FACTOR MARKETS

Comparative Analysis of Factor Markets for Agriculture across the Member States

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No. 27, July 2012

Marco Puddu, Fabio Bartolini and Davide Viaggi

Simulation of Land Use and Investment Behaviour under Different Policy Scenarios

Results of the extended farm/household model

ABSTRACT

Factor markets are a central issue in analyses of farm development and of agricultural sector vitality. Among the different production factors, land is one of the most studied. Several studies seek to estimate the effect of government policy payments on land value or land rental prices. The studies mostly agree that government payments and other types of policy support are significant in explaining land prices and account for a large share of them. In October 2011, the European Commission published a new policy proposal for the common agricultural policy (CAP) up to 2020. The proposed regulation includes a shift from historical to regional payments. The objective of this paper is to provide an *ex ante* analysis of the impact of the new CAP policy instruments on the land market. In particular, the effect of the regionalisation of payments in Italy is examined. The analysis is based on the use of a mathematical programming model to simulate the changes in land demand for a farm in Emilia Romagna. The results highlight the relevance of the new policy mechanism in determining a change in land demand. Yet the effect is highly dependent on initial ownership of entitlements under the historical payment scheme.

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Marco Puddu, Fabio Bartolini and Davide Viaggi*

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1. Introduction and objectives

Factor markets are a central issue in analyses of farm development and of agricultural sector vitality. Among the different production factors, land is one of the most studied. The land market is an imperfect market, because of its low substitutability, poor transparency and high transaction costs. It is characterised by a low number of transactions and a local dimension, and is also influenced by economic, policy and institutional frameworks. In particular, the agricultural economic literature has highlighted the effects of the common agricultural policy (CAP) on factor markets (Floyd, 1965; Parsch et al., 1998; Latruffe and Le Mouel, 2006; Ciaian and Swinnen, 2006; Bartolini et al., 2011) and specifically studied the way in which CAP reforms have changed these effects over time.

Nowadays the CAP differs greatly from its commencement under the Treaty of Rome (1957). Over the years, the CAP has moved away from a production-oriented policy to arrive, with the 2003 reform, at an almost purely income-support policy with the introduction of the single farm payment (SFP). Farmers receiving the SFP have the flexibility to grow any crop on their eligible area except fruit, vegetables and table potatoes. In addition, they are obliged to keep their land in good agricultural and environmental condition (cross-compliance). The decoupling of payments has gradually been extended to almost all agricultural sectors. The 'Health Check' of the CAP (2008) added a number of measures to help farmers better respond to changes in the market, as the possibility was introduced for member states to elaborate a national strategy for sustainable operative programmes for fruit and vegetable markets. Several measures were abolished (such as arable set-aside) and others developed (such as milk quotas) in a progressive move towards abolition in 2015 or towards modulation with the reduction of direct payments to farmers in order to transfer resources to the rural development component of the CAP. Today the CAP is undergoing a new reform process; indeed, in October 2011 the official proposal for post-2013 reforms was published. In Italy, it would provide for the switch of the payment regime from a historical to a regional basis. This means that the new payment would lose its connection to the three-year reference period (2000–02) and the entitlements owned by farmers. In addition, farmers would be able to obtain payments for all of their operated land area.

The objective of this paper is to provide an *ex ante* analysis of the impact of the new CAP policy instruments on the land market. More specifically, attention is focused on the regionalisation of payments. The paper aims at contributing to understanding of the relation between the CAP reform and farmers' behaviour through an analysis of investment in land under different policy scenarios. The investigation is conducted first by performing a graphical and theoretical analysis of the effects of the CAP reform scenarios, and second by

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developing an empirical analysis based on a farm-level, mathematical programming model. The paper is organised as follows. In section 2 we look at the background literature. In section 3 we describe the main features of the new direct payment introduced by the 2013 CAP reform proposal. In section 4 we present the theoretical analysis of the effect that the availability of farm entitlements has on land markets, undertaking a graphical examination of the shift from historical to regional payments and of the greening component. In section 5 we give an empirical example by developing a model of a case study farm, and identify some results. Conclusions are drawn in section 6.

2. Background and literature

Land can be regarded as the productive factor that most often limits agricultural production and farm development (Bartolini and Viaggi, 2011). In this section, we briefly analyse the literature on farmland value and rental price formation, and their determinants, as the background of the core issue of this paper. The first works that analyse the direct effect of policy on land demand, and in particular the effect of agricultural price supports on the factor returns and on the personal distribution of income, is the paper by Floyd (1965). Many authors, in later papers, show a close relationship between the effects of policy on the supply of production factors and their elasticity, as well as their factor substitution possibilities (Parsch et al., 1998; Goodwin et al., 2003; Latruffe and Le Mouel, 2006). Several works seek to estimate the effect of policy payments in terms of their capitalisation into land values or land rental prices, and to calculate a share of capitalisation depending on the type of policy support (Ciaian and Swinnen, 2006; Kilian and Salholfer (2008); Dziemianowicz et al., 2008; Courleux et al., 2008; Latruffe and Le Mouel, 2009). The studies mostly agree that government payments and other types of policy support are significant in explaining land prices and account for a large share of it. Studies estimate this share to be around 15-30%, although it could be up to 70% for specific regions and time periods (Latruffe and Le Mouel, 2006).

The literature also underlines the effects of policy changes on the reallocation of productive factors over time (Bartolini and Viaggi, 2011). Numerous papers analyse the effects of decoupling, introduced in 2003 by the Fischler reform, on the dynamics of the exchange of land. These works identify the determinants of capitalisation of payments into land prices in the distribution of payments among beneficiaries, in relation to the possibility of exchanging entitlements and the ratio between the eligible area and the number of entitlements owned (Le Mouel, 2006; Kilian et al., 2008; Courleux et al., 2008; Zier and Petrick, 2010; Viaggi et al., 2010).

Both *ex ante* and *ex post* analyses have some relevance in the literature. *Ex ante* approaches are found in the evaluation of the effects of policy as a result of different scenarios. *Ex post* approaches evaluate policy effects after the policy has been implemented and are based on surveys or (time) series, or secondary data. Given the objectives of these works, one could say that econometric models are better suited to *ex post* analysis, while mathematical programming models are more appropriate for *ex ante* analysis.

Studies of the effects of different policy scenarios on changes in land demand or land rented/sold are often based on or expressed through changes in the marginal value of land.

Mathematical programming models have been used to simulate the impact of policy reforms that also take into consideration changes in farm size under various price, policy and cost scenarios. This type of model likewise has important uses in analysing competition for land allocation among different farms, measuring the effects of drivers of changes through the marginal value of land (Galko and Jayet, 2011).

Some studies seek to investigate farmers' investment behaviour (including in land) and evaluate the impact of alternative CAP scenarios, with a special focus on the Single Payment Scheme (SPS), in order to contribute to understanding of the relation between policy

objectives and farmers' behaviour (Gallerani, Ghinassi and Viaggi, 2008; Viaggi, Bartolini, Raggi, et al., 2011).

Several papers use econometric models based on the application of statistical and mathematical methods to show the effects of changes in policy mechanisms or property rights on the number of land market transactions (Parsch et al., 1998; Latruffe and Le Mouel, 2006; Gallerani, Gomez y Paloma, et al., 2008; Ciaian et al., 2008; Jin and Jayne, 2011).

A subject of a large branch of recent literature is the analysis of policy effects in Central and Eastern European countries (CEECs). In these countries, during the post-communist period and the EU accession process, major land reforms took place. Transaction costs in land exchange and imperfections in the land markets, such as imperfect competition, can be very significant in CEECs and the combination of imperfect competition and transaction costs has had a strong impact on land prices (Swinnen, 1999; Ciaian, 2007).

3. Direct payments in the post-2013 CAP reform

3.1 General provisions

The CAP's development has been characterised by an evolution from agricultural price support, to area payments and to the present decoupled payments. The latest scheme, introduced with the 2003 reform and active since 2005, is the SFP. In October 2011, the European Commission published a new policy proposal (COM(2011) 625/3) for the CAP for the period 2013–20.[1]

The mechanism of payment is to be based on a disentangling of the single farm payment into four different components: basic payments, a greening component, payments to less favoured areas and payments to young and small farms. The first two components are expected to be the most relevant because they cover almost the entire payment that farmers can receive. The basic payments can reach a maximum of 70% of the amount of payment assigned to the farm (the regional ceiling divided by the number of entitlements fixed at the regional level). The basic payments are to be assigned to active farmers. An active farmer is one whose annual amount of direct payments is greater than 5% of the total receipts obtained from non-agricultural activities in the most recent fiscal year and who carries out on his/her land the minimum activity established by member states in accordance with the definition of "agricultural activity". These limitations will not apply to farmers who receive less than €5,000 in direct payments. The member states shall decide not to grant direct payments to a farmer if the total amount of direct payments claimed or due to be granted in a given calendar year is less than €100 or if the eligible area of the farm is less than one hectare.

Member states will be able to assign a small portion of the regional payments ceiling to young and small farms (respectively 2% and 10%). Member states may grant payments to farmers entitled to compensation under a basic payment scheme whose holdings are fully or partly situated in less favoured areas. The reform also introduces a "capping" element, which is a reduction of the amount of payments to farmers who receive more than €150,000 in direct payments. This shall be calculated by subtracting the salaries effectively paid and declared by the farmer in the previous year from the total amount of direct payments initially due to the farmer.

3.2 From historical to regionalised payments

The proposed regulation includes provisions to switch the direct payment regime from a historical to a regional or national basis in the countries in which the historical payment is

[1] European Commission, Proposal for a regulation of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy, COM(2011) 625/3, Brussels, 2011.

still in place (COM(2011) 625/3). Member states shall divide the national ceiling among the regions and they may decide, before 1 August 2013, to apply the basic payment scheme at the national or regional level. In Italy, the most likely strategy is to adopt the direct payments at the regional level. In this case, the member state shall define the regions in accordance with objective and non-discriminatory criteria, such as their agronomic and economic characteristics and their regional agricultural potential, or their institutional or administrative structure. The regionalised payment is a homogenous payment per hectare for farms in the same region and will be distributed on the basis of the farm area on which some agricultural activity is carried out. This measure is prompted by the desire for a more uniform distribution of payments per hectare across EU farms.

3.3 The greening component

The greening component of the payment is assigned to farmers entitled to a payment under the basic payment scheme and who comply, on their eligible hectares, with some ecological prescriptions (COM(2011) 625/3), i.e. those who

- have at least three different crops on their arable land where the arable land of the farm covers more than three hectares;
- maintain existing permanent grassland on their holding; and
- have ecologically focused areas (7% of the total farm area) on their agricultural area, such as land left fallow, terraces, landscape features, buffer strips and woodlands.

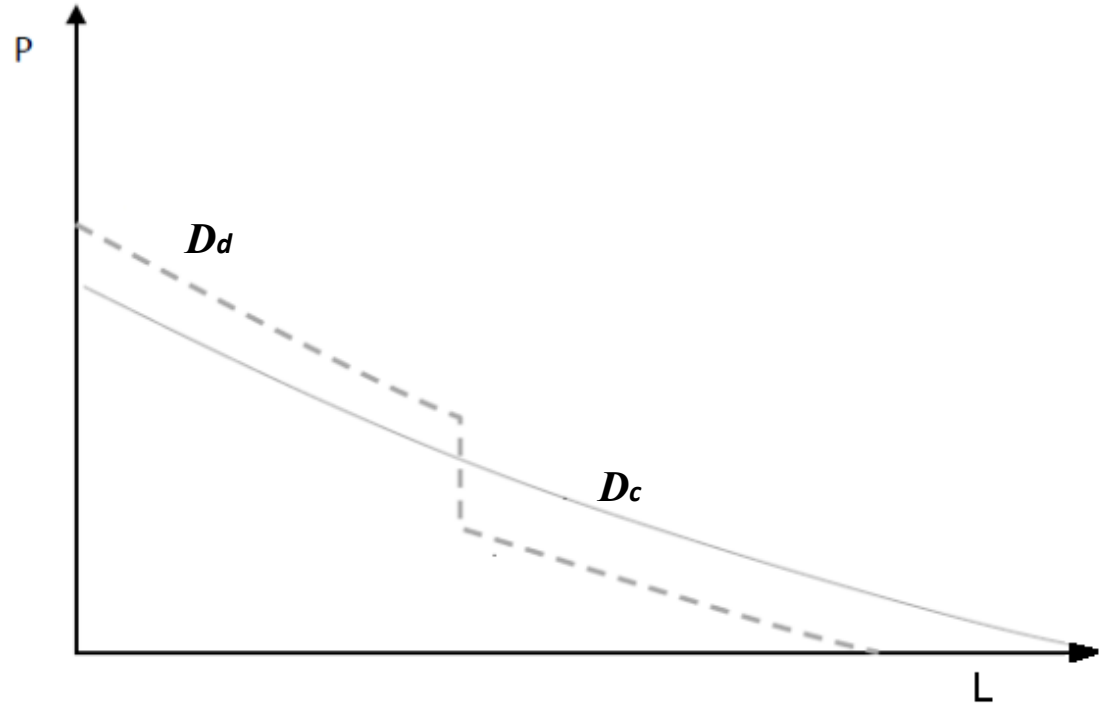
The greening payment is consistent with biological farming. Member states will use 30% of the national envelope to pay for the greening component.

4. Theoretical analysis

4.1 A graphical analysis of regionalised payments

Use of the marginal value of land as generated by single farm models and the derived land-demand function of the single farm significantly facilitates understanding in the study of land markets. But when it comes to numerical models, they give information that is time-specific and not easily generalised with respect to the effects of policy on land values (Ciaian and Swinnen, 2006; Gallerani, Gomez y Paloma, et al., 2008). Several studies suggest a graphical analysis of the effect of decoupling, introduced in 2003 with the Fischler reforms, on the function of individual demand for farmland. In particular, our theoretical work starts from Figure 1, based on the paper developed by Gallerani, Ghinassi and Viaggi (2008), who built their analysis on previous work by Swinnen (2007). The figure shows two curves: the first one, with a dotted line, represents the decoupled scenario with a discontinuous farmland-demand function; the second one, with a continuous line, shows the scenario before the introduction of decoupling, in which the payment was coupled with the area of selected crops (under Agenda 2000). In the decoupled scenario, assuming historical payments, this figure may be used to illustrate the mechanism by which direct payments are capitalised into the sale or rental price of land. This leads to the formation of two categories of farmland and prices: that which is exchanged with the related entitlements and has a higher value encompassing the value of the direct payment, and that which is exchanged without entitlements and has a consequent lower value. Even if land were not sold with entitlements, the ownership of entitlements would likely affect the willingness to pay for additional amounts of land, as having more land available would offer the possibility to benefit from the activation of the entitlements. This applies up to the point at which the number of entitlements owned ends (if the trade is not allowed for). Hence, the decoupled scenario, under the assumption of the non-tradability of entitlements, is represented by a drop in the marginal value of land when the entitlements owned by the farmer end. The additional availability of land has a lower marginal value, as it cannot be used to activate entitlements.

Figure 1. Effect of decoupling on the function of individual demand for farmland

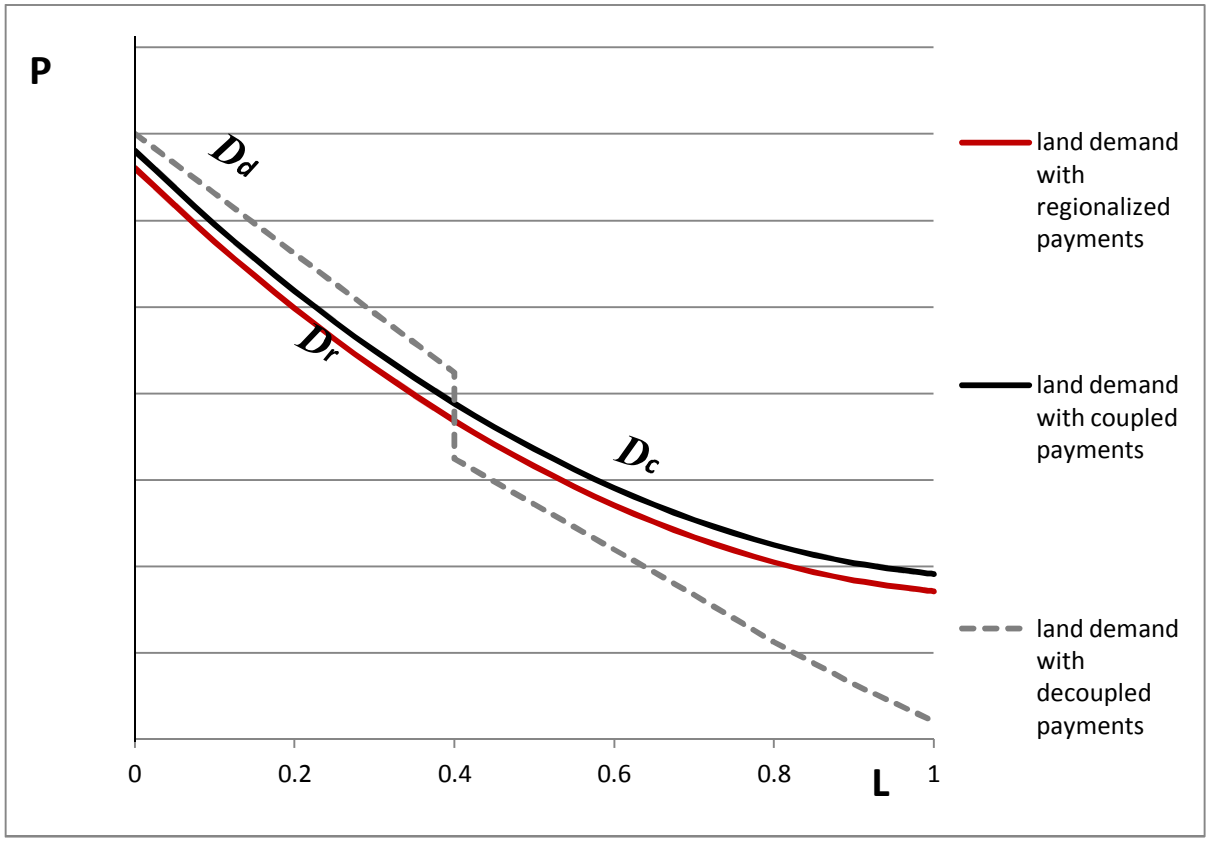


Sources: Swinnen (2007) modified by Gallerani, Ghinassi and Viaggi, 2008

The dotted line (*Dd*) represents the decoupled payments scenario, with a step corresponding to the end of entitlements owned by the farm, and the continuous curve (*Dc*) corresponding to the coupled payments scenario. As discussed above, in the left-hand part of the figure, the decoupled curve is higher than the coupled one, while in the right-hand part of the figure, after the step the coupled curve is higher than the decoupled one. This underlines the capitalisation of the amount of the entitlements into the land value, with the consequent willingness to pay for land. To follow the evolution of the CAP as envisaged by the proposals for the post-2013 CAP reform, we develop the above analysis further, assuming the introduction of the regional payment scheme in the framework above.

Figure 2 shows three farmland demand curves: the black one (*Dc*) corresponds to the land demand curve with a coupled payment and represents the Agenda 2000 payments, while the grey dotted line (*Dd*) shows the land demand with decoupled payments and depicts the Fischler 2003 payments. The red one (*Dr*) is the land demand with the application of the regionalised payments scheme. Assuming that the regionalisation drops the entitlement system, the new scheme would have a double effect on land demand. First, the new homogeneous payments would remove the inequality among farms due to the historical amount of the payments. Second, it would reduce the difference in terms of purchasing power depending on the relation between the farm area and the number of entitlements owned. The latter effect stems from the possibility for farmers to require more entitlements if they need them. Moreover, the amount paid for each entitlement is less than before because of the redistribution of the total amount of direct payments among more farms than was previously the case. Accordingly, the red curve is lower than the black one to represent the lower amount of direct payments received. The new curve is not a discontinuous farmland-demand function because we lose the step due to the drop in land value as a consequence of the end of entitlements owned by the farmer.

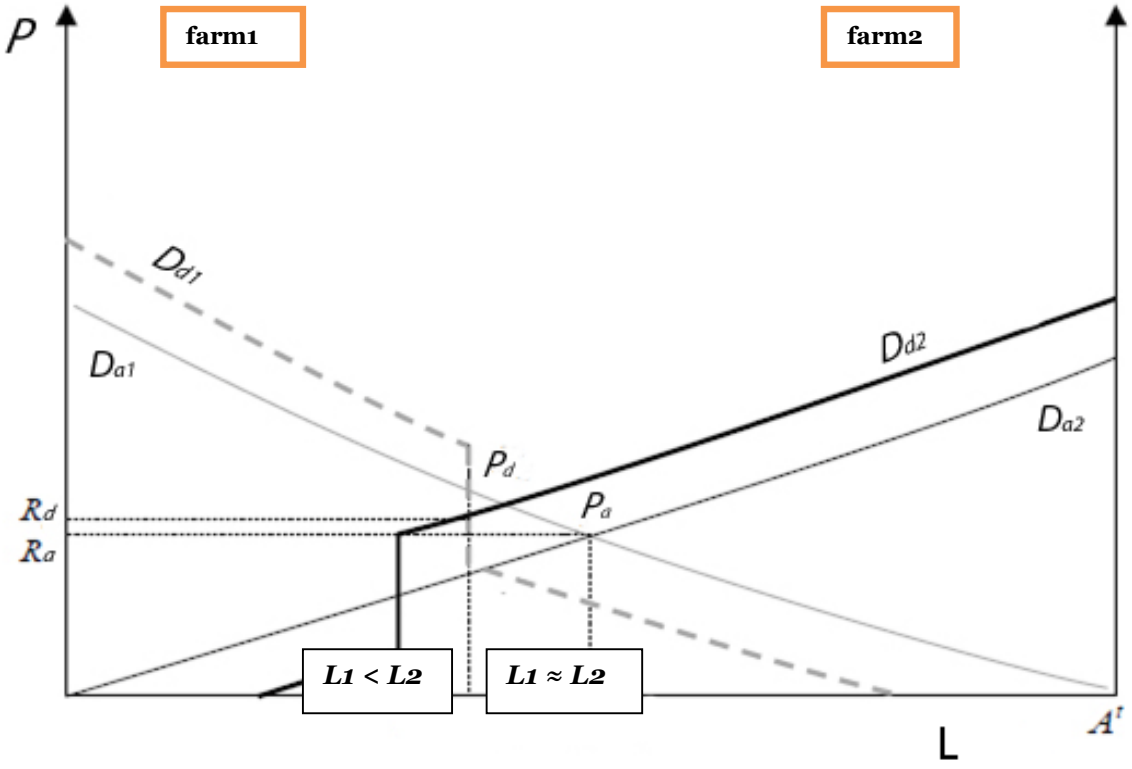
Figure 2. Effect of the *post-2013 reform on the function of individual demand for farmland*



To better understand the market effects of the reaction of farms to the reform and to test differences between farms in land competition, we undertake a theoretical analysis based on a simplified land market constituting just two farms. We consider the sum of the land available for the two arable farms as the total land available to make the two farms compete for the same area. We develop a series of graphics to analyse how the prices and quantity of land of the two farms would change in the new policy scenario. In the first part of the analysis, the farms considered are the same and have the same amount of entitlements, in order to verify the effects of alternative scenarios on the land price without the result being affected by farm heterogeneity. In the second part, the study uses two farms with different characteristics and amounts of entitlements to analyse the distribution of the total land between the farms and the changes in land price. More specifically, this part of our theoretical work follows Figure 3, which comes from a previous paper developed by Gallerani, Ghinassi and Viaggi (2008), who built their analysis on previous work by Swinnen (2007) and developed it.

The theoretical analysis starts from the analysis of the shift from area payments (pre-2003 reform) to decoupled payments. Figure 3 shows a simplified market composed of two farms, where the amount and the distribution of rights determine the new equilibrium price. In this case the new equilibrium price, with decoupled payments, is higher than the initial one. The demand for farmland decreases compared with area payments for the farm with a lower amount of aid rights and vice versa for the other.

Figure 3. Effect of decoupling on the land market: A hypothesis of two farms



Sources: Swinnen (2007) modified by Gallerani, Ghinassi and Viaggi (2008).

Figure 4 shows a situation where the intersection of the two decoupled land-demand curves (dotted lines) occur before the step that characterises the end of entitlements owned by the farm. This situation represents farms with entitlements for a large share of the land operated. Between the scenarios the land rental price changes. In particular, the regional payment results in a price (Pr) that is lower than the price (Pd) in the decoupled scenario. This happens because the intersection between the two decoupled curves takes place in the part of the curve representing land associated with entitlements, so this value of land includes the value of the entitlements, which is higher in the decoupled scenario than in the regionalised one. Thus, in terms of the demand for land, the results show a decrease with the shift to a regionalised payment scheme for farms having a high amount of entitlements with respect to the land operated.

Figure 5 shows a situation with a low relation between the entitlements owned and the land operated by the farms. This means that only a small share of the land operated by the farms is covered by entitlements. In this situation, the shift to regionalised payments results in an increase in the land price (Pr) with respect to the price (Pd) in the decoupled payments scenario. This happens because the intersection between the two decoupled curves takes place in the part of the curve that represents the land without associated entitlements. Because this value of land does not include the value of the entitlements, it is lower than in the regionalised case. Hence, altogether the regionalised payment leads to an increase in land demand for farms with a low amount of entitlements relative to the land operated.

Figure 4. Effect of regionalised payments on the function of individual demand for farmland: A hypothesis of two equal farms (entitlements on 60% of farm area)

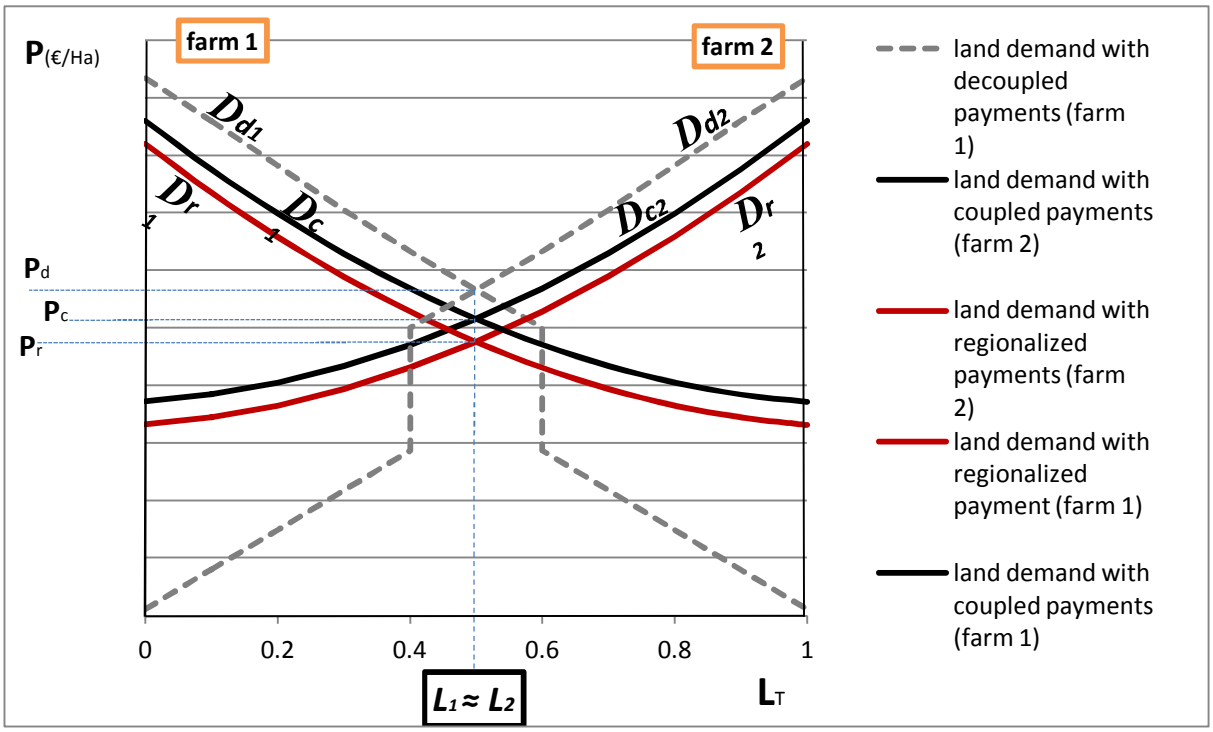


Figure 5. Effect of regionalised payments on the function of individual demand for farmland: A hypothesis of two equal farms (entitlements on 30% of farm area)

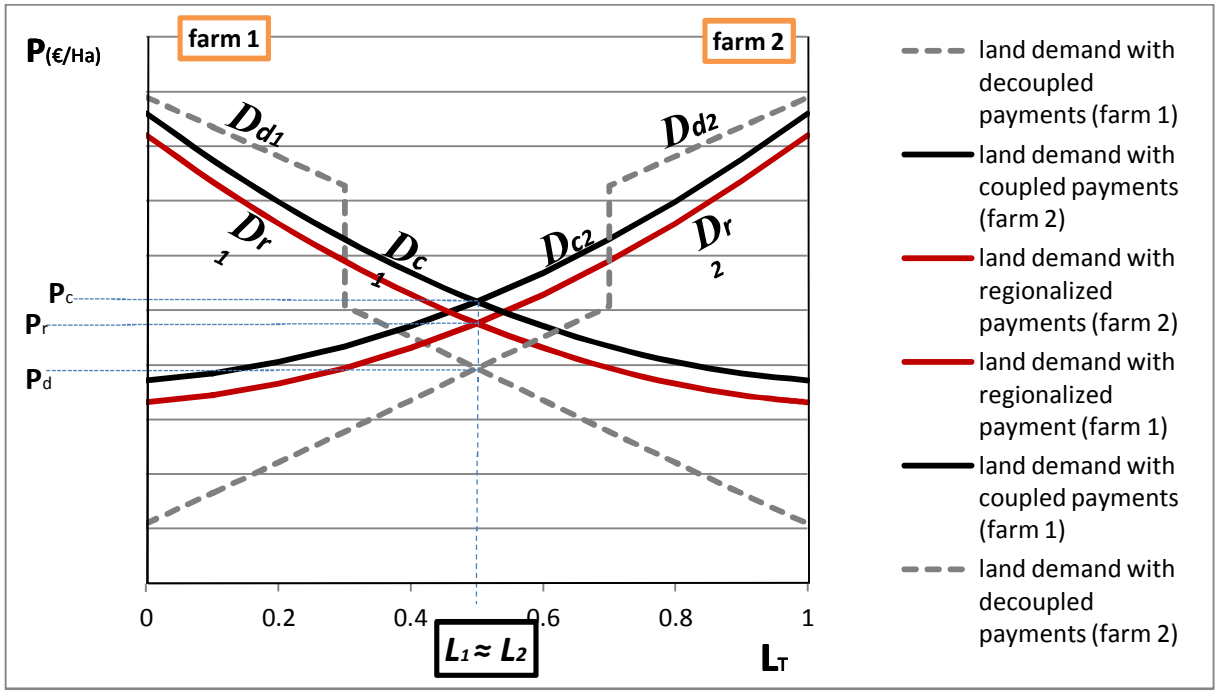
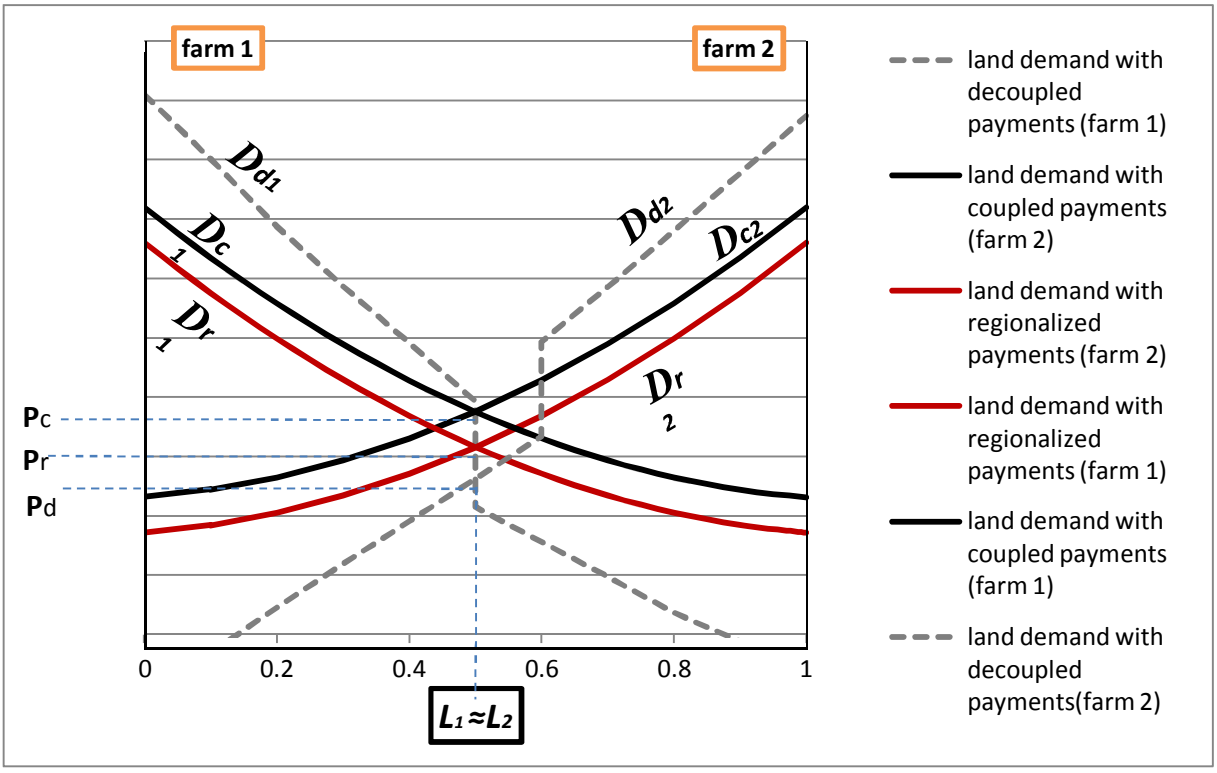


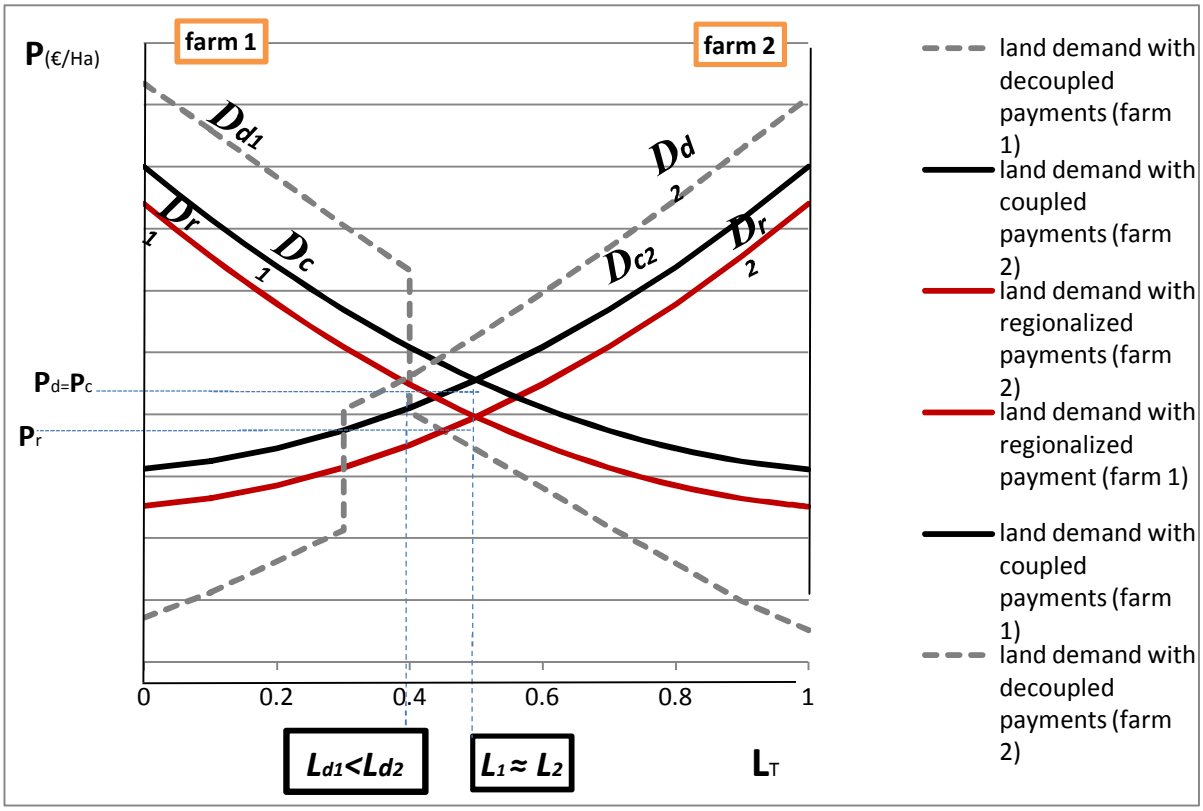
Figure 6 shows a situation in which the intersection between the two decoupled land-demand curves (dotted lines) occurs in the middle of the step for farm 1 and in the part without entitlements for farm 2. Farm 1 has more entitlements than farm 2. Between the scenarios the land rental price changes. In more detail, the regional payment results in a price (Pr) that is higher than the price (Pd) in the decoupled scenario. This takes place because the marginal value assigned to the land stems solely from land profitability and does not additionally include the value of the entitlements. Therefore, in terms of farmland demand the results of this case show an increase with the transition to a regionalised payment scheme, although to a less relevant degree compared with the previous case. The difference in the price of land is determined by the intersect position of the curves, so it is directly correlated with the amount of entitlements with respect to the area operated.

Figure 6. Effect of regionalised payments on the function of individual demand for farmland: A hypothesis of two different farms (entitlements farm 1 > farm 2)



In the case of heterogeneous farms, the equilibrium in terms of the allocation of land and obviously in terms of land demand between the two farms, also changes with the shift to regionalised payments compared with the decoupled situation. In the decoupled scenario, the graph in Figure 7 shows a decrease in land demand for the farm with a lower level of entitlements than the other. Farm 1 loses in terms of demand for land and vice versa for farm 2. With the shift to regionalised payments, regarding farmland demand the results show a decrease with the shift to the regionalised payment scheme. The historical advantage of a farm with more area covered by entitlements relative to the other farm comes to an end with the regionalised payments.

Figure 7. Effect of regionalised payments on the function of individual demand for farmland: A hypothesis of two different farms (entitlements farm 2 > farm 1)

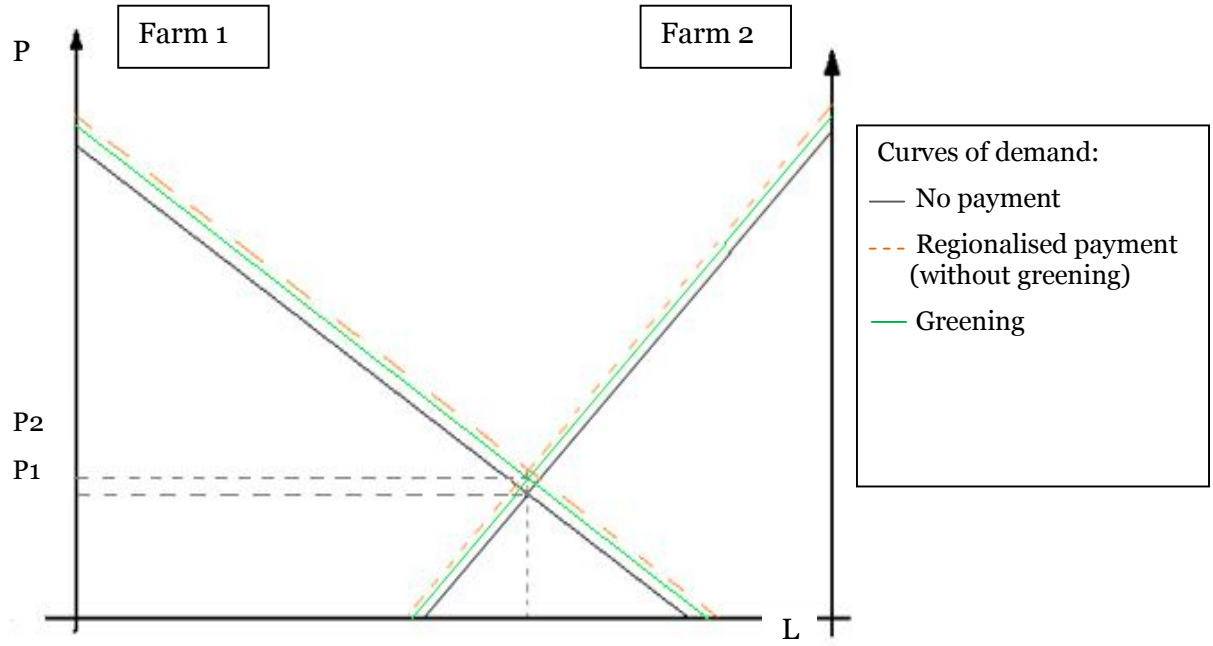


4.2 A graphical analysis of the greening component

Following the above approach, we extend the theoretical analysis to a simplified market composed of two farms in order to test the greening scenario. This instrument provides for a component of the payment that is received by farms complying with some ecological rules (rotation, 7% set aside, etc.). The amount of the direct payments dependent upon compliance with this prescription is 30% of the total amount that one farm can receive from direct payments linked to greening.

Figure 8 shows the two curves (dotted yellow lines) of land demand with the regionalised payment (assuming no greening), along with the two curves (green lines) that represent the application of the greening component. The equilibrium changes due to the fact that the greening component leads to a net additional cost for the farmers. The market price would be higher than in the case of no payment, but lower than with a regionalised payment without greening. The new price with greening, compared with the initial historical payment, will depend upon the point of the previous equilibrium with respect to the number of entitlements (see the analysis above). Assuming homogeneous payments between farms and a homogenous cost of greening, the land allocation would not change.

Figure 8. Effect of greening payments on the function of individual demand for farmland: A hypothesis of two different farms



Hence the main effect of greening would be a decrease in land value and in demand owing to the loss of profitability of the land used under ecological constraints. The actual effect would also depend on the individual conditions of each farm, with regard to the implementation of greening. In general, farms that may take more advantage of this payment are those which already have areas not being used for farming, for example because of inconvenience or some problem associated with the slope or fertility of the land. In this case the farm does not have any costs it must sustain for the sake of the greening application and hence it may present a different effect, as it does not show a reduction in land demand.

5. Empirical analysis

5.1 Case study

In this paper we analyse the land market effects of the CAP reform of 2013 through the simulation of a farm's behaviour during the period before and after the reform and the resulting changes in land demand. The case study data come from a survey of about 250 farms conducted in 2009 for the project "Farm Investment Behaviour under the CAP Reform Process" by the Unibo team (Viaggi, Bartolini, Raggi, et al., 2011). We use the data of only one representative farm located in Italy, in the Emilia Romagna region, in the plains area of the Bologna province. It is specialised in arable crops, such as alfalfa, maize, sugar beet, wheat and durum wheat. The owner of the farm works as a full-time farmer and has the possibility to take on external workers. The farm size is 105 hectares and is made up of a single parcel of land. The market value of the land reported in present conditions is €600 for rent and €25,000 for the land value per hectare, which is consistent with the real price in the Bologna province for this type of land. The household is composed of seven members, among whom only two work on the farm (with each of the two dedicating 2,200 hours per year). One of these two persons has the possibility to work outside the farm if more advantageous, so we assign an external revenue amount in euros per hour for this work. Also, the farmer has the possibility to take on external labour if necessary and the cost for employing the external labour per hour is €13. We consider a household consumption level of €60,000 per year.

We build up four different scenarios and in particular we focus attention on one part of the new direct payments – the regionalised payments. The first scenario shows the situation before the reform and involves a control period or a baseline scheme that reflects the actual situation of the CAP. In that scenario, the farm receives from the historical SFP the payment amount of €37,000 and owns 118 entitlements. Thus it receives around €313 per entitlement linked to each eligible hectare. The other three scenarios relate to alternative hypotheses of regionalised payments, each with a different amount of payment. Because the regulation has not yet been implemented and it is not yet clear how the regionalised payments will be precisely calculated, we use the indicative amount of €250 as the regionalised payment, applying a reduction of about 20% with respect to the historical SFP payment used in the baseline scenario. To take into account various possibilities for payment, we tested the other two scenarios beyond the baseline and the regionalised scenarios – one with half the amount of payment with respect to the regionalised case, and the other with a 50% higher payment compared with the regionalised scenario. The results in terms of the amount of land operated are shown as an average between the years of 2013 to 2020.

5.2 Scenarios

We build up four different scenarios. The first one represents a baseline scenario characterised by the 'Health Check'. The other scenarios represent situations with the introduction of regionalised payments. To test various possibilities for the amount of payment, we formulate three hypotheses concerning changes to the payment in relation to the baseline scenario. Among them, scenario 2 involves a reduction of 20% relative to the baseline, scenario 3 entails a reduction of 50% compared with the previous scenario and scenario 4 represents an increase of 50% compared with scenario 2. Scenario 2 has been created to simulate one of the most frequently mentioned hypotheses of a reduction in the regionalised payment relative to the historical one in Italy, of around 20%. Scenarios 3 and 4 respectively simulate a general decrease and increase in the amount of the payment arbitrarily decided (see Table 1).

Table 1. Amount of payments assumed in each scenario (€/hectare)

	Scenario 1: Health Check (Baseline)	**Scenario 2: Regionalised**	**Scenario 3: Regionalised *0.5**	**Scenario 4: Regionalised *1.5**
Historical SFP	313.00	0	0	0
Regionalised SFP	0	250.00	125.00	325.00

Source: Authors.

5.3 The model

We simulate the effects of the regionalisation of payments at the farm level using a dynamic integer programming model simulating household behaviour, as proposed by Viaggi, Bartolini, Raggi, et al. (2011). The objective function is expressed by the net present value (NPV) of total household cash flows over the time horizon. The NPV maximisation is subject to constraints on decision variables, represented by the feasible set and by non-negativity constraints. The general mathematical formulation is as follows:

$$\text{Max } Z = \sum_t \delta F_t (X_t)$$

s.t.

$$x \in X$$

$$x \geq 0$$

$$C_t \leq C *$$

where

Z = objective function,

X = feasible set,

X_t = vector of decision variables,

δ = discounting factor,

Ft (Xt) = net cash flow expressed as a function of the activities carried out in time period t,

Ct = annual consumption, and

C* = minimum acceptable yearly consumption by the household.

A detailed illustration of the model is available in Viaggi, Bartolini, Raggi, et al. (2011, annex B).

The model focuses on the investment component of the farm's activity. To adapt the original model as developed by Viaggi, Bartolini, Raggi, et al. (2011) to the needs of this paper, we concentrate attention on investments in land, excluding all others. The household characteristics are included and detailed in the model. To better understand the variables that influence the model we develop a sensitivity analysis of the results using different interest rates on credit, along with different values for the rent and sale of land. We use a time horizon of 10 years (2009–20) but we divide this horizon into two periods, computing the average of the results separately for the period before the reform (2009–13) and after the reform (2013–20).

5.4 Results

5.4.1 The land demand curve by land rental value under CAP scenarios

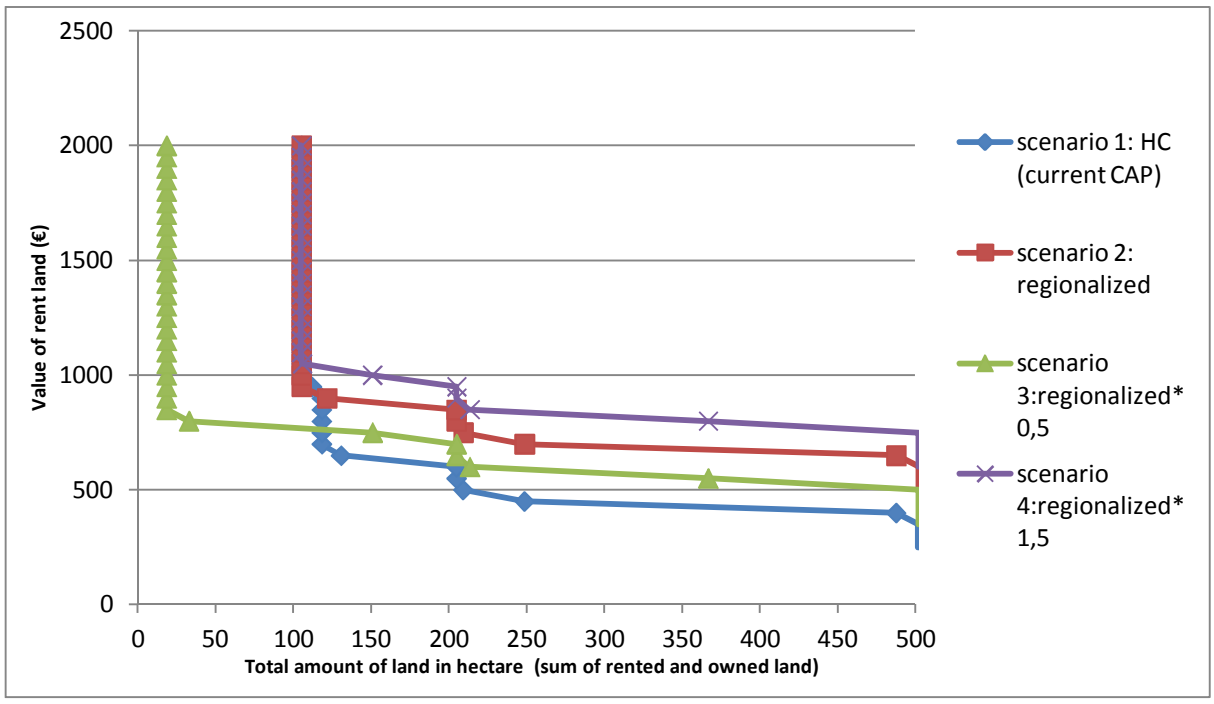
The land demand curve, in Figure 9, shows an increase in the total land used by steps. These stem from the kind of model used. When changing the rental prices, the demand shows the same trends in all scenarios, but the willingness to pay for land is rather diversified. In this way differences in the amount of the payments owing to the new regionalised payment scheme have an influence on the demand for land.

When the rental price is high (more than €800 per hectare), in scenarios 1, 2 and 4 the farm maintains the same amount of land as in the baseline scenario. In scenario 3, when the rental value is high (over €800) there is a sharp reduction in the farm size and a small area is rented in; farm activity is less profitable due to the reduction of direct payments as implemented in scenario 3.

Generally, for rental prices higher than €1,000 per hectare in all scenarios it is not profitable to rent in the land. Indeed, all the land operated is owned and the farmer has no incentive to expand the farm. Between €600 and €1,000 per hectare there is a progressive substitution between land rented in and land owned, along with a progressive increase in farmland area.

With rental prices lower than €600 per hectare, the amount of land operated is highly diversified between the two SFP systems (regionalised or historical). Given the same rental price, the quantity of land operated under the scenario based on the historical system is lower than under all the other scenarios (which represent the situation with the regionalised system). As expected, under the regionalised system the increased accessibility of new payments (because of the lack of historical constraints) translates into an increase in the marginal value of land and hence causes an increase in land demand.

Figure 9. Land demand curve by land rental value under CAP scenarios



The increase in the amount of land operated follows a trend characterised by steps, which is due to the specific model used and to the relation between the land price and labour. More specifically, the increase in land demand is not linear and some point in the curve, characterised by a step, represents a different strategy in the use of household labour and the possibility to employ an external worker. Indeed, with a low rental price for the land, the farmer, the other member of the family and an additional external person work on the farm. This is due to the high profitability of the land when it has a low rental value. The opposite situation happens when the land has a high rental price. In this case, only one member of the household works on the farm and the other member of the family finds it more advantageous to work off the farm. Between these two extreme cases there is an intermediate situation, which is represented by the area of the curves between €800/1,000 of rental value and 100/200 hectares of land operated. Here there is one member of the family who works on the farm, one who works outside and there is a progressive reduction in the external labour employed on the farm.

In all the curves, when the value of rent is less than €1,000 per hectare, the acquisition of land follows a continuous increase because the farming activity involves only the household worker. When internal labour ceases to be available, the curve of land demand proceeds horizontally, finding a sufficiently lower price to allow the purchase of external labour. The external labour permits further expansion of the farm area. It is important to highlight that the farm finds it more convenient to take on external labour before completely using up the available internal labour. At the same time, one of the two members of the household, who until now worked on the farm, finds it more beneficial to work outside. This happens because the labour outside the farm has an opportunity cost that is higher than the profitability of the labour of this worker on the farm.

The above analysis is consistent with the literature and confirms that labour allocation is a key factor in farm behaviour, mainly as most farms are run by households and off-farm income accounts for an increasing share of total revenues for rural households (Viaggi et al., 2008).

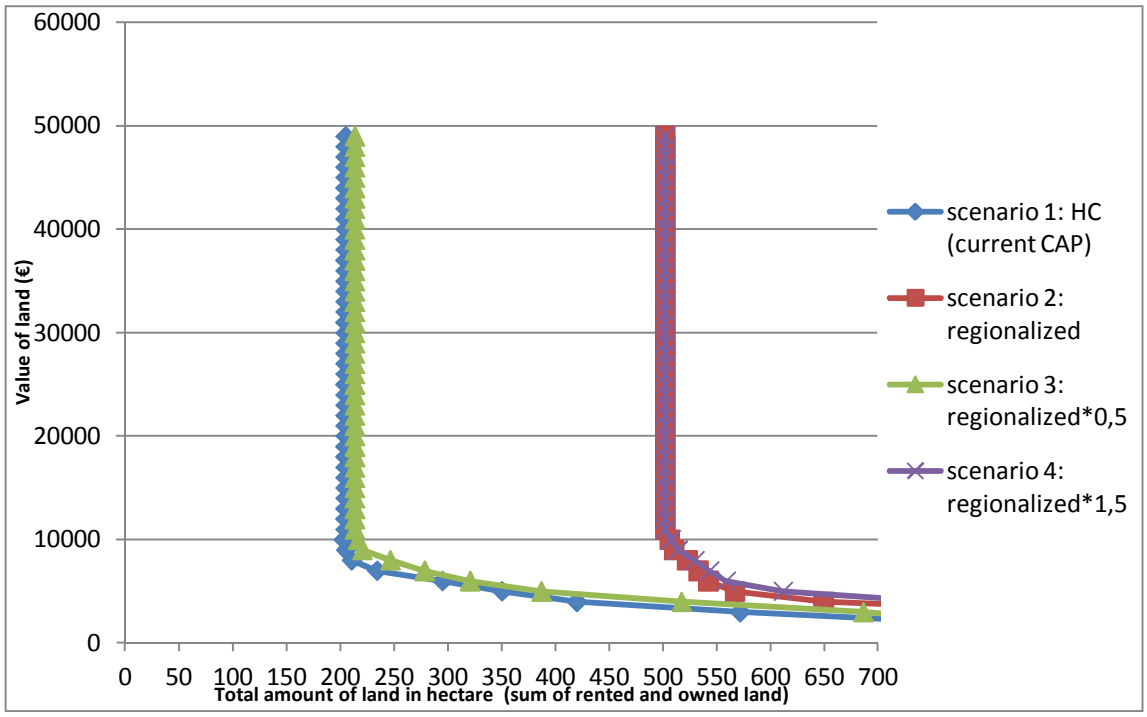
5.4.2 The land demand curve by land sales value under CAP scenarios

The land demand under the scenarios analysed in Figure 10 shows how the total amount of land operated, rented and owned changes at different selling prices. In the figure, the scenarios are grouped into two clusters: the baseline and scenario 3 in one cluster, and scenarios 2 and 4 in the other. Under the conditions of the baseline and scenario 3 (the regionalised scenario with a lower payment per hectare), there is less total land operated compared with the other two scenarios. This confirms that the policy has a major influence on land demand.

In all the scenarios, with an increasing land price there is a reduction in the total amount of land operated. For the higher land price of €7,000 per hectare under scenarios 1 and 3, there is a substitution effect between owned land and land rented in. In the other scenarios, this effect starts at lower price levels (€3,000 per hectare).

In all the scenarios, at a value of €23,000 per hectare, it is not profitable to own the land and all the usable agricultural area is rented in, with marked diversification among the scenarios. This is highlighted by results from the model, but it is not actually depicted by the curve.

Figure 10. Land demand curve by land sales value under CAP scenarios



With a higher price of land per hectare the curve follows a linear evolution characterised by the conversion of all the land owned into land rented in, and shows a much higher demand for land under the regionalised payment that is even more evident in scenarios 2 and 4. Only with a very low price for land is there a strong increase in demand for land in all the scenarios. In general, the figure shows an increase in land demand in scenarios 2 and 4 that is identical to and which maintains the same distance to scenarios 1 and 3.

5.4.3 Sensitivity analysis

In the previous figures we considered a single variable at a time, while in this subsection we develop a scenario analysis taking a combination of the value of land, rent and interest rates on credit. For all of the period and all the scenarios we test the sensitivity of results for different land values (€20,000-50,000), rent (€600-1,000) and interest rates on credit (0.01–0.07%) (see Table 2).

Table 2. Sensitivity results

r credit (%)	rent value (€)	land value(€)	years	scenario 1: Health Check				scenario 2: Regionalized payment				scenario 3:Regionalized payment(*0,5)				scenario 4:Regionalized payment(*1,5)			
				owned(ha)	rent_in(ha)	rent-out(ha)	total(ha)	owned(ha)	rent_in(ha)	rent-out(ha)	total(ha)	owned(ha)	rent_in(ha)	rent-out(ha)	total(ha)	owned(ha)	rent_in(ha)	rent-out(ha)	total(ha)
0.01	600	20000	2012-2013	105,00	56,28	-	161,28	105,00	56,28	-	161,28	105,00	56,28	-	161,28	105,00	56,28	-	161,28
0,01	600	20000	2014-2020	105,00	99,55	-	204,55	105,00	396,81	-	501,81	105,00	108,23	-	213,23	105,00	396,88	-	501,88
0.01	600	50000	2012-2013	-	161,28	-	161,28	-	161,28	-	161,28	-	161,28	-	161,28	-	161,28	-	161,28
0,01	600	50000	2014-2020	-	204,55	-	204,55	-	501,81	-	501,81	-	213,23	-	213,23	-	501,88	-	501,88
0.01	1000	20000	2012-2013	118,00	-	-	118,00	113,97	-	-	113,97	105,00	-	-	105,00	126,64	-	-	126,64
0.01	1000	20000	2014-2020	118,00	-	-	118,00	113,97	-	-	113,97	105,00	-	-	105,00	135,28	29,81	-	165,10
0.01	1000	50000	2012-2013	105,00	-	-	105,00	26,67	-	-	26,67	26,67	-	-	26,67	105,00	-	-	105,00
0.01	1000	50000	2014-2020	105,00	-	-	105,00	19,52	-	-	19,52	18,33	-	-	18,33	105,00	45,65	-	150,65
0,07	600	20000	2012-2013	105,00	56,28	-	161,28	105,00	56,28	-	161,28	105,00	56,28	-	161,28	105,00	56,28	-	161,28
0,07	600	20000	2014-2020	105,00	99,55	-	204,55	105,00	396,81	-	501,81	105,00	108,23	-	213,23	105,00	396,88	-	501,88
0,07	600	50000	2012-2013	-	161,28	-	161,28	-	161,28	-	161,28	-	161,28	-	161,28	-	161,28	-	161,28
0,07	600	50000	2014-2020	-	204,55	-	204,55	-	501,81	-	501,81	-	213,23	-	213,23	-	501,88	-	501,88
0,07	1000	20000	2012-2013	115,95	-	-	115,95	110,00	-	-	110,00	105,00	-	-	105,00	118,22	-	-	118,22
0,07	1000	20000	2014-2020	115,95	-	-	115,95	110,00	-	-	110,00	105,00	-	-	105,00	125,21	34,13	-	159,34
0,07	1000	50000	2012-2013	26,67	-	-	26,67	26,67	-	-	26,67	26,67	-	-	26,67	26,67	-	-	26,67
0,07	1000	50000	2014-2020	11,43	15,24	-	26,67	7,86	10,47	-	18,33	7,86	10,47	-	18,33	11,43	139,22	-	150,65

Source: Authors' elaborations.

Among the scenarios the results show variations in farm size. Scenario 1, with the actual CAP policy compared with the regionalised situations, shows a general reduction in land owned only in the hypothesis with a high rental value. This holds true except in scenario 4, characterised by a high amount of payments, where the variation is positive. With a low rental value the results reveal differences among the scenarios only for the amount of land rented in – which increases sharply in scenarios 2 and 3 and to a lesser extent in scenario 3. This happens for all the options of credit interest rates and for all the land values examined. In addition, there is a substitution of land owned with land rented in because the farmer finds it convenient sell all of the land owned and to rent it. This underlines the sensitivity of the model to rent values. This situation leads to a general increase in the farm area. The opposite situation occurs when the value of the rent is high. Here we have substitution of land rented with land owned and a consequent reduction of farm size. Between the two temporal periods the results show a general rise in land rents over time. The sensitivity of the model to the variation of the interest rate on credit is very low. Indeed, only in the case of high land values does a high interest rate lead to a decrease in farm area. And this takes place in scenario 1, the baseline and in scenario 4 (the regionalised case with 50% more payments). Overall, the results highlight the relevance of the new policy mechanism in determining a change in land demand. In particular, the introduction of regionalised payments and the new rules in connection with the availability of eligible land will directly affect the marginal value of land and hence land demand.

6. Conclusion

In conclusion, the theoretical and empirical analyses show a reaction in land demand owing to the introduction of a regionalised component of direct payments. Different factors – in particular labour availability and its cost, the specific SPS situation and household characteristics – play an important role in explaining farm behaviour in relation to the simulated reforms and the corresponding land demand function.

The regionalised payment, like the historical one, seems to be capitalised into land value, but in this case the amount of the entitlements is the same across farms, which should make the effects more homogenous among farms.

The reaction is strongly influenced by the previous historical system for the distribution of payments. In fact, the quantity of entitlements owned before the reform and their linkage to the farm area are the key factors affecting the change in land demand due to the upcoming reform.

With the introduction of the regionalised payment, the results show two different effects on farm income. First, the reform offers the possibility to increase the area under payment independent of the previous entitlements available. This stems from the removal of the historical linkage between entitlements and the reference period (2000–02). To understand the consequences of this change, it is important to distinguish two categories of farms: those that in the previous situation had more entitlements than farm area, and vice versa, those that had less entitlements than farm area.

The second effect has a different outcome: the amount of the average single (per hectare) payment changes, because the regional payment for each region is calculated by dividing the total amount of direct payments for the region by a larger area than before.

Accordingly, while the introduction of regionalised payments gives rise to a general effect, which is the reduction of payments, the effect on individual farms depends on the actual historical amount and on the ratio between the entitlements owned and the eligible area. Therefore, particularly for farms with less entitlements than area, the reform can be expected to translate into higher marginal values of land and hence into an increase in demand for land.

On balance, of the two effects – payments of a lower value and the possibility to receive payments on all of the farmed area – the second one may have a stronger influence on land

demand, as it directly affects the marginal value of land. This effect applies exclusively to farms for which the entitlements do not cover all of the farmed area.

These results are consistent with the literature, in which the SFP affects land demand in diverse ways and especially as a result of the relation between the availability of eligible land and the number of entitlements owned.

In more detail, higher marginal capitalisation because of the eligibility of a wider range of farming activities has a stronger positive effect on farms with a reduced area of farmland covered by entitlements, while the effect is less relevant for farms with a large share of farmland covered by entitlements. Conversely, the decrease in land value due to the reduction in the value of single entitlements capitalised into land value may have the effect of reducing land demand, but in this case farms with a high number of entitlements in relation to the farm area will be more affected. It is difficult, however, to assess the global effects on land markets because the policy produces different outcomes depending on the specificity of the farm.

This work is affected by several limitations. A key limit to the work is the current uncertainty about CAP reform (still in the negotiation phase), which hinders the formulation of realistic hypotheses about the actual details of the allocation mechanisms. A straightforward development of the work will hence be found in the revision of the model once the reform is approved and the implementation process is clearer. In addition, new instruments could be included in the analysis or better developed, such as the greening and the capping components.

Another set of limitations derives from the characteristics of the model, which is well suited to represent specific investment decisions in an area similar to actual farm choices but less well suited (i.e. more dependent on specific assumptions of constraints) to the simulation of conditions dissimilar to actual farm conditions. In addition, the detailed representations of labour availability and of investment in assets other than land tend to add constraints that are too specific to allow for a generalisation of the empirical results of this exercise.

Still, the model enables explicit analysis of the relationship between financial constraints, interest rates, salaries and land markets, which are largely unexplored in the present paper and represent further lines for development in this project.

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Appendix. Investment project model

The empirical model – Objective function

The model used in this paper is a dynamic integer programming model that simulates household behaviour, derived from version 1 (net present value (NPV) maximising) of the models used in Gallerani, Ghinassi and Viaggi (2008) and it corresponds to the model used in Viaggi, Bartolini, Raggi, et al. (2011).

In the following discussion, land is included as one of the generic types of investments (m).

The objective function is expressed by the NPV of total household cash flows over the time horizon. In case 1, the objective function takes the following form:[2]

$$\text{Max } Y = \sum_t \rho_t Y_t \tag{A1}$$

where

$$Y_t = y_t^a + y_t^l + y_t^c + y_t^I - y_t^{tc} + y_t^p \tag{A2}$$

$$y_t^a = \sum_i x_{i,t} gm_i - v_m^p \upsilon_m^p \tag{A3}$$

$$y_t^l = \sum_h l_{h,t}^{out} w_h^{out} - \sum_j l_{j,t}^{in} w_j^{in} \tag{A4}$$

$$y_t^c = c_t^- r^- - c_t^+ r^+ \tag{A5}$$

$$y_t^I = \sum_m \sum_\tau I_{m,t,\tau}^- k_{m,\tau} - \sum_m \sum_\tau I_{m,t,\tau}^+ k_{m,\tau} \tag{A6}$$

$$y_t^{tc} = TC^- \sum_m \sum_\tau I_{m,t,\tau}^- k_{m,\tau} + TC^+ \sum_m \sum_\tau I_{m,t,\tau}^+ k_{m,\tau} \tag{A7}$$

$$y_t^p = \sum_i x_{i,t} \psi_{i,t} + \Psi_t^d \tag{A8}$$

.

Yearly household income includes farm gross margin from farm activities (A3), net household labour income (A4), capital costs (A5), net costs for investment/disinvestment (A6), transaction costs (A7) and CAP payments (A8).

Transaction costs have been included to represent the realistic evidence that buying, selling or keeping items results in additional costs related to the operation of the transaction. Since transaction costs are very complex, the amount of information needed could not be collected through the survey. Accordingly, during the testing, a reasonable time for the conclusion of transactions was estimated, including the associated administrative costs. Since this value may vary considerably among farms, it has been approximated as a uniform percentage of asset value (20%).

[2] See Box A1 at the end of this appendix for a description of the symbols used.

To maintain the household perspective, a minimum requirement has been assumed on consumption (C_t), based on the interviews. This minimum consumption has been added as a constraint to the model, forcing the annual consumption to be higher than the minimum acceptable declared by the household:

$$C_t \leq C^* . \tag{A9}$$

The empirical model – Constraints and feasibility set

The constraints defining the feasibility set are organised into subgroups:

- investment and capital;
- activities;
- liquidity, credit and external investment;
- labour;
- payments; and
- non-negativity constraints.

Investment and capital

$$I_{m,t,\tau} = I_{m,t-1,\tau-1} + I^{+}_{m,t,\tau} - I^{-}_{m,t,\tau} \tag{A10}$$

$$k_{m,\tau} = \gamma_{m,\tau} k_{m,0} \tag{A11}$$

$$K_t = \sum_m \sum_\tau I_{m,t,\tau} k_{m,\tau} + \chi_t \tag{A12}$$

$$I_{m,1,\tau} = I^{i}_{m,\tau} \tag{A13}$$

$$I^{-}_{m,T,\tau} = I_{m,T,\tau} . \tag{A14}$$

This group of equations describes capital and investment relations. In equation (A10) capital at time *t* is related to capital at time *t*-1, plus investments, minus disinvestments. The variables $I^{i}_{m,\tau}$ represent the number of individual assets, defined by their type (*m*) and age (t) and are defined as integer variables. Equation (A10) is verified for each year (*t*). The value of each capital good is calculated in equation (A11), based on the initial value $k_{m,0}$ and the depreciation coefficient $\gamma_{m,\tau}$. Depreciation is assumed to be linear with age.

Land is one of the m categories of investment. Unlike the others, it is not depreciated.

The value of the total household capital is calculated in equation (A12) as a sum of the depreciated value of all capital assets, plus the value of liquidity χ_t. Equations (A13) and (A14) are included to control for the beginning and the end of the actual time horizon considered. A13 assigns the initial capital endowment and A14 forces the model to sell all capital at time *T*. This allows the model to take into account the salvage value of all capital when taking decisions close to the end of the time horizon.

As the model refers to individual farms, it is not adapted to structural change or land exchanges. To keep the model 'conservative' (i.e. avoiding an unrealistic growth of the farm through land purchases), the possibility of farm expansion is allowed only when land purchases are already planned. In other cases, land availability is considered fixed and the propensity to expand will be judged on the basis of the marginal value of land.

Activities

$$\sum_i x_{i,t} a_{i,s} \leq rhs_s \tag{A15}$$

$$\sum_i x_{i,t} a_{i,z} \leq \sum_m I_{m,t,\tau} v_{m,z} + v_m^p \tag{A16}$$

$$gm_{i,t} = \mu_i p_{i,t} - e_{i,t} . \tag{A17}$$

Equation (A15) is the standard set of constraints of a mathematical programming model ensuring that the solution is compatible with the availability of resources defined by rhs_s for each resource *s*. Furthermore, rhs_s also includes the non-productive household assets (i.e. house, holiday house and leisure flat), and with equation (A15) the maintenance for the whole time horizon of such assets. Land, machinery, quotas and production rights are generally treated elsewhere in the model, in the category of investments. Equation (A15) covers relevant technical and economic constraints in addition to the standard issue of resource availability. These are very different from case to case and have been designed as the most appropriate. In general, the most common issues have been the following:

- management of intermediate products, such as feeding with own-produced fodder and use/handling of organic waste from animals;
- crop rotation; and
- market constraints.

Equation (A16) connects crops, capital goods and service rental through the use of 'investment services' *z* (e.g. hours of work of specific machinery). Each capital good can produce some amount of service *z* ($v_{m,z}$) per year, which is used by farm activities. The availability of capital goods can be substituted by the purchase of the service v_m^p. Equation (A16) ensures that the amount of capital services required by farm activities is available from capital goods plus rented services. In the case of land, the service is simply the availability of land area; the purchase of the service is the possibility to rent land in. In the case of land, the model also allows land to be rented out.

Equation (A17) is a simple computation of gross margin subtracting the variable costs of each activity from the gross revenue from the sale of products.

Liquidity, credit and external investment

$$S_t = Y_t - C_t \tag{A18}$$

$$\chi_t = \chi_{t-1} + S_{t-1} + c_t^+ \tag{A19}$$

$$\sum_{m}\sum_{q} I^{+}_{m,t,\tau}k^{+}_{m,\tau} + \sum_{j} l^{in}_{j,t}w^{in}_{j,t} + \sum_{m} v^{p}_{m}\upsilon^{p}_{m} + \sum_{i} x_i e_i + y^{tc}_{t} + c^{-}_{t} \leq \chi_t \quad \text{(A20)}$$

$$c^{+}_{t} \leq \delta K_t . \quad \text{(A21)}$$

This group of equations defines the relationships between capital, liquidity and investment. Savings S_t are defined as the difference between income Y_t and consumption C_t (equation A18), quantified at the household level. Liquidity at year t χ_t is defined as the sum of liquidity of year t-1, the savings of year t-1 and the amount of external capital purchased (credit) c^{+}_{t} (equation A19). In equation A20, liquidity requirements due to investment, payment of external labour, variable activity costs, machinery service rental costs, costs of credit and off-farm investments c^{-}_{t} are constrained to liquidity availability. The access to credit c^{+}_{t} is constrained to the share δ of total capital owned (equation A21). The model constrains credit to some share of capital availability. Credit and external investment are treated as yearly variables (i.e. no mortgage structure).

Labour

$$\sum_{i} x_{i,t}a^{l}_{i} + l^{out}_{h,t} \leq L^{t}_{h,t} + l^{in}_{j,t} \quad \text{(A22)}$$

$$l^{in}_{j,t} \leq l^{in*}_{j,t} . \quad \text{(A23)}$$

Equation A22 constrains labour use to labour availability at the farm household level. Labour use includes both on-farm and off-farm activities of the farm household. Labour availability includes both own household labour and purchased labour.

Payments

$$\Psi^{d}_{t} = SFP\frac{\sum_{i} x_{i,t}n^{u}_{i}}{n} . \quad \text{(A24)}$$

Payments are calculated based on owned entitlements, after adjustment based on eligible land uses. Payments are not traded.

Non-negativity constraints

$$x_{i,t}, l^{in}_{j}, l^{out}_{h}, I_{m,t,\tau}, I^{+}_{m,t,\tau}, I^{-}_{m,t,\tau}, c^{+}_{t}, c^{-}_{t}, S_t, \chi_t \geq 0 . \quad \text{(A25)}$$

Equation A25 includes all variables that can take only zero or positive values in the model.

Box A1. Description of the symbols used

Parameters and variables (v in parentheses = variable)

Z = objective function;

z_q = value of attribute/objective q;

$z_q^{\min}$ = minimum achievement required for each objective;

X = feasible set;

x = vector of decision variables;

ρ_t = discounting factor;

Y_t = total farm household income (v);

y_t^a = household cash flow from production activities, including farming (v);

y_t^l = household cash flow from labour: external household labour minus hired labour (v);

y_t^c = household cash flow from liquid capital management: rents from investment in non-durable goods minus cost of credit (v);

y_t^I = cash flow from investment and disinvestment activities (v);

y_t^{tc} = transaction costs connected to investment/disinvestment (v);

y_t^p = cash flow from agricultural policy payments (v);

$x_{i,t}$ = degree of activation of productive activity i (v);

gm_i = gross margin from productive activity i;

$l_{j,t}^{in}$ = labour purchase of type j (v);

$l_{j,t}^{in*}$ = maximum labour purchase of type j (v);

w_j^{in} = cost of labour purchase of type j;

$l_{h,t}^{out}$ = labour selling (v);

w_h^{out} = wages from labour selling of type h;

c_t^+, c_t^- = purchase of liquidity (access to credit), investment of liquidity in non-durable goods outside the farm (v);

r^+, r^- = interest rate paid on credit, interest rate gained on liquidity and related uses (e.g. bonds);

$I_{m,t,\tau}, I_{m,t,\tau}^+, I_{m,t,\tau}^-$ = number of capital goods, investment and disinvestment activities of type m and age τ at time t (v);

$k_{m,\tau}$ = value of capital goods m, depending on age;

Box A1. cont'd

TC^{+}, TC^{-} = transaction costs on, respectively, investment and disinvestment as a percentage of the value of investment/disinvestment;

$\psi_{i,t}, \Psi_t^d$ = area based and decoupled payment (v), respectively;

C_t = consumption;

C^* = minimum acceptable yearly consumption accepted by the household;

a_{iq} = coefficient of the objective *q* for the activity *i*; a_{iq} quantifies the change in the value of objective *q* as a result of a unit increase in activity *i*;

ω_q = weight of attribute *q*;

χ_t = liquidity;

$\gamma_{m,\tau}$ = depreciation coefficient for capital goods;

$I_{m,\tau}^i$ = stock of capital good *m* on the farm in the initial year (2006);

rhs_s = right-hand side: availability of resource *s*;

$a_{i,s}, a_{i,z}, a_i^l, a_{i,o}$ = technical coefficients with respect to farm resource *s*, investment, labour use and environmental impact;

$v_{m,z}$ = amount of investment service *z* produced by investment *m*;

v_m^p = purchased amount of investment service *z*;

υ_m^p = price of purchased investment service *z*;

S_t = savings (v);

$p_{i,t}$ = product price of activity *i*;

μ_i = yield of activity *i*;

$e_{i,t}$ = variable costs of activity *i*;

K_t = value of the household's capital stock (v);

δ = maximum debt/asset ratio allowed;

$L_{h,t}^t$ = labour availability of type *h* in the household;

SFP = single farm payment;

n, n_t^u = total and used payment entitlements (v) in each year, where the latter depends on the crops cultivated;

E_o = value of output indicator *o*.

Box A1. cont'd

Sets

q = objectives;

t=1, 2..., T = time/years in the planning period, with T = time horizon;

i = activities (e.g. crops);

j = labour type for purchase (non-household);

h = labour type for selling (household);

m = types of capital goods;

τ = age of capital goods;

s = farm resources and constraints (different from land, labour or capital);

z = investment services;

o = output indicator.

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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