether farming is the principal occupation, whether the farm size has increased compared to the previous year, whether the number of hours worked by own labour is larger than the number of hours worked by hired labour. In the second stage, we estimate the rental equation, where the selection bias is controlled by including the Inverse Mills Ratio (IMR) computed in the first stage.[18]

Although, the FADN sampling strategy is representative and methodologically consistent (see next section), theoretically, the estimation of equation (**??**) could suffer also from attrition bias. The FADN is an unbalanced panel, where every year 5

[17] The dependent variable h_i is a dichotomous $(1, 0)$ variable indicating whether the i-th farm rented land or not.

[18] If IMR is significant in the second stage, it suggests a sample selection bias in the initial model. One potential limitation of the Heckman method is that if the Heckman in the selection model is not well-specified, the IMR may be weaker than expected and the Heckman method may have limited power to detect bias. As a result, a second factor to examine following the addition of the IMR variable into the initial specification models is whether or not there have been significant changes in any of the parameter estimates.

to 20 percent of farms is dropped from the sample. Farms are excluded either because of the FADN sampling strategy of regular annual replacement of observations and/or because of other reasons (voluntary drop-out, exit from farming). If some groups of farms drop out from the sample more frequently than others, then the standard estimators would yield biased results. Therefore, we test also for the attrition bias using the Heckman's sample selection model. We find no significant impact on the estimated coefficients.[19]

In order to control for unobserved productivity differences between regions, we include region fixed effects, R_{jt}. The time-varying region-specific effect, R_{jt}, captures localised effects that might affect farmland rents, and allows for transient shocks, such as weather or pests that affect all farms within a localised region. As a result, the time-varying fixed-effects model (6) is resistant to bias caused by weather and pest differences between regions, which are varying over time, and, at least theoretically, might have affected the calculated per-hectare subsidy in the reference period.

Further, in order to capture rental price differences due to farm specialisation and farm type, in the estimation of equation (6) we also include sector and farm-type dummies.[20][21] As a result, we obtain the following empirically estimable time-varying fixed-effects model:

$$\triangle r_i = R_j + \beta_1 \triangle s_i + \beta_2 \triangle X_i + \beta_3 \triangle g_i + \beta_4 \triangle IMR_i + \triangle \eta_i \qquad (6)$$

where $\triangle r_{it}$ is change in land rent for farm i, R_j are region fixed effects, $\triangle s_i$ is change in the SAPS payment per hectare, X_{it} captures change in the observable covariates, $\triangle g_i = g\left(\phi_i/\phi_r\right)$ captures the impact of future subsidies, where ϕ_i and ϕ_r are farm-level and regional total factor productivity (TFP) measures, respectively, and IMR_i is the the Inverse Mills Ratio.

Equation (6) is the final empirical specification which we estimate. The coefficient of interest is β_1, which measures the share of each marginal SAPS euro that is capitalised into land rents.

[19] Similar as in the case of selection bias related to farms' rental market participation, in the first stage we examine the determinants of farms' decision to exit the sample using the Probit model. In the second stage, we estimate the rental equation with correcting for the selection bias by the inclusion of the Inverse Mills Ratio computed in the first stage. Because the estimated results are not affected significantly, we do not follow this approach.

[20] The sectoral dummies capture 14 different farm specialisation types, which are changing over time, among others, due to crop rotation and other agronomic requirements. Farm-type dummies capture the restructuring of farms in the post-centrally-planned transition economies. Both farm sectoral specialisation and farm type may affect productivity and hence rental price.

[21] We also experiment with country level variables, but their magnitude turns out to be insignificant.

4.2 Data and variable construction

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.[22] In total there is information about 150 variables on farm structure and yield, output, inputs, 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, 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.

The FADN is unique in sense that it is the only source of harmonised (the book-keeping principles are the same across all EU Member States) and is representative micro-economic data in the EU. Farms 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 FADN survey does not, however, cover all agricultural farms in the EU, but only those which are of a size allowing them to rank as commercial holdings (FADN 2010).

In the present study we use a sub-sample of the FADN data, 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. 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.

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),[23] 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

[22] The surveys are conducted by national authorities.

[23] The rental costs in the FADN data include not only farm land rents, but also rents for buildings and other rental charges. We made an attempt to correct for this data issue (e.g. by excluding high value rents which may represents rental for buildings), but one must take this into consideration when interpreting the results because the data may still contain a measurement error bias.

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 received subsidies, farmers also report the Singe Area Payments (SE632). We obtain the per-hectare SAPS payments by dividing the total SAPS payments by total hectares (SE025). According to the FADN data, in 2004 the SAPS accounted for 23 percent of all the subsidies in the NMS.[24]

The identification of the rental price change due to the SAPS is given by three sources of SAPS variation. The first source is the interregional variation of SAPS. Different regions have different value of subsidies, hence leading to year-to-year regional variation in the hectare value of SAPS. Second, farms which use non-eligible land will have lower SAPS per hectare than farms with all land qualifying for the SAPS. Third, although farms are eligible for the payments, in some cases the payment is claimed by landowners. This farms experience lower level of SAPS and hence have lower willingness to bid rental price up. However, this effect may lead to underestimation of the impact of the SAPS on land rent, because actually landowners benefit from the SAPS as they are direct payment recipients. There are no data available to account for this effect. According to data, the coefficient of variation (standard deviation divided by mean) of the first differenced hectare values of SAPS (2005 relative to 2004) varies between 0.4 and 1.05. All three sources of variation pose limited endogeneity problem as both are independent of farm behaviour and tend not to ne linked to farm characteristics. The first source of variation is determined by past regional productivities[25] and the second and third sources are determined by policy and market conditions, respectively. The land eligibility is imposed by the policy whereas whether farms or landowner apply for the SAPS is determined by institutional setting of land rental contracts.

Similarly, the covariates are constructed from the FADN data. Their selection is based on findings of Ciaian, Kancs and Swinnen (2010) and Ciaian et al (2011), which

[24] The remaining 77% of subsidies are coupled payments and include subsidies such as crop and livestock coupled payments, investment payments, environmental payments, etc. These payments are allocated to farmers independently of the SAPS. In general, they depend on the current activity level of the farm to which they are targeted on (e.g. cultivated area of supported crop, stock of supported livestock, supported farm environmental practices). Their exact value is set by the EU CAP regulation. However, there is tendency to support livestock sector through this payments in some NMS. The main objective is to offset the disadvantage of a lower farmland area available on livestock farms which may result in less SAPS payments allocated to this type of farms. This implies that the total value coupled payments might be correlated with the total value of the SAPS but their hectare values are independent of each other, because the SAPS per hectare value does not depend on the farm activity level. To control for their potential impact on land rents, we introduce the variable other subsidies in the estimated equation.

[25] As a robustness test, we also perform estimations by MS, but we do not find significant differences compared to the full sample results.

study the determinants of agricultural land values in the EU. Similar covariates were used by other studies on capitalisation of subsidies into farm land rents (e.g. Lence and Mishra 2003; Patton et al. 2008; Kirwan 2009). All covariates except ratios are measured on a per-hectare basis.[26] Given that agricultural productivity is one of the key determinants of farmland rental rates, we include a variable capturing market return. 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 (SE025). A variable capturing all other subsidies is directly available in the FADN data set by subtracting SAPS (SE632) from the total subsidies (SE605) and divide by the total area. In order to capture higher market power of large farms on land rental markets, we include a variable capturing the economic size of the farms, which is also available in the FADN data set (SE005). Economic size of holding is expressed in European size units on the basis of the EU typology.[27] Given that land rent may increase with the share of family labour due to productivity differences between family and hired labour, we include the relative share of family and total labour. The ratio of family labour/total labour is constructed by dividing unpaid labour input (SE015) by total labour (SE010) (unpaid plus paid labour input). Both are directly available in the FADN data. Finally, in order to account for farm access to credit, in the regressions we also include the assets-to-liabilities ratio by dividing total fixed assets (SE441) with long and medium-term loans (SE490) plus total fixed assets (i.e. SE441/(SE441 + SE490)). The total fixed assets 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 addition, in order to account for farmer adjustments with respect to the future SFP payments, we construct a variable called 'Future policy changes'. From the Eurostat and Agra Europe (2007) we extract approximate future SFP payments by country. Then we subtract the SFP payments in 2013 from the SAPS in 2005 to obtain future subsidy change. As explained above, 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

[26] 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.

[27] The economic size of holding is expressed in European size units on the basis of the Community typology – the total standard gross margin in euro / 1200.

by estimating TFP using the FADN data (see Kancs and Ciaian 2010). Multiplying the relative farm productivity by the future subsidy change yields variable Future policy changes. A summary of key variables is provided in Table 1.

Table 1: Definition and summary statistics of key variables

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 (ESU)	FADN	2004	57.25	187.02
			2005	57.43	186.47
h_{it}	Family labour/total labour	FADN	2004	0.565	0.437
			2005	0.556	0.441
c_{it}	Assets-to-liabilities ratio	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.

In addition, we construct six regional variables: wheat yield, total factor productivity, share of CF in 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 region specific effects we introduce regional dummies. According to the FADN classification of the European Union, the seven NMS (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland and Slovakia) are divided into 66 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 (Kancs and Ciaian 2010). In order to account for non-agricultural pressures on land rental markets, in robustness tests we include population density at regional level, regional GDP growth and country-level percentage change (2005 relative to 2004) in the total utilised area. These variables are extracted from the Eurostat.

As discussed in section 2, CF's market power has important implications for land rents. In order to proxy for the CF's market power, we calculate weighted average shares of CF in the total land use for each region.

4.3 Results

We estimate equation (6) using first difference estimator with farm fixed effects. The results are reported in Table 2. Models (2) and (4) control for (*future policy changes*), whereas models (3) and (4) control for a potential sample selection bias. All estimations contain also region, sector dummies and farm type dummies (suppressed in Table 2).

All estimated models suggest that the contemporaneous subsidies (*SAPS payments* and *other subsidies*) drive up land rents in the New EU Member States. The estimates are relatively stable across the four models. When accounting for expectations about future changes in subsidy payments (*future policy changes*), the estimated incidence of subsidies slightly reduces, whereas the decrease is stronger for other subsidies than for the SAPS. These estimates imply that, when accounting for the expected future changes in subsidy payments, the rental price of farmland increases between 0.18 EUR and 0.20 EUR for each SAPS payment Euro. 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, which increases competition for land resources leading to higher land rents. These results are in line with the underlying theoretical model, according to which the SAPS may get capitalised into farmland rents if land supply is inelastic. Given that empirical studies find rather low (between 0.1 and 0.6) land supply elasticity (Salhofer 2001), land owners may benefit a substantial share of the total value of the SAPS area payments through higher rental prices.

The estimated incidence of the SAPS payments is comparable to that of Kirwan (2009), who finds that farmers who rent the land they cultivate capture around 75 percent of the subsidy, leaving just 25 percent for landowners. The findings of the present study and of Kirwan (2009) contradict the prediction from neoclassical models. According to the theoretical literature (Floyd 1965; Alston and James 2002; de Gorter and Meilke 1989; Gardner 1983; Guyomard, Le Mouël, and Gohin 2004; Salhofer 1996; Ciaian and Swinnen 2006), land-based subsidies get capitalised to a large extent into land rents. The standard prediction may not hold due to other factors constraining the adjustment of land rents, such as, imperfections in the farmland rental market, the presence of long term rental contracts and informal institutions in the land rental markets in the NMS. Second, 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 farm uncertainty and/or delayed subsidy capitalisation into land values. These issues should be addressed in future research, when more recent data becomes available.

Similarly to contemporaneous subsidies, the expected change in future subsidies (*future policy changes*) induces a positive and significant impact on land rents. This implies that future subsidies affect contemporaneous farmland allocation decisions in the NMS. These results are line with studies arguing that future subsidies may affect current farm decisions, therefore farmers may react to policies differently than expected (OECD 2001; Shaik, Helmers, and Atwood 2005).

As expected, market return has a positive and significant impact on land rents (Table 2). These results suggest that agricultural profitability is an important determinant of farmland rental rates. These results are in line with the previous literature (Goodwin, Mishra and Ortalo-Magné 2003, 2005; Lence and Mishra 2003; Roberts, Kirwan, and Hopkins 2003). The estimated coefficient is statistically significant at 1% in all estimated models.

Similarly, the relative importance of family labour in total labour (*family/total labour*) has a positive and significant impact on land rents, though its significance is lower. These results are in line with literature on farm structure (Pollak 1985; Allen and Lueck 1998). In line with these studies, land rent may increase with the share of family labour due to productivity differences between family and hired labour. Family labour enhances farm productivity and leads to higher land rents. However, the importance of family labour is less significant than the market return and subsidy variables.

Table 2: First-difference estimates with farm fixed effects.

	(1)	(2)	(3)	(4)
SAPS payments	0.1932***	0.1870***	0.1827***	0.1964***
	(0.0259)	(0.0358)	(0.0243)	(0.0349)
Market return	0.1220***	0.1098***	0.1187***	0.1044***
	(0.0099)	(0.0319)	(0.0105)	(0.0343)
Other subsidies	0.0807***	0.0778***	0.0864***	0.0807***
	(0.0060)	(0.0120)	(0.0065)	(0.0124)
Future policy changes	-	0.0513***	-	0.0468***
	-	(0.0103	-	(0.0098)
Farm size	-0.0281**	-0.0432***	-0.0256**	-0.0389***
	(0.0192)	(0.0112)	(0.0184)	(0.0111)
Family /total labour	0.0344*	0.0558**	0.0326*	0.0556*
	(0.1458)	(0.0959)	(0.1513)	(0.1053)
Assets-to-liabilities ratio	-0.0288**	-0.0493***	-0.0303**	-0.0529***
	(0.0345)	(0.0117)	(0.0364)	(0.0123)
Inverse Mills Ratio (IMR)	-	-	0.0103	0.0082
	-	-	(1.9021)	(1.8851)
N	10465	10465	10465	10465
R^2	0.57	0.65	0.61	0.66

Notes: OLS estimates, robust standard errors corrected for heteroscedasticity in parenthesis. All estimations contain also region, sector dummies and farm type dummies (suppressed in Table 2). *significant at 10% level, **significant at 5% level, and ***significant at 1% level.

Farm size has a negative impact on land rents; the coefficient is significant in all models reported in Table 2. It may reflect the effect of market power of large farms on land rental markets. In the same time, this variable may account for productivity differences between different farm sizes. The previous literature is not conclusive 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 (Feder 1985). This result 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. The more recent literature finds evidence against this hypothesis. Several studies have shown that when taking into account, among others, the 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; Deolalikar 1981). Studies focusing on Eastern Europe mainly analyse the productivity difference between IF and CF. These studies typically find that the relative efficiency depends on various factors, including the types of activities (e.g. crop, livestock, vegetables), institutions, infrastructure and economic conditions, which in turn depend on the type of farm (e.g. Gorton and Davidova 2004).

The coefficient of the 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) show that both effects reduce land rents.[28] Hence, the higher is the share of CF in land use in a particular region, the higher can be expected the land transaction costs and the CF market power.

The assets-to-liabilities ratio tends to reduce land rents, which implies that farm access to credit may affect land rents negatively. More credit per farm (the smaller the ratio fixed assets/total liabilities) implies higher land rents and vice versa. The selection bias was examined using the Heckman's model. The insignificant Inverse Mills Ratio in models (3) and (4) suggests no evidence of its existence.

5 Conclusions

In this paper we analyse the incidence of CAP subsidies in the New EU Member States. According to the underlying theoretical framework, in well functioning land markets area payments would get incorporated into land values and thereby benefit mainly land owners. On the other hand, they would increase the input costs for farms. 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 reduce the SAPS capitalisation into land values.

This is the first paper which empirically estimates the size of the SAPS capitalisation into land values in the NMS. Using a unique farm-level panel data set with 20,930 observations for 2004 and 2005 we are able to control for important sources of endogeneity. The estimation results indicate a positive and statistically significant

[28] According to Ciaian and Swinnen (2006), land withdrawal transaction costs increase the costs of rental transactions hence they reduce activity on the rental market and push rental prices down. Corporate farms may not be price takers in the land rental market. For example, in countries such as Slovakia, where they occupy around 90% of the land, CF may have important market power and may affect rental prices. Ciaian and Swinnen (2006) use a dominant buyer model to show that renting land in large quantities allows CF to affect market rents. Through their rental behaviour they may set the rental price below the competitive market rent yielding market power gain to CF.

impact of the SAPS on land rents in the NMS. However, the effect is smaller than theoretically predicted. Our estimates suggest that one Euro of SAPS payments per ha increases land rents per ha by 19 cents. This implies that there are important constraints which prevent full adjustment of land rents in the NMS. These could be, for example, due to information asymmetries, long-term rental contracts, informal rural institutions, and the short time period since the SAPS implementation. However, because in some NMS the payment may be claimed directly by landowners and not by farmers, our estimate might slightly understate the total landowners benefit from the SAPS.

Table 3: Farm size, land renting and non-farming land owner gains from the SAPS

	Share of rented farmland, %			Non-farming land owner gains, %		
	Total	IF	CF	Total	IF	CF
Czech Republic	91	76	96	17	14	18
Estonia	62	55	80	12	10	15
Hungary	67	48	99	13	9	19
Lithuania	62	55	91	12	10	17
Latvia	42	38	68	8	7	13
Poland	28	25	71	5	5	13
Slovakia	96	90	97	18	17	18
NMS	52	36	92	10	7	17

Notes: land owner gains, % - non-farming land owner gains in percent of the SAPS; IF- individual farms, CF - corporate farms. Source: own calculations based on Table 3 and the FADN data for 2005. In all calculations we assume a 19 percent incidence.

Based on the estimated SAPS incidence and on the FADN data on land renting, we calculate the aggregate non-farming land owner gains from the SAPS. The results are reported in Table 3.[29] 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 approximately 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. These results suggest that, except for Slovakia, the SAPS leakages are stronger for CF than for IF, because on average the

[29] We assume a 19 percent incidence. To obtain the non-farming land owner gains from the SAPS, we adjust the incidence rate for the rental share. Implicitly, we assume that the rental income from own land represents the return to farmers (i.e. to farming land owner).

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.

Our results indicate that the SAPS to a large extend is in line with the policy objective of promoting standard of living of the agricultural community since the SAPS capitalisation rate into land rents and its leakage rate to non-farming land owners are relatively low. In 2010 the total value of SAPS represented around 4.4 billion Euros (EUR-Lex 2010). If we consider the 10% leakage rate of SAPS to non-farming land owners (Table 3), only around 0.44 billion Euros is channelled outside farming sector. Second, the leakage rate is bigger for large CF than for small IF due to differences in land renting patterns which also tends to be in line with the policy objective to promote smaller holdings rather than large farm enterprises.

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