FACTOR MARKETS

Comparative Analysis of Factor Markets for Agriculture across the Member States

245123-FP7-KBBE-2009-3

WORKING PAPER

No. 29, July 2012

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Income Distributional Effects of Decoupled Payments

Single Payment Scheme in the European Union

ABSTRACT

This paper analyses the effects of the Single Payment Scheme (SPS) with and without farm structural change. Particular focus is placed on how income distributional effects and farm restructuring are impacted by the SPS under: alternative entitlement tradability, cross-compliance and CAP 'greening' requirements, different SPS implementation models, the entitlement stock, market imperfections and institutional regulations. The authors find that the SPS implication details are highly significant: farmers' benefits can range from 100% of the SPS value to a negative policy incidence, and farm structural change may be hindered by the SPS.

Key words: Decoupled subsidies, capitalisation, land market, income distributional effects, SPS, structural change.

JEL: H22, L11, Q11, Q12, Q15, Q18, P32, R12.

Available for free downloading from the Factor Markets (www.factormarkets.eu) and CEPS (www.ceps.eu) websites

ISBN 978-94-6138-219-1

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1. Introduction

The distributional effects of agricultural policy, which Alston and James (2002) refer to as the "incidence of agricultural policy", have been studied extensively in the literature. Previous studies have analysed how these effects differ among policies (Alston & James, 2002; de Gorter & Meilke, 1989; Dewbre, Anton & Thompson, 2001; Gardner, 1983; Guyomard, Mouel & Gohin, 2004), how the results change if one includes more agents along the vertical chain (Desquilbet & Guyomard, 2002; Sheldon, Pick & McCorriston, 2001) or if one takes into account imperfect competition (McCorriston & Sheldon, 1991 and Salhofer & Schmid, 2004), imperfections in factor markets (Ciaian & Swinnen, 2006; 2009), or transaction costs and constraints in the implementation of the policies (OECD, 2007; de Gorter, 1992; Munk, 1994; Vatn, 2001).[1]

Early studies focused on policies that were coupled to production decisions, e.g. the price intervention or production quotas. After the decoupling of policy support in the late 1990s in the US and 2003 in the EU, more recent studies have analysed the impact of decoupled subsidies (e.g. Chau & de Gorter, 2005; de Gorter, 2007; Goodwin & Mishra, 2006; Hennessy, 1998; 2004; Serra et al., 2005; Sckokai & Moro, 2006). However, only few studies have looked at the income distributional effects of the EU Single Payment Scheme (SPS) (e.g. Ciaian & Swinnen, 2006, 2008; Courleux, et al., 2008; Kilian & Salhofer, 2008).

Courleux et al. (2008) and Kilian and Salhofer (2008) find that the impact of the SPS largely depends on the ratio of the eligible area to the total number of entitlements. If the allocated entitlements are in deficit relative to the eligible area of land, then the SPS benefits farms, the SPS is not capitalised into land values. However, if the allocated entitlements are in surplus, then the SPS gets capitalised into land values. Additionally, Kilian & Salhofer (2008) show that the income distributional effects of the SPS depend significantly on the implementation model, i.e. in the variability of the SPS between farms. They show that the larger the SPS variation between farms, the higher the capitalisation rate of the SPS may be.[2]

According to Ciaian, Kancs and Swinnen (2010), a further important determinant of the SPS capitalisation is the conditionality of the SPS. In the EU farm eligibility for the SPS is subject to cross-compliance and, according to European Commission (2011), also future SPS might be subject to the 'greening' requirements. Given that both the cross-compliance and the

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[1] There are also important empirical studies measuring the impact of agricultural policies on land markets (Goodwin, Mishra & Ortalo-Magné, 2003; Lence & Mishra, 2003).

[2] There is a large related literature on the effects of tradability of production quota (Alston, 1981; Burrell, 1989; Babcock & Foster, 1992; Guyomard et al., 1996; Sumner & Wolf, 1996; Boots, Oude Lansink & Peerlings, 1997; Bureau et al., 1997; Bureau, Guyomard & Requillart, 2001).

'greening' impose additional costs to land use, the net effect of the SPS rent distribution would be lower.

Conceptually, an important shortcoming of previous studies is that they assume fixed farm structure in perfectly competitive markets to investigate the distributional effects of the SPS (Courleux et al., 2008; Kilian & Salhofer, 2008). They do not take into account the potential adjustments in farm structure, which may be a result of various factors, such as improvement in the technology and rural institutions, farm entry and exit, the SPS-induced alleviation of farm credit problems and the associated productivity growth, as well as decoupling – which accompanied the introduction of the SPS – potentially resulting in the adjustment of the farm production mix and farm efficiency, causing a structural adjustment of the farming sector. They also do not take into account the presence of market imperfections and institutional rigidities, which affect the distributional effects of the SPS however.

The objective of this paper is to analyse the impacts of decoupled payments on land values in the EU – the SPS – by explicitly capturing the income distributional and farm restructuring effects in the presence of structural change, such as, exogenous productivity change and farm entry/exit, and market imperfections and institutional rigidities. For this purpose we adopt the land market model of Ciaian and Swinnen (2006), which allows us to capture farm heterogeneity and structural effects of the SPS on rural land markets.

However, the implications of the SPS may differ if one considers structural change. Even though the SPS may be un-distortive in an environment with static farm structure, it still may affect adjustments in the agricultural sector in the presence of structural change. Moreover, the SPS may interact with farm restructuring by preventing markets from full structural adjustments. By neglecting these effects one may under- or over-estimate the true impact of the SPS.

Structural change is a medium- to long-run process, which might interact with and be affected by SPS if the policy is in place for a longer duration. Given that recent developments in the Common Agricultural Policy (CAP) suggests a continuation of the SPS into the next EU financial period spanning from 2014 to 2020,[3] the implementation of the SPS system with structural change may have different impacts than those analysed in recent studies without structural adjustment (Courleux et al., 2008; Kilian & Salhofer, 2008).

Our second contribution is in analysing the SPS effects in the presence of market imperfections and institutional rigidities. Rural land markets are often constrained by various rigidities and imperfections, which may affect land market response to the SPS. The two most important imperfections identified in the literature and analysed in the paper are credit market imperfections, and land market institutions and regulations (Blancard et al., 2006; Lee & Chambers, 1986; Färe, Grosskopf & Lee, 1990; Ciaian & Swinnen, 2009; Ciaian, Kancs & Swinnen, 2010).

2. Agricultural policy in the EU

In 2003 the Common Agricultural Policy (CAP) underwent significant reforms. The 2003 CAP reform decoupled most of the direct payments by introducing the SPS from 2005 onwards.[4] Since then the SPS entitlements have been allocated as a fixed set of payments per farm. Farms are entitled to yearly payments, depending on the number of SPS entitlements and the eligible land they possess.

In 2011 the European Commission drafted a proposal for the CAP application for the new financial period 2014-20. The main features of the current SPS will remain largely

[3] In 2011 the European Commission proposed to maintain the SPS system largely unchanged in the next financial period (European Commission, 2011).

[4] MS could choose to introduce the SPS either in 2005 or in 2006. For comparison purposes, the data used in this paper covers the period before and after the introduction of SPS in the EU-15 (see below).

unchanged. The key difference to the current policy framework is related to stronger linkage of the SPS to agricultural practices beneficial to the environment (so-called “CAP greening”).

2.1 Entitlements

Under the SPS each farm is allocated a fixed amount of the SPS entitlements. Farms can only activate the entitlements and receive the corresponding payments if they are accompanied by an equal amount of eligible land.[5] This implies that the SPS is indirectly linked to land because, in the absence of an eligible amount of land, farms cannot cash in the SPS entitlements. However, the SPS is not linked to a specific area of land. An SPS entitlement can be activated by any eligible farmland in the region.[6]

This setting of subsidy implementation makes the SPS different from a standard area subsidy. Under the standard area subsidy farms receive payments for the entire area they use, whereas with the SPS only a pre-defined quantity of land (determined by the number of entitlements) may obtain payments. The standard area subsidy is implemented in the new EU member states (MS).

2.2 SPS implementation models

When implementing the SPS, the MS could choose between three different SPS implementation models: the historical model, the regional model, and the hybrid model. Under the historical model, the SPS is farm-specific and equals the support the farm has received in the "reference" period. Under the regional model, an equal per hectare payment is granted to all farms in the region. The hybrid model is a combination of historical and regional models, it has two versions: a static and a dynamic version. The key difference between the three models is in the unit value of entitlements. Under the historical and hybrid models the value of entitlement varies between farms (stronger in the former than in the latter), whereas under the regional SPS model all farms in a given region received entitlements with the same unit value. Currently the most commonly implemented SPS model in the EU is the historical model.

The 2011 Commission's proposal envisages convergence towards a uniform value at MS level (or regional level within MS) in the new financial period 2014-20; implying a shift to the regional model. However, the proposal introduces additional payments that can supplement SPS, such as young farmer payments and payments to farmers located in disadvantaged areas. These additional payments may result in variations of per-hectare SPS payments across regions and farms within a MS.

2.3 Cross-compliance requirements

Farm eligibility for the SPS is subject to cross-compliance. Each farm that receives the SPS must comply with the “statutory management requirements”, and maintain the agricultural land in “Good Agricultural and Environmental Condition”. The cross-compliance covers standards in the field of the environment, land management, food safety, animal and plant health and animal welfare, maintenance of soil organic matter and structure, preservation of habitats, and water management.

In the past the statutory management requirements were based on EU directives and regulations, such as the Nitrates Directive. The 2003 CAP reform made cross-compliance compulsory and extended the coverage of requirements in the fields of environment, public,

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[5] According to EU regulations, the eligible areas for the activation of payment entitlements include any agricultural area used for an agricultural activity or predominantly used for agricultural activities (EUR-Lex, 2009).

[6] Under certain conditions MS can also allocate new entitlements from the national reserve but their allocation is not automatic. Member states create the national reserve by a linear percentage reduction (up to 3%) of their SPS national ceiling.

plant health and animal welfare. A farm's failure to respect these conditions can lead to a reduction or a complete stop of the SPS payments. According to current EU regulations, the entire land area cultivated by farms receiving the SPS must respect the cross-compliance criteria, irrespective of whether all or part of the SPS entitlements are activated and irrespective of whether all or part of the agricultural land is used for the activation of the entitlements (EC, 2003).[7]

According to Ciaian, Kancs and Swinnen (2010), adherence to the cross-compliance requirements implies additional costs for farms. Given the heterogeneity of farms in the EU, the costs related to meeting cross-compliance requirements will have heterogeneous impacts on the land markets and hence on the income distributional effects of SPS.

2.4 CAP 'greening'

The 2011 Commission proposal introduces a 'greening' component to decoupled payments, according to which a basic SPS payment will be supplemented by additional greening payments taking up to 30% of the SPS envelope. The 'greening' requires farmers to implement agricultural practices beneficial to climate and environment, which go beyond the cross-compliance requirements. The CAP greening consists of three main requirements: crop diversification, maintenance of permanent grassland and an ecological focus area (set-aside). Under crop diversification, farmers' cultivation of the arable land needs to include at least three different crops with the minimum and maximum threshold for each crop being set at 5% and 70% of the arable land, respectively. Under the maintenance of permanent grassland, farmers need to maintain permanent grassland on the areas declared grassland in 2014. The ecological focus area requires farms to set aside at least 7% of farmers' eligible hectares (excluding areas under permanent grassland). The areas that qualify as ecological focus area include land left fallow, terraces, landscape features, buffer strips, etc. Similar to cross-compliance, farms' failure to fulfil the greening requirement may result in a reduction of SPS payments.

2.5 Entitlement tradability

Generally, entitlements are tradable. However, due to regulatory constraints and market imperfections, the tradability of entitlements might be heavily constrained because of regulatory restrictions and market imperfections. First, the SPS entitlements are tradable only within MS (not among them) and under certain conditions. The general EU regulations specify that the lease and similar market transactions with entitlements are allowed only if the transferred entitlements are accompanied by an equivalent number of hectares of eligible land (European Council, 2003). Farms may transfer their entitlements without land only once they have used at least 80% of their payment entitlements during one year, or once they have voluntarily given up all unused entitlements to the national reserve in the first year of the SPS. If more than 20% of the SPS value is allocated from the national reserve then the entitlement cannot be transferred for five years.[8]

The tradability of entitlements may also be constrained by market imperfections, such as imperfectly functioning rural credit markets or policy uncertainty. Given that the SPS represents the right to a future stream of subsidies, a potential buyer would need to pay the

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[7] The activation of at least one entitlement is sufficient to make cross-compliance obligatory on all farmland. Even areas not used for entitlement activation must be farmed in accordance with the cross-compliance requirements.

[8] The MS can impose additional country-specific restrictions on the transfer of entitlements. For example, a MS may decide that payment entitlements may only be transferred or used within a region. Member states may also require that in the case of a sale of payment entitlements without land, up to 50%, and in the case of sale of payment entitlements with land, up to 10% must be reverted to the national reserve. In terms of the entitlement tradability France, Portugal and Spain are the most restrictive countries (Ciaian, Kancs & Swinnen, 2010).

seller the present net value of the future stream of subsidies in competitive markets. However, if the buyer is credit constrained, then his/her ability to pay for entitlements is reduced, which acts as a tax on entitlement sellers. In addition, policy uncertainty introduces a risk component to the entitlement market, because there is uncertainty about the duration of the SPS. The current CAP framework and the financial allocation run until 2013. The post-2013 CAP is subject to negotiation between MS. However, both the implementation of the SPS and its budgetary allocation may change in the future. As with credit market imperfections, the uncertainty about the future development of the CAP reduces the willingness to participate in the entitlement market; the effect of which is similar to an entitlement tax.

3. Conceptual framework

3.1 Land market model

The conceptual framework of the present study builds on Ciaian and Swinnen (2006) who model area payments (a uniform per hectare payment) in the new MS. We adopt this land market model to illustrate the distributional and structural effects of the SPS. The model captures farm heterogeneity, which allows an accounting for farm structural change. Following Ciaian and Swinnen (2006), to account for farm heterogeneity and the SPS variation across farms, we assume that agricultural goods are produced by two types of farms.[9] The output of each farm type is assumed to be a continuous and increasing function of the amount of land used, A^i. Output price, p, is assumed fixed and the same for all farms. The entire land is owned by landowners, who rent it to farmers.[10]

Farms maximize profits, $\prod^i$, which is the difference between sales revenue and land rent:

$$\prod^i = pf^i(A^i) - wA^i$$

where w is rental rate and $f^i(A^i)$ is a well-behaved production function with $f^i_A > 0$, $f^i_{AA} < 0$. Farms compete for land by renting the amount of land that maximizes their profits:

$$pf^i_A = w$$

$$A^1 + A^2 = A^T$$

Equation 0 represents the marginal conditions of land, and equation 0 determines the equilibrium in the land market, where the total agricultural land (A^T) is assumed to be fixed.[11]

Graphically, the land market is illustrated in upper panel of Figure 1. The horizontal axis shows the quantity of land, the amount of land rented by farm 1 (A^1) is shown from the left to right on the horizontal axis, whereas the amount of land rented by farm 2 (A^2) is shown from the right to left with $A^2 = A^T - A^1$. The vertical axis measures the rental price and subsidies. The initial land demands of farm 1 and farm 2 are given by downward sloping curves D^1 and

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[9] Implicitly, we assume that farm 1 represents *n* farms of the same type and farm 2 represents *m* farms of the same type. A similar approach was applied by Courleux, et al. (2008) by assuming two profit maximizing producers in the agricultural economy.

[10] This distinction between landowners and farmers is convenient for our explanation but is not essential for the analysis and the derived results.

[11] This assumption does not affect the general results of the model. Non-fixed land supply with positive elasticity implies that derived capitalisation rates of SPS, if any, (see further) are lower than with fixed land supply. However, due to low elasticity of land supply (Salhofer, 2001) the downward adjustment of the SPS capitalisation rate is probably small. In empirical studies the land supply elasticity is usually found to be rather low, mostly due to natural constraints. For example, based on an extensive literature review, Salhofer (2001) concludes that a plausible range of land supply elasticity for the EU is between 0.1 and 0.4. For more details on the implication of non-fixed land supply on SPS capitalization, see Courleux et al. (2008).

D^2, respectively, derived from the marginal conditions 0. Without the SPS, the equilibrium set of land allocation and land rent is (A^*, w^*). Farm 1 rents A^* hectares of land ($A^1 = A^*$) and farm 2 rents $A^2 = A^T - A^*$ hectares of land.

3.2 Introducing the SPS

We extend the land market model of Ciaian and Swinnen (2006) by introducing the SPS. Let us denote the endowment of the SPS entitlements of type 1 owned by farm 1 by A_E^1, and its unit face value by t^1 (Figure 1). Analogously, A_E^2 $(= A^T - A_E)$ is the endowment of entitlements of type 2 owned by farm 2 and t^2 is its unit face value.

In the presence of the SPS, farm i's profit maximization problem 0 changes as follows:

$$\prod^i = pf^i(A^i) - wA^i - c^i(A^i)A^i + t^i A_{EA}^i + \gamma p_t^i\left(A_E^i - A_{EA}^i\right) + \gamma\left(t^j - p_t^j\right)A_{ET}^j$$

subject to the entitlement activation constraint $A_{EA}^i + \gamma A_{ET}^j \le A^i$ for $i, j = 1$ and 2;

where $c^i(A^i)$ are cross-compliance costs (which may vary with land use A^i), A_{EA}^i is the number of activated entitlements of type i, A_{ET}^j is the total number j entitlements purchased and activated by farm i, A_E^i is the initial entitlement endowment, p_t^i is the entitlement price, and γ captures the tradability of entitlements: $\gamma = 0$ implies non-tradable entitlements, while $\gamma = 1$ implies fully tradable entitlements.[12] The entitlement activation constraint $A_{EA}^i + \gamma A_{ET}^j \le A^i$ represents the fact that farms can activate entitlement payments only, if accompanied by the necessary amount of land. Note that farm i initially owns A_E^i entitlements, part $\left(A_E^i - A_{EA}^i\right)$ of which may be sold or unused.[13] Conversely, farm i can acquire entitlements A_{ET}^j by purchasing from farm j. The total endowment of entitlements, $A_E^i + A_E^j$, may or may not exceed the total land, A^T, implying that they may be in surplus, $A_E^i + A_E^j > A^T$, or in deficit, $A_E^i + A_E^j < A^T$.

Farm i's decision variables include: the amount of rented land, A^i, the number of activated entitlements, A_{EA}^i, of type i and the number of purchased and activated entitlements, A_{ET}^j, of type j. Farms compete for land by renting the amount of land that maximizes their profits. The FOC and market clearing conditions yield 0 as well as:

(1) $pf_A^i = w + c^i - \lambda^i$ for $i = 1$ and 2

(2) $\gamma p_t^i \le t^i - \lambda^i$ for $i = 1$ and 2

(3) $\gamma p_t^j \le \gamma t^j - \gamma\lambda^i$ for $i = 1$ and 2

(4) $A_{EA}^1 + A_{EA}^2 + A_{ET}^1 + A_{ET}^2 \le A_E^1 + A_E^2$

(5) $A_{EA}^1 + A_{EA}^2 + A_{ET}^1 + A_{ET}^2 \le A^T$

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[12] In reality, none of the two extreme situations may hold – the entitlements are likely to be partially tradable. However, partial tradability of entitlements does not change the main intuition of the distribution SPS effects derived in this paper. The two extreme cases considered in this paper represent upper and lower bound entitlement tradability.

[13] If entitlements are not tradable, $\gamma = 0$, the difference $A_E^i - A_{EA}^i$ represents unused entitlements, whereas if they are tradable, $\gamma = 1$, then it represents unused entitlement if their price is zero (e.g. this may occur with surplus entitlement); otherwise the difference represents traded entitlements.

where λ^i are the LaGrangean multipliers associated with the entitlement activation constraint $A^i_{EA} + A^j_{ET} \leq A^i$.[14] Equation (1) represents the marginal condition of land. Equations (2) and (3) determine the entitlement price if entitlements are tradable, $\gamma = 1$. The entitlement price varies between zero (if $\lambda^i = t^i$) and its face value (if $\lambda^i = 0$) and it may differ between the two type of entitlements if $t^i \neq t^j$. The entitlement activation constraint is binding if $\lambda^i > 0$. Equation (4) determines the equilibrium in the entitlement market, which constrains the aggregate number of activated entitlements by farm 1 and farm 2 ($A^1_{EA} + A^2_{EA} + A^1_{ET} + A^2_{ET}$) to the level not higher than the total entitlement endowment ($A^1_E + A^2_E$). Equation (5) constrains the total amount of activated entitlements by farms to be no higher than the total land.

In equilibrium, the equality of either equation (4) or equation (5) will hold depending on the total endowment of entitlements. If the total endowment of entitlements is lower than the total area, $A^i_E + A^j_E < A^T$, then the total activated entitlements will equal the total stock of entitlements (equation (4)), but not all areas will benefit from the SPS (equation (5)). Otherwise, if $A^i_E + A^j_E > A^T$, then the activated entitlements will equal the total land (equation (5)), but not all entitlements will be activated (equation (4)). Equation (5) is linked to farms' activation constraints $A^i_{EA} + \gamma A^j_{ET} \leq A^i$. If activation constraints are binding for both farms ($\lambda^i > 0$), then equality (5) holds in equilibrium. In the reverse case with non-binding activation constraints for at least one farm ($\lambda^i = 0$), inequality (5) holds in equilibrium.

The SPS creates kinks in the land demand functions of farms. Farms do not receive the SPS for the land that they rent above the amount of the entitlements they own, i.e. above $A_E{}^1$ and $A_E{}^2$ (= $A^T - A_E$).[15] In this case, farm *i*'s willingness to pay for land is not affected by the SPS. For additional land farm *i* cannot pay more than the marginal profitability of land. In the reverse case, when farm *i* rents less land than its eligible area $A_E{}^i$, the marginal profitability of land is increased by the value of entitlement, t^i. Now farms are willing to pay a higher rent up to t^i. Otherwise the payment is lost to farms. Graphically, the introduction of the SPS is illustrated in Figure 1 (upper panel). Starting from the left-hand side and following the thick full lines, the land demand of farm 1 is given by $D_t{}^1 D^1$, whereas the land demand of farm 2 is given by $D^2 D_t{}^2$.

Farm *i* receiving the SPS is subject to cross-compliance costs, c^i.[16] Given that the entire cultivated area of land receiving the SPS must respect the cross-compliance regulations irrespective of whether all or part of the SPS entitlements are activated and irrespective of whether all or part of the land is used for the activation of entitlements (European Commission, 2003), cross-compliance costs, c^i, are linked to land, not to entitlements.[17] In

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[14] For the sake of simplicity, when indexing variables with *i* we refer to both farms. We drop the text 'for *i* = 1 and 2'.

[15] A_E is used as support to indicate on the horizontal axes the stock of type 2 entitlements given that the area and entitlements of farm 2 are measured from right to left on the figures.

[16] For simplicity, in graphical analysis we assume homogenous cross-compliance costs across farms, c^i ($= c^1 = c^2$). In reality, however, the heterogeneity in farms' natural endowment, production structure and technology determines the actual costs of cross-compliance, which each farm incurs by complying with the requirements. Moreover, the cross-compliance costs can also vary between the MS, regions, and cross-compliance instruments (Alliance Environment, 2007). We discuss the implication of the heterogeneous cross-compliance costs (see below).

[17] We implicitly assume that cross-compliance costs are lower than the entitlement value, i.e. $c^i < t^i$. Otherwise, farms would not enter the SPS programme and would not own entitlements.

Figure 1 cross-compliance costs result in a downward shift of land demand functions of farm 1 and farm 2 to D_{tc}^1 D_c^1 and D_c^2 D_{tc}^2, respectively.

The lower panel in Figure 1 shows the entitlement market. The horizontal axis shows the quantity of entitlements. The vertical axis measures the entitlement face value and their price. Farm *i*'s maximum willingness to pay for an entitlement is determined by the face value of the entitlement (given by equations (2) and (3)). This is represented by horizontal curves G^1 and G^2 for entitlements 1 and 2, respectively. The entitlement supply is determined by the total endowment: i.e. A_E^1 and A_E^2 (= A^T - A_E) for entitlement 1 and 2, respectively. In Figure 1 the supply of entitlements 1 and 2 is represented by curves S^1 and S^2, respectively.

4. Static farm structure

4.1 Entitlement stock effect

The entitlement excess stock (relative to the eligible area) increases the capitalisation of the SPS and hence the landowners' policy gains, whereas the excess supply of eligible land reduces the capitalisation of the SPS. In the extreme case, the excess supply of land may drive the SPS capitalisation to zero, whereas the entitlement excess stock may lead to full capitalisation of the SPS into land values. A related analysis has been carried out by Courleux et al. (2008) and Kilian and Salhofer (2008). For the sake of tractability, graphically, we analyse the two extreme cases, but the results hold generally, also for intermediate cases. The difference in distributional effects between the deficit and surplus stock of entitlements (relative to the eligible area) can best be seen without entitlement tradability ($\gamma = 0$), in the absence of 'greening' and cross-compliance requirements in perfectly competitive land markets, which is shown in Figure 1 and Figure 2.

Under the *deficit stock of entitlements*,[18] the entitlement endowment of farms (A_E^1 and A_E^2, respectively) is strictly smaller than the eligible area, implying that farm *i*'s activation constraint is not binding (i.e. $\lambda^i = 0$).[19] Given that $\lambda^i = 0$ (and with $c^i = 0$ and $\gamma = 0$), farm *i*'s marginal condition of land is not affected by the SPS, t^i, implying that the SPS capitalisation rate is zero.[20] The equilibrium marginal value product of land is the same both with and without the SPS, $pf_A^i\big|_{SPS>0}^{deficit}$ (equation (1)) and $pf_A^i\big|_{SPS=0}$ (equation 0), respectively. Given that $pf_A^i\big|_{SPS>0}^{deficit} = pf_A^i\big|_{SPS=0}$, the SPS does not affect land rents relative to no SPS situation, $w\big|_{SPS>0}^{deficit} = w\big|_{SPS=0}$.

Graphically, the deficit entitlement stock effect is shown in Figure 1 (upper panel). The land demands without the SPS are D^1 D^1 and D^2 D^2 and the land market equilibrium is at (A^*, w^*). The SPS shifts them to D_t^1 D^1 and D^2 D_t^2, for farm 1 and farm 2, respectively. This implies that with deficit entitlements the equilibrium with and without the SPS is the same at (A^*, w^*). Both the equilibrium land demand and prices are not affected by the SPS. The SPS has a

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[18] For deficit entitlements we refer to a situation where at least one farm has fewer entitlements than the eligible area and it holds that $A_E^1 + A_E^2 < A^T$, whereas for surplus entitlements we refer to the reverse situation where at least one farm has more entitlements than the eligible area and it holds that $A_E^1 + A_E^2 > A^T$.

[19] In our model we assume that the entire land (A^T) is eligible for activation of the SPS entitlements. According to EU regulations, the eligible areas for the activation of payment entitlements include any agricultural area used for an agricultural activity or predominantly used for agricultural activities (EUR-Lex 2009).

[20] The analytical derivation of the optimal conditions is cumbersome because of the discontinuity in the demand functions with SPS.

zero-distortive marginal effect on farm rental decisions. This implies zero capitalisation of the SPS and that all policy rents (given by area *BC*) go to farms; landowners do not benefit from the SPS.

Next, assume that under the *surplus entitlements* (entitlements are more than the eligible area) farms 1 and 2 receive entitlements such that $A_E^1 + A_E^2 > A^T$ (upper panel in Figure 2).[21] Given that entitlements are in surplus and farms need land to activate their entitlements, activation constraints are binding (i.e. $\lambda^i > 0$). Profit maximizing farms will compete for land in order to activate their unused entitlements. Competing farms will underbid the market price for land until its marginal profitability (including the SPS). Given that $\lambda^i > 0$, from FOC (2) it follows that $\lambda^i = t^i$. The combination of FOC (2) and marginal condition of land (1) (with $c^i = 0$ and $\gamma = 0$) implies that in equilibrium the farm rental decisions are impacted by the SPS: $pf_A^i + t^i\Big|_{SPS>0}^{surplus}$. The SPS increases the willingness to pay for rent compared to a situation without the SPS (equation 0), implying $pf_A^i + t^i\Big|_{SPS>0}^{surplust} > pf_A^i\Big|_{SPS=0}$ and hence $w\Big|_{SPS>0}^{surplus} > w\Big|_{SPS=0}$. As a result, the SPS will be capitalised into land rents.

In Figure 2 (upper panel), land demands without the SPS are D^1 D^1 and D^2 D^2 for farms 1 and 2, respectively. With the SPS their respective land demands shift to D_t^1 D^1 and D_t^2 D^2, the equilibrium shifts from (A^*, w^*) to (A_t^*, w_t^*). In equilibrium the rental rate increases by w_t^* - w^*, meaning that the SPS is reflected in higher rents. Hence, under the excess stock of entitlements, the SPS gets capitalised into land rents.[22] Landowners' gains are equal to area *EFHK*, while farms' gains are equal to area *C*.

4.2 SPS implementation models

The capitalisation of the SPS and hence landowners' gains might decrease in the variation of the face value of entitlements, as long as the capitalisation rate is positive. Under the current implementation, the variation in the face value of entitlements is determined by the SPS model. Under the regional model, the entitlements' face value is equal among all farms in a given region, $t^i = t^j$, implying that capitalisation may be larger than under the hybrid or historical models, where the face value of entitlements varies among farms, $t^i \neq t^j$. The European Commission's (2011) proposal envisages the equalisation of payments across farms in a given region (i.e. regional model). However, it also aims to introduce new measures allowing for a variation of payments, such as young farmer payments and payments to farmers located in disadvantaged areas. Their impact on land markets is similar to the historical/hybrid model. A related analysis has been done by Kilian and Salhofer (2008). In order to better illustrate the distributional effects, we consider surplus entitlements, no entitlement tradability ($\gamma = 0$), zero cross-compliance requirements and no 'greening' requirements.

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[21] Several factors may lead to a situation whereby the number of entitlements exceeds the eligible area in the medium run, i.e. agricultural land conversion to non-agricultural use, or the allocation of new entitlements to farms (e.g. entrants). The relative stock of entitlements tends to be larger in countries that implement the hybrid model than in countries using the historical model. This is because under the historical model the total number of entitlements corresponds to the number of hectares that generated subsidies in the reference period. Under the hybrid model (or the regional model), the total number of entitlements is equal to all land declared eligible at the time of the SPS' introduction.

[22] This result is driven, among other things, by the assumption of competitive markets where farms compete for land. If a farm were not willing to pay higher rent, landowners could always find another farm with some unused entitlements willing to pay this rent.

Given that we consider the case with surplus entitlements, the activation constraints are binding (i.e. $\lambda^i > 0$). From equations (2) and (3) it follows that with surplus entitlements the SPS affects the marginal condition of each farm differently, depending on the variation in entitlement value, $pf_A^i + t^i = w$. Compared to a situation without the SPS, farm willingness to pay for land renting (at the equilibrium land use without the SPS, A^*) is higher for the farm possessing high value entitlements as opposed to the farm possessing low value entitlements, $pf_A^i + t^i \neq pf_A^j + t^j$ if $t^i \neq t^j$. The competition for the fixed supply of land will lead to a situation whereby the farm with high value entitlements will out-compete the farm owning low-value entitlements. As a result, the farm with high-value entitlements will gain, whereas the other farm will not benefit from the SPS. Given that farms benefit from the SPS, landowners capture policy gains only partially. With reducing variation in entitlement value across farms, the SPS capitalisation increases and farmers' gains go down. In the extreme, which is the case of regional model with uniform surplus entitlements, all farms are equally affected by the SPS at the margin, $pf_A^i + t^i = pf_A^j + t^j$ if $t^i = t^j$, implying that the SPS gets fully capitalised into land rents and all policy benefits are leaked to landowners.

Graphically, the income distributional effects are illustrated in Figure 2 (upper panel). Entitlements $t^1 \neq t^2$ represent the case of *hybrid/historical SPS model*. As shown in the previous section, the equilibrium capitalisation amount with t^1 and t^2 is $w_t^* - w^*$. The relationship between the level of marginal capitalisation rate and the face value of entitlements is negative. High value entitlement, t^1 ($> t^2$), is partly reflected in higher rents ($w_t^* - w^* < t^1$), whereas low value entitlement, t^2, is fully incorporated into land values ($w_t^* - w^* = t^2$). In other words, the capitalisation level of the SPS, expressed in monetary terms, $w^* - w_t^*$, is equal for both entitlements. However, the capitalisation rates, expressed per unit of the SPS, vary between entitlements: low-value entitlement, t^2, is fully capitalised, whereas high value entitlement, t^1, is partially capitalised into land rents. The distributional effects of the SPS are asymmetric: landowners' gains are equal to area *EFHK*, farm 1 gains area *C*, whereas farm 2 does not benefit from the SPS.

The *regional SPS model* with equal face value of entitlements, $t^1 = t_1^2$, is shown in Figure 2 (upper panel).With t^1 and t_1^2 land demands are D_t^1 D^1 and D_{t1}^2 D^2 and market equilibrium is at (A^*, w_{t1}^*), implying that both entitlements are fully incorporated in higher land values, $w_{t1}^* - w^* = t^1 = t_1^2$. The equalisation of entitlement face value strips away the policy gains of farms possessing high value entitlements (area *C* for farm 1 with $t^2 < t^1$). Now all SPS benefits go to landowners represented by area *CEFGHK*, which equals the total value of disbursed SPS payments. Farms have zero policy benefits.

4.3 Cross-compliance effect

Cross-compliance requirements reduce the capitalisation of the SPS and hence policy rents to farmers and/or landowners. Under certain circumstances, cross-compliance requirements may drive the capitalisation to zero or even negative values because they create an additional cost for farms by imposing constraints on farm activities, for example, with the aim of promoting environmentally friendly farming practices.[23] The fulfilment and the relevance of these requirements vary by farm, as the heterogeneity in farms' natural endowment, production structure, geographical location and technology determines the actual costs of cross-compliance that each farm incurs by complying with the requirements. Moreover, the cross compliance costs can also vary between the MS, regions, and cross-compliance instruments (Alliance Environment, 2007; European Commission, 2007b).[24]

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[23] The empirical evidence suggests that cross-compliance requirements imply additional costs not only for farms, but also for public administrations managing the SPS (Ciaian, Kancs & Swinnen, 2010).

[24] According to the European Commission (2007b), a farmer's administrative costs of SPS in Denmark, France, Germany, Italy and Ireland were calculated in the range 5-29 euro/ha. This represents between 3 and 9% of the total SPS payments.

We show the distributional effects of cross-compliance with surplus and deficit entitlements separately, as their effects are very different. As above, we assume non-tradable entitlements ($\gamma = 0$) and no greening requirements.

First, in Figure 2 (upper panel) we consider the entitlement excess stock. In the previous section we have shown that with *zero cross-compliance costs* and entailments t^1 and t^2, the land demands with the SPS are D_t^1 D^1 and D_t^2 D^2, for farm 1 and farm 2, respectively, and the land market equilibrium is at (A_t^* w_t^*). The SPS amount equal to w_t^* - w^* is capitalised into land rents. Next, consider a situation with *positive cross-compliance costs*. As noted above, the additional cross-compliance costs are linked to land, implying that cross-compliance costs reduce the profitability of land. The equilibrium conditions (1) and (2) (with $\lambda^i > 0$ and $\gamma = 0$) imply that for surplus entitlements and positive cross-compliance costs $pf_A^i + t^i - c^i = w$. Comparing the two cases with and without the cross-compliance costs, in equilibrium it holds that $pf_A^i + t^i - c^i\big|_{c>0}^{\text{surplus}} < pf_A^i + t^i\big|_{c=0}^{\text{surplus}}$ and hence $w\big|_{c>0}^{\text{surplus}} < w\big|_{c=0}^{\text{surplus}}$. In other words, farms' equilibrium marginal product of land is reduced by cross-compliance costs, which reduces the willingness to pay for rent, causing a downward adjustment in land rents.

In Figure 2 (upper panel) positive cross-compliance costs shift the land demand curves downward from D_t^1 D^1 and D_t^2 D^2 to D_{tc}^1 D_c^1 and D_{tc}^2 D_c^2 (dotted lines), for farm 1 and farm 2, respectively. The equilibrium shifts from (A_t^* w_t^*) to (A_t^* w_c^*). Overall, the cross compliance costs reduce land rental price, implying that the capitalisation level is also lower (by w_t^*- w_c^*) relative to a situation with zero cross-compliance costs and entitlements in place, w_c^* - w^* < w_t^* - w^*. The total value of cross-compliance costs is given by area *EH* and represents a reduction of policy rents to landowners. Landowners' policy gains decrease from area *EHFK* with zero cross-compliance costs to area *FK* with positive cross-compliance costs.

Deficit entitlements are illustrated in Figure 1 (upper panel). Land demands with zero cross-compliance costs are D_t^1 D^1 and D^2 D_t^2, for farm 1 and farm 2, respectively, and the land market equilibrium is at (A^*, w^*), which is the same as without the SPS. With positive cross-compliance costs and deficit entitlements (and with $\lambda^i = 0$ and $\gamma = 0$), equations (1) and (2) imply that farm *i*'s marginal condition of land is affected by cross-compliance costs, i.e. $pf_A^i - c^i = w$, implying that the SPS capitalisation could be negative. Comparing the two cases with and without cross-compliance costs, in equilibrium it holds that $pf_A^i - c^i\big|_{c>0}^{\text{deficit}} < pf_A^i\big|_{c=0}^{\text{deficit}}$ and hence $w\big|_{c>0}^{\text{deficit}} < w\big|_{c=0}^{\text{deficit}}$. In Figure 1 (upper panel) the cross-compliance costs, c ($c = c^1 = c^2 > 0$), shift land demands of farm 1 and farm 2 to D_{tc}^1 D_c^1 and D_c^2 D_{tc}^2, respectively, and land rent drops from w^* to w_c^*, relative to zero cross-compliance costs and deficit entitlements, and relative to a situation without the SPS. Hence, cross-compliance costs lead to negative capitalisation of SPS. The total value of cross-compliance costs is given by area *D*, all of which are incurred to landowners.

The situation is shown in Figure 1 and Figure 2, where landowners fully bear the costs through reduced land rents, although cross-compliance costs are incurred by farms. First, this is because they are directly linked to land use and hence act as a land tax. Second, it is because in both figures we assume cross-compliance costs constant and equal among farms. In reality they may change (increase or decrease) with land renting too as they may differ by farm type. In the first case, landowners loose proportionally more (less) than the total value of cross-compliance costs, if these increase (decrease) with land quantity, they generate a gain (loss) to farms. In the second case, if the cross-compliance costs differ by farm type, they may affect farms asymmetrically. Cross-compliance costs may also affect farm restructuring and may lead to a land-relocation-induced income redistribution similar to a productivity change, which is shown in section 5.

4.4 CAP 'greening' effect

The CAP 'greening' requirements affect land productivity as they may constrain farmers on crop planting and use of land. In the case of crop diversification, farms may be required to relocate land between crops if they do not have at least three crops on their land, or if the minimum and/or the maximum threshold are not respected, which implies that for a marginal hectare farms may plant a higher share of a less profitable crop to respect the crop diversification requirement. This leads to a reduction in marginal land profitability and hence in the reduction of the willingness to pay for land rent. The implications of the permanent grassland requirement are similar. If it would be optimal for farm to convert grassland to other uses in the absence of the SPS, then the 'greening' requirement will constrain farms from doing so, causing a downward adjustment of land profitability. The ecological focus area requires 7% of the area to be withdrawn from production, which directly cuts the return from each additional hectare. The CAP 'greening' effect has not been considered in other studies in the literature.

Heterogeneity in farms production structure, specialisation and technology determines the actual impact of the CAP 'greening'. Some farms may not need to adjust to all three greening requirements, for some farms the greening may not be a constraining factor if, for example, their production structure is sufficiently diversified, they have no incentive to convert grassland to other uses and possess strips of land that are economically not suitable for production. For some other farms, in particular those specialised in growing a single crop and with no fallow land, the adjustment in production structure might be required. This implies that the greening impact can vary between the MS, regions and farms.

The impact of the CAP greening on land markets is analogous to the impact of cross-compliance costs. Both requirements induce explicit or implicit costs to farms and reduce the willingness to pay for land renting. As a result, the CAP greening probably reduces the capitalisation of the SPS and policy rents to farmers and/or landowners. As with cross-compliance, under certain circumstances, the CAP greening may drive the capitalisation to zero or even into a negative balance. Given that the distributional effects are similar to cross-compliance the derivations of the effects are not repeated.

4.5 Entitlement tradability

Up to now we have assumed that entitlements cannot be traded among farms. In this section we relax this assumption and analyse the entitlement price formation. Trade allows farms to exchange entitlements, if they possess more/less than the eligible area. The market determines the entitlement price, p_t^i, which may differ from its face value to zero, depending on SPS capitalisation into land rents. To illustrate how the price of entitlements is correlated with the SPS capitalisation, we consider two cases: zero capitalisation of the SPS (deficit entitlements) and positive capitalisation of the SPS (surplus entitlements). To simplify the analysis, we assume zero cross-compliance costs ($c^i = 0$) and no greening requirements. A related analysis has been performed by Courleux et al. (2008) and Kilian & Salhofer (2008).

In the case of *deficit entitlements* ($A_E^1 + A_E^2 < A^T$) the entitlement constraint is not binding, $\lambda^i = 0$. Equilibrium conditions (2) and (3) imply that the price of entitlements will equal their face value, $p_t^i = t^i$. As shown in the previous section, equilibrium conditions (2) – (5) imply that the SPS is not capitalised into land rents, because the marginal condition of land is not affected by the SPS, $pf_A^i = w$. The effects are illustrated in Figure 3. With deficit entitlements the equilibrium with and without the SPS is the same at (A^*, w^*), and all SPS benefits go to farmers (area *BC*) (upper panel). Under this distribution of entitlements there is no trade of entitlements, although the implicit equilibrium price of entitlements is equal to their face value, given by the intersection of entitlement supply S^1 for farm 1 and S^2 for farm 2 and entitlement value G^1 for farm 1 and G^2 for farm 2, respectively (lower panel). This is because each unit of entitlement generates to its owner (farmer) a gain equal to its face value. Selling the entitlement below the face value, $p_t^i < t^i$, would attract buyers because of positive profits.

Competition among buyers would drive the price up such that $p_t^i=t^i$, because entitlements are in deficit relative to the total land (i.e. strict inequality holds in equilibrium for equation (5)).[25]

Trade in entitlements will take place if some farms hold surplus entitlements.[26] For example, if the stock of entitlements of farm 2 is in surplus relative to its optimal land use without the SPS at A_{E1}^2 where $A_{E1}^2 > A_E^2$ and $A_{E1}^2 = A^T - A_{E1} > A^T - A^*$, while the overall entitlement stock is still in deficit, $A_E^1 + A_{E1}^2 < A^T$, the land market equilibrium is the same at (A^*, w^*) (upper panel in Figure 3). Given that farm 2 owns more entitlements than the optimal land use $A^T - A^*$, it has incentives to sell the surplus amount $A^* - A_{E1}$. In contrast, given that farm 1 owns fewer entitlements than its optimal land use, it is willing to buy additional entitlements. If farm 2 would not sell the surplus entitlements and would instead rent an equivalent area $A^T - A_{E1}$,[27] the equilibrium rent would be w_2 because of higher marginal return of farm 1 at A_{E1}. Farm 2 benefits from the marginal entitlement at A_{E1} are equal to $t^2 - (w_2 - w_1)$. If however farm 2 sells the marginal entitlement for price $p_t^{2'}$, such that $t^2 - (w_2 - w_1) < p_t^{2'}$, and farm 1 buys the entitlement, then farm 2 gains from trade.

The difference, $w_2 - w_1$, is the marginal productivity loss due to suboptimal land renting at A_{E1} and it represents the total gains of entitlement trade. Because the total amount of entitlements is in deficit (inequality (5) holds in equilibrium), the competition of farm 1 will lead to an equilibrium entitlement price equal to its face value, $p_t^2=t^2$ (lower panel in Figure 3).[28] This holds for all area in the interval A_{E1}, A^*. In equilibrium all entitlements are activated (i.e. strict equality holds for equation (4)). Overall, farm 2 sells all surpluses entitlement $A^* - A_{E1}$ to farm 1 and its equilibrium renting will stay at $A^T - A^*$. Area *BC* represents the aggregate gains of trade. The rationale behind this result is that farm 2 does not have incentive to keep the surplus entitlements because the productivity loss (area *BC*) due to suboptimal land use would cut part of the gains of holding them, whereas the equilibrium entitlement price allows farm 2 to fully benefit from the surplus entitlements. The entitlement price equals its face value, because the SPS is not capitalised into land rents. This is because entitlements are scarce relative to the total land that can be used to activate the payment associated with them. All policy benefits (area *B* to farm 1 and area $(A^T - A_{E1})t^2$ to farm 2) are distributed to farmers.

The case with *surplus entitlements* is illustrated in Figure 2. With surplus entitlements t^1 and t^2, $A_E^1 + A_E^2 > A^T$, the equilibrium is at (A_t^*, w_t^*) and part of the SPS, $w_t^* - w^*$, is capitalised into land rents. The entitlement of farm 2 is fully capitalised whereas the entitlement of farm 1 is partially capitalised into land rents, implying that the price will differ among the two types of entitlements. With activation binding constraint ($\lambda^i > 0$), from equations (2) and (3) it follows that in equilibrium the difference in entitlement face values is equal to the difference in their prices, $t^i - t^j = p_t^i - p_t^j$. With $pf_A^i + (t^i - p^i) = w$ (equations (1) and (2)), the price for entitlement, p^i, represents the part of the entitlement face value, which is not capitalised into land rents.

In Figure 2 (lower panel) entitlements of farm 2 will have zero equilibrium price $p_t^2 = 0$, because they are fully reflected in higher rents ($w_t^* - w^* = t^2$), and because entitlements are in surplus relative to land, $\lambda^i > 0$ (equality (5) holds in equilibrium) (the maximum willingness to pay for entitlement 2, G^1, intersects the supply of entitlement 1, S^1) Competition among sellers drives their price down to zero: some entitlements will not be traded. Buyers (farm 1)

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[25] Note that we assume that farm 1 represents *n* farms of the same type and farm 2 represents *m* farms of the same type implying that there is no duopoly on the land rental and entitlement market.

[26] This may occur due to structural change, for example (see below).

[27] Note that the activation of SPS requires that each entitlement is accompanied by an equivalent number of hectares.

[28] Note that although entitlements of farm 1 are not traded, their implicit equilibrium price is $p_t^1=t^1$. This follows from equations (3).

do not have any incentive to buy additional entitlements, because they do not have land for their activation (inequality (4) hold in equilibrium). However, the equilibrium price of entitlements of farm 1 is positive and equals its face value net of capitalisation rate, $p_t^1 = t^1 - (w_t^* - w^*)$ (= $w_{t1}^* - w_t^*$). Selling entitlements below this price would attract buyers because of positive profits for its owner. Hence, these benefits are only partially passed through to landowners through higher land rents (in contrast to entitlements of farm 2). This result holds as long as entitlements of type 1 are in deficit relative to the total area of land, $A_E^1 < A^T$.

Note that in the case illustrated in Figure 2, the actual entitlement trade will not take place, because the stock of entitlements of farm 1 is equal to its optimal land use. Under a different distribution of entitlements, where farm 1 would own surplus entitlements, trade would occur with farm 2 purchasing entitlements from farm 1 at price $p_t^1 = w_{t1}^* - w_t^*$ and, as long as $A_E^1 < A^T$, there would be no changes in the equilibrium land rental price and land use.

If the face value of both entitlements is equal, (as under the regional SPS model), the price of entitlement owned by farm 1 will drop to zero. This is illustrated for t_1^2 in Figure 2, where $t_1^2 = t^1$. With $t_1^2 = t^1$ the equilibrium land rent is w_{t1}^*, implying that both entitlements are fully incorporated into higher land rents and are captured by landowners. In lower panel of Figure 2, the maximum willingness to pay for entitlements (G^1 and G_1^2 for farm 1 and farm 2, respectively) is equal to their capitalisation level $w_{t1}^* - w^*$. There is no incentive to purchase additional entitlements and their equilibrium price is zero, $p_t^1 = p_{t1}^2 = 0$.

5. Farm structural change

In the previous section we assumed that the structure of the agricultural sector does not change. In reality, however, agriculture faces various structural adjustments, such as productivity shifts, farm entry and exit, which we consider in this section. Given that the SPS will probably also be in place in the next financial period 2013-20, the structural changes might be more pronounced in a long-run perspective. The effects analysed in this section have not been considered in the literature before and the results are new.

5.1 Productivity change

Changes at the aggregated sectoral level productivity may be caused by several factors. Firstly, the decoupling, which accompanied the introduction of the SPS, may have stimulated farm production adjustment leading to improved farm efficiency. Secondly, at the sectoral level productivity may increase trough the entry of new farms, which can be more dynamic and productive. Thirdly, cross-compliance and CAP greening requirements may induce an asymmetric increase in costs, resulting in a negative productivity shock. Fourthly, it may be induced by general improvement in the technology and rural institutions. Finally, the time gap between the reference period used for the entitlement allocation and the period of the SPS introduction (particularly the historical model) may have implications for land markets. The allocation of entitlements under the historical model was based on a historical reference period (2000–02), but not on the land used at the time of the SPS implementation (2005–06). If productivity has changed between the two periods, then land use adjustments will take place.

The dynamic distributional effects are different from the static distributional effects, especially if the entitlements are non-tradable. With productivity change, entitlement tradability reduces the capitalisation of the SPS, whereas barriers to entitlement trade increase the capitalisation of the SPS and thus benefits to landowners. Moreover, in the dynamic context the SPS may affect farm structural change in agriculture. With productivity change, entitlement tradability facilitates the structural adjustment, whereas barriers to entitlement may prevent land markets from full structural adjustments. The effects of productivity change can be best seen by considering deficit entitlements in perfectly competitive land markets with two types of heterogeneous farms, which is shown in Figure

4.[29] Farm 2 experiences an exogenous productivity improvement relative to farm 1. As above, to simplify the exposition, we assume that zero-cross compliance costs and that there are no greening requirements.

First, consider *free entitlement trade*. An exogenous productivity improvement of farm 2 increases its willingness to pay for land rent. This is illustrated in Figure 4, where the productivity advantage of farm 2 shifts its land demand from $D_t^2\ D^2$ to $D_{tg}^2\ D_g^2$ (dotted line), whereas the land demand of farm 1 is not affected (upper panel).[30] With perfectly tradable entitlements the corresponding shift in equilibrium is from (A^*, w^*) to (A_g^*, w_g^*), implying zero capitalisation of the SPS. Although, the equilibrium rent increases by w_g^* - w^*, the SPS does not contribute to this increase. With or without a productivity advantage, the rent is entirely determined in the demand curves segment, which is not affected by the SPS, but is determined by the D^1 and D_g^2 part of land demand of farm 1 and farm 2, respectively. The rent increase is induced solely by the productivity advantage of farm 2. This is due to the fact the entitlement activation constraint is not binding ($\lambda^i = 0$) – trade allows farm 1 to sell surplus entitlements $A_E^1 - A_g^*$ to farm 2 which has excess land. Because of deficit entitlements (i.e. strict inequality holds for equation (5)) competition among buyers will drive their price to their face value (equations (2) and (3)). The equilibrium amount of traded entitlements between farms is $A_E^1 - A_g^*$. Farm 1 sells entitlements to farm 2 for a price equal to the face value of its entitlements, $p_t^1 = t^1$ (Figure 4, lower panel). Overall, farms gain the full value of the SPS (area *BEFGHI*), whereas landowners do not benefit from the SPS.

Next, consider land market equilibrium with *non-tradable entitlements*.[31] Prohibitive barriers to entitlement trade imply that farm 1 cannot sell entitlements $A_E^1 - A_g^*$. Instead, it uses the SPS to compete for land with the aim of retaining its land in order to be able to activate all entitlements. Otherwise, part of its entitlements and the corresponding benefit of the SPS would be lost to farm 1. In Figure 4 (upper panel) the non-tradability of entitlements implies that the land market equilibrium shifts from (A^*, w^*) (before the SPS) to (A_E^1, w_t^*) (with the SPS).[32] As shown above, with freely tradable entitlements the equilibrium is at (A_g^*, w_g^*), implying that with non-tradable entitlements, the SPS capitalisation into land rents is equal to w_t^* - w_g^*.[33] Relative to the initial equilibrium (A_g^*, r_g^*) without the SPS, farm 1 gains are equal to area *BF*. Farm 2 loses due to reduction in land use (area *GK*), while it gains the full value of the SPS (area *I*). Landowners' benefits are equal to area *EGK*. This implies that entitlement, t^1, is distributed between farm 1 (area *BF*), landowners (area *E*) and productivity loss due to a misallocation of land resources (area *GH*). Entitlement, t^2, fully benefits farm 2 (area *I*).

In the presence of productivity change, the SPS may interact with farm restructuring and it may prevent land markets from full structural adjustments. Tradable entitlements allow full

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[29] The results are generally valid also for the case with surplus entitlements but the effects are similar to the case without structural change, because when the entitlement stock exceeds the total eligible area of land, the SPS is always capitalised into land rents. With surplus entitlements, the SPS is always capitalised into land rents. This is independent of whether we consider productivity change and whether entitlements are tradable or non-tradable. Only the difference in face value of entitlements among farms may have .enhanced impact on SPS capitalisation with productivity change. The intuition is analogous to the case of deficit entitlements.

[30] Note we assume asymmetric productivity change where relative increase of farm 2 productivity is higher than the productivity increase of farm 1. For simplicity with assume zero increase in productivity of latter type of farm, however the results hold in general. With symmetric productivity change the SPS effect is the same with and without entitlement tradability.

[31] This could occur either due to regulatory constraints or market imperfections, or both.

[32] Now the sale of entitlements ($A_E^1 - A_t^*$) is not possible. As a result farm 1 uses the SPS to compete for land.

[33] Note that if the productivity increase of farm 2 is sufficiently high, then entitlement t^1 is fully capitalised into land rents; in the opposite case if the productivity increase is sufficiently low, the capitalisation is zero even if the entitlements are not tradable.

adjustments on land markets, whereas entitlement trade restrictions hinder land relocation among farms. The allocation of entitlements between farms cannot fully adjust if entitlement trade is restricted. Instead, farms will use the SPS to compete for land. This effect is illustrated in Figure 4.

To indentify the impact of the SPS on farm restructuring with *tradable entitlements*, the counterfactual is a situation without the SPS. As shown above, with and without the SPS, the productivity advantage of farm 2 (the increase of its land demand from D^2 D^2 to D_g^2 D_g^2) shifts the equilibrium from (A^*, w^*) to (A_g^*, w_g^*). With and without the SPS, A^*- A_g^* amount of land is relocated from farm 1 to farm 2 implying that, when entitlement tradability is allowed, the SPS does not constrain farm restructuring.

Next, consider the implications on farm restructuring with *non-tradable entitlements*. As shown above, with non-tradable entitlements the land market equilibrium is at (A_E^I, w_t^*) (Figure 4). This implies that land demand of more the productive farm 2 is greater with than without the tradability constraint (A^T - A_g^* > A^T - A_E^I). The tradability constraint reduces the relocation of land. The relocation quantity with and without tradable entitlements is A^* - A_g^* and A^* - A_E^I, respectively, where A^* - A_g^* > A^* - A_E^I. The tradability constraint decreases land reallocation from farm 1 to farm 2 by A_E^I - A_g^*. The more productive farm 2 cannot reach its optimal scale. Farm 1 uses the SPS to maintain higher land renting relative to what would be the case if entitlement trade would be possible or relative to no SPS. The total deadweight effect is equal to area *GH*.

In summary, the entitlement trade allows farms to make decisions on the entitlement use and land renting separately from each other. The farm that experiences a lower relative productivity gain (i.e. farm 1) can detach its surplus entitlements from land by selling them, allowing in such a way to relocate unprofitable land to farms experiencing higher productivity increase (i.e. farm 2). However, if trade is constrained, then the relocation of entitlements cannot take place from the less to more productive farms. Farm 1 owning surplus entitlement (A_E^I - A_g^*) in Figure 4 will use them to compete for land in order to activate the surplus entitlements. Otherwise the associated payment would be lost (i.e. (A_E^I - A_g^*)t^1). Hence, the counterfactual land market equilibrium is disturbed by policy rents.

5.2 Farm entry/exit

The entry/exit of farms can be triggered by changes in farm opportunity returns and/or farm profitability. Two issues are relevant with respect to farm entry and exit: the impact of farm entry and exit on land markets and entrants' eligibility to entitlement. As above, to simplify the analysis we assume zero-cross compliance costs and no greening requirements.

Farms enter (exit) the sector, if their profits from farming are higher (lower) than the opportunity returns. A marginal farm which does not enter (exit) has profits just lower (higher) than the opportunity returns. An exogenous change in the relative returns will trigger the entry or exit of farms (i.e. farm 1 and/or farm 2). The entry into the farming sector stimulates the demand for land, if entrants are more productive than the incumbent farms. As with productivity change, it will shift the aggregate land demand upward. The exit of farms has the opposite effect on land market, causing a downward shift in land demand.

The effect of the SPS in the presence of *farm exit/entry* is analogous to a negative/positive productivity change, implying the qualitatively similar effects to productivity change analysed in the previous section. The exit (entry) of type 1 farms implies a downward (upward) shift in their respective land demand leading to the same SPS impact on income distribution and farm restructuring as an equivalent productivity decrease (increase).

The results derived above are conditional upon the SPS linked to the incumbent farms. The entrants (who are potentially more dynamic and more productive and therefore a source of productivity growth) are excluded from the SPS support system. To address these concerns, a

national 'reserve' was created in each MS.[34] National reserves can be used to allocate entitlements to i) farms in a special situation, ii) new entrants and iii) farms in regions subject to restructuring. The European Commission's proposal of 2011 outlines, among others, the priority use of national reserve to young farmers who start farming. Further, the European Commission proposal envisages a redistribution of entitlements with the start of the new financial framework in 2014. The redistribution of entitlements may stimulate entry, as it will allow new entrants to obtain entitlements. Similar behaviour was observed with the hybrid model (e.g. Sweden and Finland) with the introduction of the SPS in 2005 (Ciaian, Kancs & Swinnen, 2010).

In general, the entrants' eligibility for the SPS stimulates the capitalisation of the SPS into land values. The entrant eligibility to the SPS creates similar effects to the surplus entitlements. The expansion of the stock of entitlements relative to the eligible land creates a stronger upward pressure on land rents, leading to a higher leakage of the SPS to landowners. The overall effect of entrants' eligibility for the SPS depends particularly on the relative share of new and initially (incumbent) allocated entitlements relative to the eligible area. To illustrate the effect we consider the case with deficit non-tradable entitlements without cross-compliance and greening requirements.[35]

Allowing entrants to obtain the SPS increases the overall stock of entitlements. The actual increase depends on the size of the reserve. This effect is illustrated in Figure 5. We consider a case whereby only the entrants of farm type 2 can obtain new entitlements. Assuming the opportunity return unchanged, the entry of marginal farm of type 2 is triggered because of an increase in policy return due to its eligibility for the SPS. The initial entitlements of farm 2 is $A_E^2 = A^T - A_E$ and we assume that new entrants can obtain up to $A^* - A_{E2}$ new entitlements, thus increasing the stock of type 2 entitlement to A_{E2}^2 (= $A^T - A_{E2}$). Farm 1 is assumed to have the same amount of entitlements, A_E^1. The overall stock of entitlements exceeds the total land, $A_E^1 + A_{E2}^2 > A^T$ implying that the activation constraints of farm *i* will be binding ($\lambda^i > 0$), and hence all land will benefit from SPS (equation (5)). The SPS increases the willingness to pay for rent, $pf_A^i + t^i\Big|_{SPS>0}^{surplus}$ (equations (1) and (2) and $\lambda^i > 0$), compared to a situation without entrants' eligibility for entitlements, $pf_A^i\Big|_{SPS>0}^{deficit}$ (equations (1) and (2) and $\lambda^i = 0$), implying a capitalisation of the SPS into land rents in the former case. In Figure 5 the equilibrium shifts from (A^*, w^*) without entrant eligibility to entitlements to (A_E^I, w_t^*) with entrant eligibility to entitlements. Relative to non-eligibility of entrants to entitlements, landowners benefit (area *CDEGI*) due to increase of land rent by w_t^* - w^*, farm 2 loses policy gains (area *IJ*) but gains due to land use increase (area *FHJ*), whereas farm 1 loses part of the SPS (area *C*) and due to land use reduction (area *DE*).[36]

The overall impact also depends on the face value of entitlements allocated to the entrants. If the value differs with respect to the incumbent entitlements, then the entitlement heterogeneity increases, causing similar effects to those analysed in the previous section on the implications of different SPS models.

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[34] Under the current SPS regulation, the MS must create a national reserve by linearly reducing (up to 3%) their national SPS ceiling. There are also other sources that may enlarge the national reserve, e.g. the unused entitlements for three years, non-attributed entitlements and revenue collected from the entitlement trade taxes.

[35] With surplus entitlements, the impact of entrants' eligibility for entitlements is minor as entitlements are already in surplus relative to land and cause their capitalisation in land rents. The only difference in the face value between old and new entitlements may have similar implications to deficit entitlements.

[36] Note that because we assume non-tradable entitlements, the SPS constrains farm restructuring. The effects are analogous to those derived in the previous section.

6. Distributional effects, market imperfections and regulations

Rural land markets are often constrained by various rigidities and imperfections (Ciaian, Kancs & Swinnen, 2010). Market imperfections can either increase or decrease the capitalisation rate of the SPS. The two most important imperfections identified in the literature are credit market imperfections, which usually increase the capitalisation rate, and land market institutions and regulations, which usually restrict rental market adjustments to the SPS (Ciaian & Swinnen, 2009).

6.1 Credit market imperfections

The agricultural sector is perceived to have significant credit problems, mainly due to the nature of production and the risk specific to agriculture that is present to a lesser extent in other sectors of the economy (Barry & Robison, 2001). Studies show that this is also the case in developed countries such as EU and the USA (Blancard et al., 2006; Lee & Chambers, 1986; Färe, Grosskopf & Lee, 1990).

The presence of credit constraint in the farming sector increases the capitalisation of the SPS and policy rents to farmers and/or landowners. We illustrate the credit constraint effect with surplus entitlements in Figure 6 (which is an extension of Figure 2). To simplify the exposition, we assume non-tradable entitlements ($\gamma = 0$), no cross-compliance costs ($c^i = 0$) and no greening requirements. Without credit market imperfections, the land market equilibrium with the SPS is at (A_t^*, w_t^*), implying that the w_t^* - w^* part of the SPS is capitalised into land rents.

According to Ciaian and Swinnen (2009), farms facing credit constraint may use subsidies to substitute for missing finances. This has important implications for the land market, as more credit may stimulate investment in technology and/or an increase in input use, leading to higher land productivity and thereby exerting upward pressure on land rents. In our model the credit constraint effect is reflected in an upward shift in land demands. To simplify the exposition, in Figure 6 we assume that only land demand of farm 2 increases due to credit constraint. The demand of farm 1 is not affected (i.e. farm 1 is not credit constrained).

The SPS has two effects on land rents: one direct and one indirect. The direct effect of the SPS is shown in the previous section in absence of credit market imperfections, and is equal to a rental price increase by w_t^* - w^*. The indirect effect results is a result of the relaxed credit constraint of farm 2, which due to the SPS allows an improvement of its technology to be financed. This increases the productivity of land (assuming that farm 2 are credit constrained), which further increases the land demand of farm 2, resulting in higher rent, which reinforces the direct effect. The indirect credit constraint effect results in a shift in land demands from D^2 D_t^2 to D_{cc}^2 D_{tcc}^2 (dotted lines), for farm 2. The new equilibrium is at (A_t^*, w_{tcc}^*). Compared to perfect credit markets, the SPS marginal capitalisation into land rents has increased by w_{tcc}^* - w_t^*. The landowners' gains are equal to area *DF* (policy gain) and area *CE* (productivity induced gain). Farm 1 gains area *B*, whereas farm 2 does not gain from the SPS.[37] The credit constraint effect depends on the size of the credit constraint. The more credit constrained the farms are, the larger the productivity effect, and hence the higher the marginal capitalisation of the SPS.[38]

6.2 Land market institutions and regulations

The rental market arrangements in the EU may either involve rental price controls or provisions on the duration of rental contracts. The rental price controls, such as minimum or maximum prices, are usually imposed by government, whereas the duration of rental

[37] In Figure 6 we assume a parallel shift in land demand of farm 2. In reality this may not be the case, implying that farm 2 may even lose from the SPS (Ciaian & Swinnen, 2009).

[38] Even if the SPS does not affect land rents directly, e.g. with deficit and tradable entitlements and no cross-compliance and no greening, its interaction with credit markets may lead to higher land rents.

contracts can be regulated through both formal governmental interventions and/or through informal rural market institutions (Ciaian, Kancs & Swinnen, 2010).

Of particular importance for the SPS capitalisation is the *maximum price intervention*. The potential capitalisation of the SPS into land rents will be reduced in the presence of a rental price ceiling. The duration of rental contracts also has an important implication for rental price adjustments. *Ceteris paribus*, long-term rental contracts for agricultural land will adjust less to policy changes than short-term contracts. According to Ciaian, Kancs and Swinnen (2010), the key determinants of rental contract durations in the EU are social norms (such as in Greece), governmental regulations (e.g. there is a minimum of nine years in Belgium and France, six years in the Netherlands and five in Spain), and market institutions (e.g. Germany, Italy, Sweden). Moreover, in several countries (e.g. France) even the renewal of rental contracts is regulated.

This is shown in Figure 2, where the equilibrium rent with the SPS (with entitlements t^1 and t^2) is w_t^*. If the rental price cannot adjust, e.g. due to land market rigidities, then the actual rent that farms pay will be lower. In Figure 2 the actual rent will lie between w_t^* and w^*, depending on the rigidity of land markets. This implies that the SPS capitalisation will be lower with market rigidities than without at least in the short-run (i.e. it will be lower than $w_t^* - w^*$). However, in the long run the rent will have the tendency to adjust upward to w_t^* with renewal of rental contracts. Upon renewal of rental contracts, competitive pressures will motivate landowners to adjust rents upward. For example, Kilian et al. (2012) estimate for Bavaria (Germany) that rental prices for contracts signed in the first year of SPS implementation (i.e. in 2005) were 16 to 20% higher due to SPS relative to previous coupled payments capitalisation. On the other hand, to overcome the rental price regulation (i.e. the maximum price intervention), farmers will have the incentive to pay unofficial payments (bribes) to landowners to prevent the loss of land to competing farms. Anecdotal evidence suggests that this indeed happens in countries with strong rental price regulation (Ciaian, Kancs & Swinnen, 2010). For example, if we assume that the maximum rental price is set to be equal to the pre-SPS rent w^*, then farmers will have an incentive to pay a bribe to landowners equal up to $w_t^* - w^*$, thus indirectly channelling part of the SPS to landowners (area *EFHK*), leaving farmers policy gain equal to area *C*.

7. Conclusions

The objective of this paper is to analyse the impacts of decoupled payments in the EU – the SPS – by explicitly capturing the income distributional effects and farm restructuring in the presence of dynamic effects, such as exogenous productivity change and farm entry/exit, and market imperfections and institutional rigidities. For this purpose we adopt the land market model of Ciaian and Swinnen (2006), which allows us to capture both the static and dynamic distributional effects of the SPS on rural land markets.

Our results suggest that the entitlement stock effect, barriers to entitlement trade and credit market imperfections increase the capitalisation rate of the SPS, whereas the cross-compliance and the CAP greening, the tradability of entitlements, variation in the face value of entitlements, and land market institutions and regulations reduce the capitalisation rate of the SPS. These results suggest that the SPS implication details are highly significant: farmers' benefits can range from 100% of the SPS value to a negative policy incidence.

These findings are consistent with empirical evidence. For example, Ciaian, Kancs and Michalek (2011) find that around 6-7% of the total SPS are capitalised into land rents in EU-15. They also find that there is a large variation in the capitalisation rate for different SPS levels and between different implementation models of the SPS, ranging from 3 to 94%.

The second important finding of our paper is that the SPS may have an undesirable effect on farm restructuring, if entitlement trade is constrained. The access to land of expanding farms or new entrants may be constrained by less productive farms motivated to preserve land use in order to retain the policy gain. This undesirable effect can be avoided or lessened by improving and/or enhancing entitlement tradability.

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Figure 1. The effect of the SPS with deficit entitlements

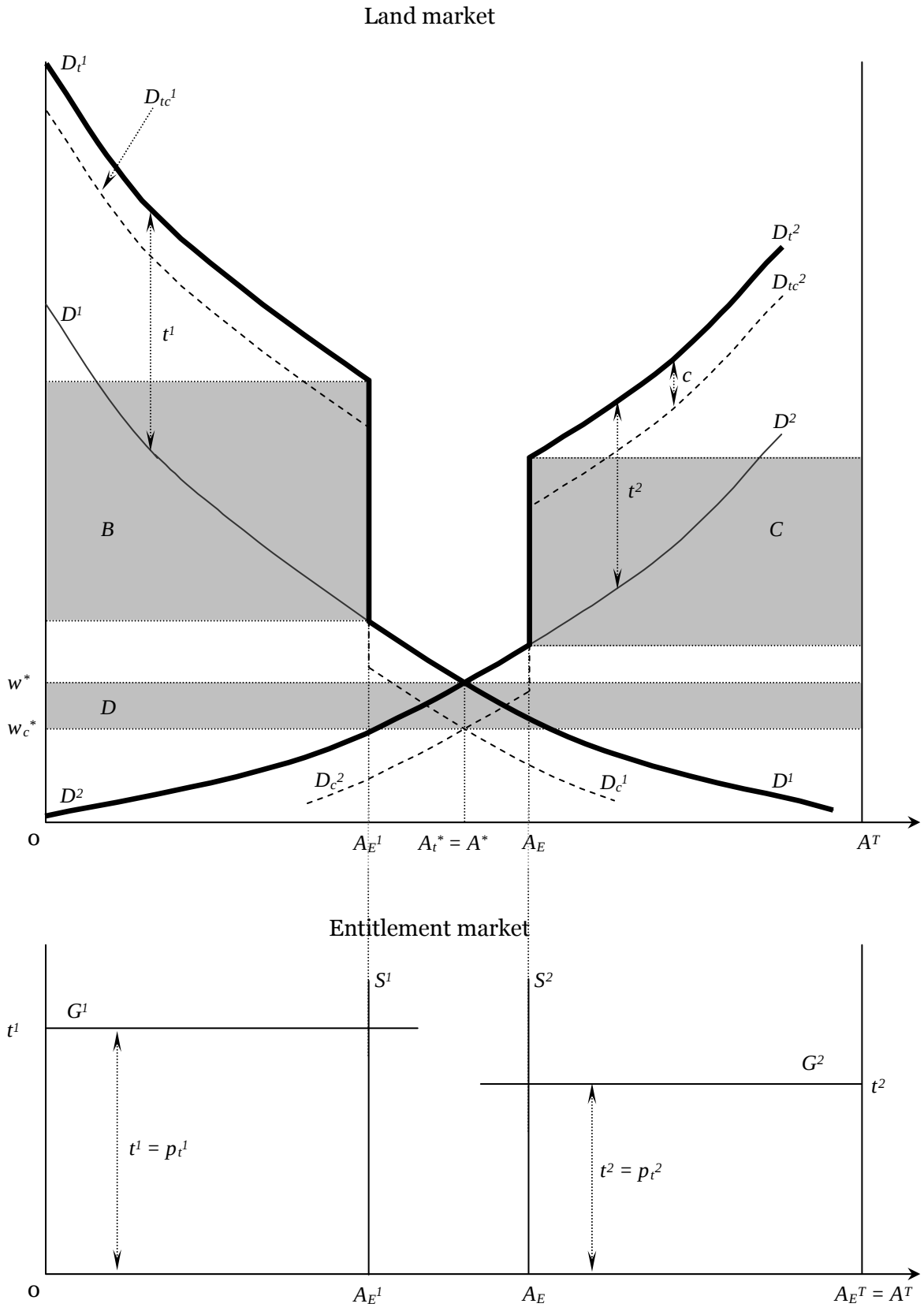


Figure 2. The effect of the SPS with surplus entitlements

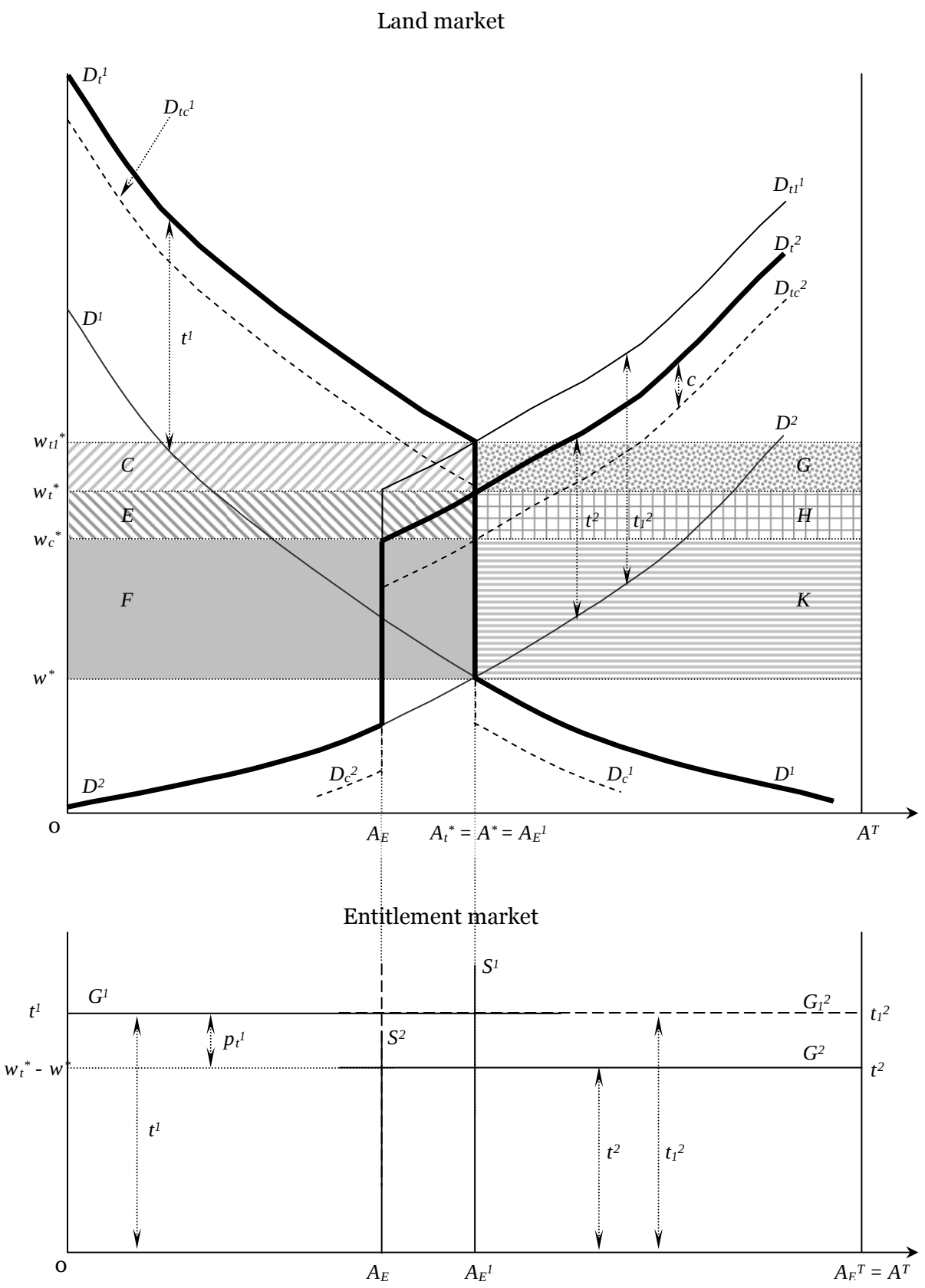


Figure 3. Trade and price of entitlements

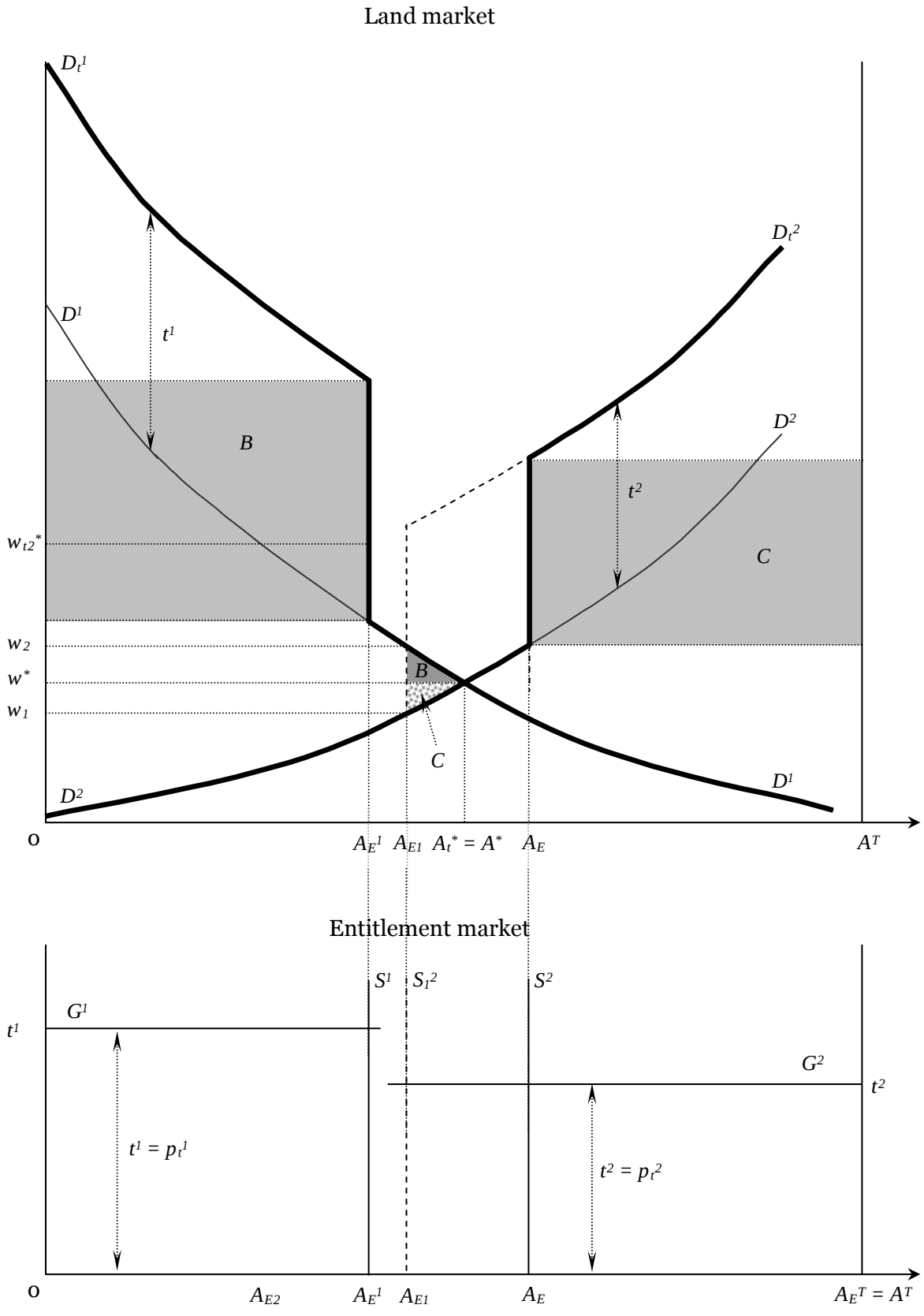


Figure 4. The effect of the SPS with productivity change

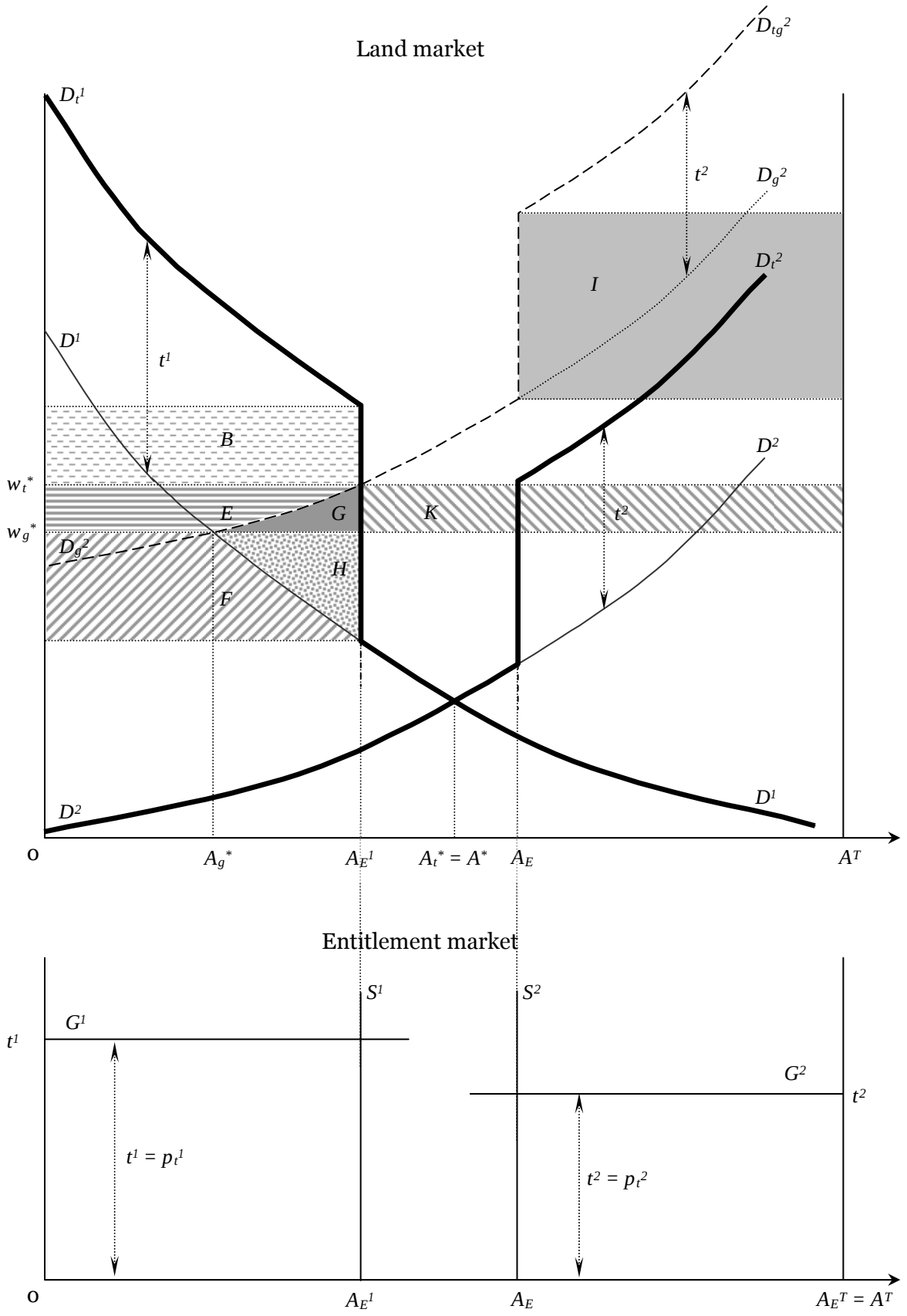


Figure 5. The effect of the SPS with entrants' eligibility for entitlements

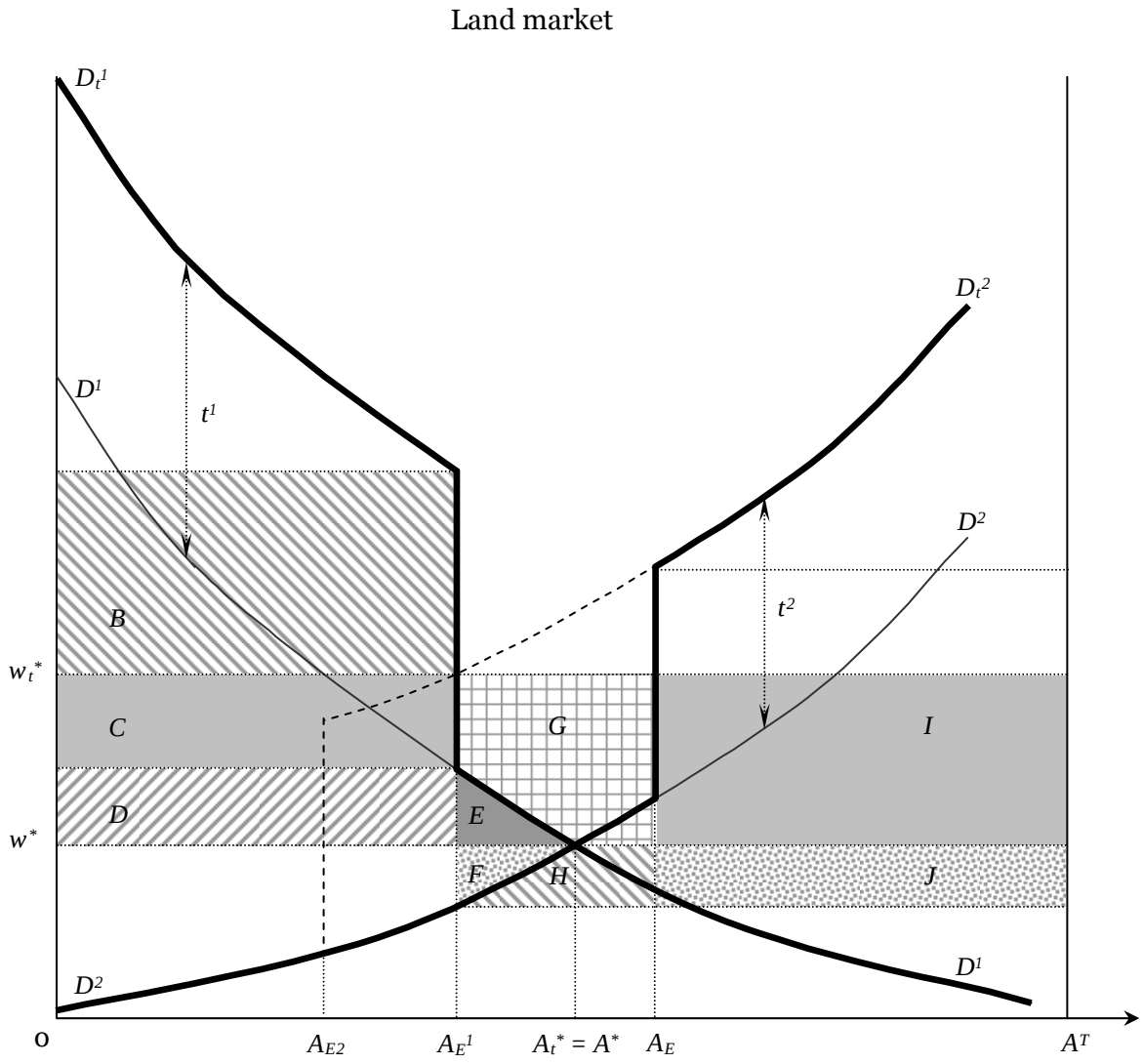
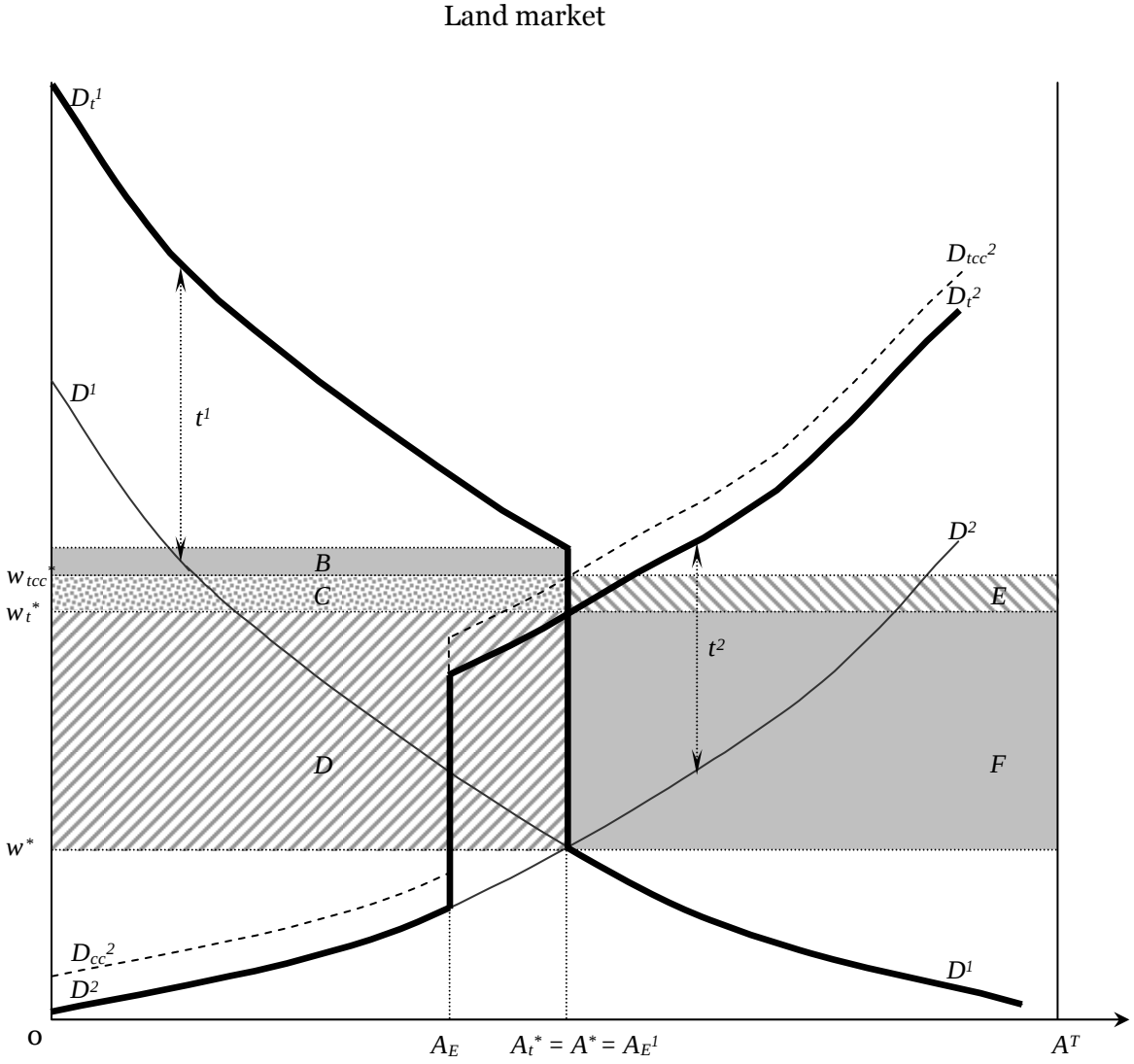


Figure 6. The effect of the SPS with credit market imperfections



Comparative Analysis of Factor Markets for Agriculture across the Member States

245123-FP7-KBBE-2009-3

The Factor Markets project in a nutshell

Title	Comparative Analysis of Factor Markets for Agriculture across the Member States
Funding scheme	Collaborative Project (CP) / Small or medium scale focused research project
Coordinator	CEPS, Prof. Johan F.M. Swinnen
Duration	01/09/2010 – 31/08/2013 (36 months)
Short description	Well functioning factor markets are a crucial condition for the competitiveness and growth of agriculture and for rural development. At the same time, the functioning of the factor markets themselves are influenced by changes in agriculture and the rural economy, and in EU policies. Member state regulations and institutions affecting land, labour, and capital markets may cause important heterogeneity in the factor markets, which may have important effects on the functioning of the factor markets and on the interactions between factor markets and EU policies. The general objective of the FACTOR MARKETS project is to analyse the functioning of factor markets for agriculture in the EU-27, including the Candidate Countries. The FACTOR MARKETS project will compare the different markets, their institutional framework and their impact on agricultural development and structural change, as well as their impact on rural economies, for the Member States, Candidate Countries and the EU as a whole. The FACTOR MARKETS project will focus on capital, labour and land markets. The results of this study will contribute to a better understanding of the fundamental economic factors affecting EU agriculture, thus allowing better targeting of policies to improve the competitiveness of the sector.
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Partners	17 (13 countries)
EU funding	1,979,023 €
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