FACTOR MARKETS

Comparative Analysis of Factor Markets for Agriculture across the Member States

245123-FP7-KBBE-2009-3

WORKING PAPER

No. 55, June 2013

Christoph Sahrbacher, Amanda Sahrbacher and Arlette Ostermeyer

Simulation Results of AgriPoliS about Diminishing Capital Subsidies and Restrictions

ABSTRACT

This paper investigates the impacts of high interest rates for borrowed capital and credit restrictions on the structural development of four European regions. The method used is the model AgriPoliS which is a spatial-dynamic agent-based model. It is able to provide aggregated results at the regional level, but very individual results as well by considering farms as independent entities. Farms can choose between different investment options during the simulation. Several scenarios with different interest rates for borrowed capital on the one hand as well as with different levels of credit restrictions on the other hand are tested and compared. Results show that higher interest rates have less impact on declining production branches than on expanding ones. If they have the possibility farms invest in the most profitable production branch which relative profitability might have changed with high interest rates. Credit restrictions lead farms to choose smaller and cheaper investments than expensive and large ones. Results also show that income losses in both cases due to under-investment compared to the reference situation are partially compensated by lower rental prices. The impacts on structural change also differ depending on the region and the initial situation. In summary credit subsidies or imperfections on credit markets might have indirect impacts on the type of dominant investment and therefore on the whole regional agricultural sector as well.

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

ISBN 978-94-6138-323-5

Contents

List of Tables

List of Figures

Simulation Results of AgriPoliS about Diminishing Capital Subsidies and Restrictions

Christoph Sahrbacher, Amanda Sahrbacher and Arlette Ostermeyer*

Factor Markets Working Paper No. 55/June 2013

1. Introduction

As farms are generally not traded on capital markets, their financing mostly rely upon either internal funds (self-financing) or bank loans. Those resources are used to cover daily costs as well as long-term investments like land acquisition, adoption of modern technologies (stables, machinery) or renovation and/or extension of agricultural buildings.

When possible investors borrow capital banks charge them with interest rates. The level of this interest rate can have an impact on the behaviour of borrowers. For instance, a high interest rate might attract riskier borrowers who are not sure of their own ability to repay the loan (which in turn can affect banks' profits) whereas risk-averse borrowers planning low risk investment might have to delay their decision to invest. Stiglitz and Weiss (1981) show that higher interest rates induce firms to undertake projects with lower probability of success but higher payoffs when successful. However, interest rates are not the only important variable to consider. Actually, the amount of the loan and the amount of collateral (or equity) the bank demands will both affect borrowers' behaviour and distribution.

European farmers might generally benefit of good access to capital and credit compared to farmers in other regions of the world. However disparities across countries and regions can be observed and are due to either to country or regional specific regulations, wealth and structural disparities between farms or privileged access to credit information for some farmers (Pietola et al. 2011).

Hüttel et al. (2010) as well as Pietola et al. (2011) identify imperfections on rural capital markets such as informational asymmetries and agency problems which lead to credit rationing. That means farms have no or limited access to debt (see Stiglitz and Weiss 1981). A further important factor identified by both authors is high transaction costs in form of the gap between costs of internal and external financing exist because banks charge farmers with excessive risk premium. Thus, timing and size of investment depend on availability of (cheap) internal funds and phenomena of under-investments occur (Hüttel et al. 2010). Pietola et al. (2011) also state that this might lead to under production through the underuse, or even the misuse, of production factors. It seems that some EU member states are aware of this problem and thus introduced credit subsidies for agriculture in different ways. That is, there are premiums on interest rates for investments into agriculture (Lithuania, Latvia, Hungary, Poland, Czech Republic, Bulgaria and France).

On the other hand Petrick and Kloss (2012) found in their econometric analysis of FADN data for seven EU member states (Denmark, France, Germany, Italy, Poland, Slovakia and the United Kingdom) that "working capital is typically used in more than economically optimal quantities and often displays negative marginal returns across countries and farm

* Christoph Sahrbacher, Amanda Sahrbacher and Arlette Ostermeyer are researchers at Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO) in Halle, Germany.

types". Petrick and Kloss (2012) also conclude that this holds less often for fixed capital. But this does not mean that farms are generally constrained to get loans to finance fixed assets. The authors state that only in a small set of sectors financing fixed assets appears to be constrained. Based on their results Petrick and Kloss (2012) conclude that EU agriculture seems to be rather over- than undercapitalised and suggest capital subsidies for agriculture should be downsized in their importance in future policy reforms.

Based on the findings of Hüttel et al. (2010), Pietola et al. (2012) and Petrick and Kloss (2012) interest rates vary among EU member states and are either too high because of market imperfections or too low because of subsidies. One goal of this paper is to analyse how investment behaviour changes with different interest rates. Another issue mentioned by Hüttel et al. (2010) and Pietola et al. (2012) is the problem of credit rationing which will also be considered in the following analysis. To analyse these problems we apply the agent-based model AgriPoliS which simulates agricultural structural change to four case study regions in Germany, Hungary and Czech Republic. However, even though real regions are modelled; the goal is not to give a one to one picture of reality in the present and in the future. Instead the study regions are seen to be representative for specific conditions. After a description of the model used in this paper (section 2) the case study regions will be shortly described (section 3). As credit costs affect individual investment behaviour, impacts on agricultural structural change have to be expected. The same should hold regarding credit rationing on farmers' investment decisions. The scenarios presented in the next section 4 will be based on these assumptions. Therefore, the first part of the results section (section 5) will provide insights on the impacts of varying interest rates in each model region. Then, the level of borrowed capital financing of investments will be varied as well. Finally, results will be discussed and conclusions will be drawn in section 6.

2. Material and method

An actual description of AgriPoliS (Agricultural Policy Simulator) documenting recent developments according to the ODD-protocol can be found in (Sahrbacher et al. 2013). For the description of the details we refer to Happe et al. (2006) and Kellermann et al. (2008). Here we focus on a brief overview of the model and provide details about the assumptions concerning investments. AgriPoliS is a spatial-dynamic agent-based model. It is able to provide aggregated results at the regional level, but very individual results as well. AgriPoliS is agent-based because farms individually act by applying a mixed integer programme (MIP). The MIP contains a set of region specific production activities and investment options as well as auxiliary activities to use overcapacities or expand scarce resources (labour, capital, milk quota etc.). Such auxiliary activities are for example short-term borrowing of capital to finance production or savings deposited at the bank. Investment options are partially financed by equity and long-term borrowed capital. Farms are able to react to price or policy changes as well as to structural changes in their neighbourhood by renting or leasing land, by changing their production system or by choosing to quit agriculture. All these decisions are made by applying the MIP with the goal to maximise farm households' income or, in case of legal entities, profit. Farms compete for land with their neighbours; therefore there is an indirect interaction between all farms through the land market. AgriPoliS is a spatial model because farms integrate transport costs between the farmstead and the field in their economic calculations. The model is dynamic because from year to year, farms are able to evolve: grow or shrink, hire or fire workers, continue farming or close down. Accordingly, it allows simulating endogenous structural change (Sahrbacher et al. 2012).

Investments are characterised by their type (hog house, cowshed, machinery, hiring a worker for a year or working off-farm for a year), production capacity (number of places per stable, amount of area manageable with machinery equipment), investment costs, maximum useful life, age, maintenance costs and labour saving due to size effects. For each type of investments we introduced various gradations in the size of the investment to allow for economies of size. Economies of size arise from decreasing costs per unit of investment and lower labour requirements the bigger the investment. During the model initialization a

random age is assigned to farms' different buildings and sets of machinery. Investments cannot be used longer than their useful life which varies between 8 and 24 years depending on the type of investment. Therefore farms have to re-invest if they want to continue within a certain branch of production. This decision is made by applying the MIP where investments are integer variables, i.e. they are not dividable. In each period farms have only the possibility to invest. In AgriPoliS investments are financed by a fixed share of equity (v) and borrowed capital ($1-v$). Long-term borrowing of capital for investments is in principle not restricted as long as a farm's liquidity covers the equity share of an investment. In case of high credit restrictions farms need more equity to finance investments and thus investments have to be postponed or farms cannot invest at all. In such a situation farms also have to decide how to use this scarce resource, which means they probably only reinvest in the most profitable production branches and cannot expand in other ways.

Short-term borrowing is restricted by a credit limit (CL) at 70% of the land assets (LA) and 30% of the equity share of assets ($A_{ec,l}$).

$$CL = 0.7 \cdot LA + 0.3 \cdot \sum_{l=1}^{L} A_{ec,l} \ . \tag{1}$$

So far short-term credits have sometimes been used to finance investments. However, this has not been an issue as long as credit restrictions for long-term borrowing have been low. With this study it is the first time that significant credit restrictions for long-term borrowing are being tested. Therefore a restriction prohibiting the use of short-term credits for investments has been added.

As investment and production are mutually interdependent, they are simultaneously considered in the MIP. The number, type, and combination of investments are not restricted. In principle, a farm agent will invest in one object or a combination of objects if the expected average return on the investment, determined in the farm-planning problem, is positive, i.e., if profit increases. For investment-planning purposes, all expenditures related to an investment, i.e. the annuity of borrowed capital ($A_h \cdot (1-v) \cdot CRF_{i_{bc},N_h}$), depreciation of own capital ($A_h \cdot \frac{v}{N_h}$) and maintenance costs (MC_h) are distributed equally over the investment's useful life (N). Maintenance costs are expressed as a percentage (w) of total investment costs. Accordingly, the average annual costs AC_h of investment $I_{h,i}$ considered in the objective function of the farm-planning problem are calculated as:

$$AC_h = A_h \left[(1-v) \cdot CRF_{i_{bc},N_h} + \frac{v}{N_h} + w \right]. \tag{2}$$

To avoid capital shortage due to investments the sum of costs in average bounded by production activities and investments has to be smaller or equal to the farms' liquidity. Therefore, the average bound equity capital of investments is determined as:

$$A_h \cdot v \cdot f, \qquad \text{with} \quad f = \frac{(1+i_{ec})^{N_h}}{(1+i_{ec})^{N_h} - 1} - \frac{1}{N_h \cdot i_{ec}}. \tag{3}$$

Once a farm decides to leave agriculture investments are lost for the sector. They cannot be sold to other farms, i.e. investment costs are sunk. For instance if a farm had invested in a cowshed five years before closing, the building would stay idle after the farmer gives up. Farms decide to quit agriculture when their expected farm income for the next year is smaller than the opportunity cost for their own labour, capital and land or when they are illiquid.

Farms' liquidity is calculated by subtracting land assets (LA) and the equity share of l other assets (A_{ec}) from equity (EC) (equation (4)).

$$L = EC_{t-1} - LA - \sum_{l=1}^{L} A_{ec,l} \ . \tag{4}$$

In scenarios with high credit restrictions the value of other assets is higher because the self-financing share is higher. Consequently, liquidity is lower. To avoid this, equity has been proportionally increased in the scenarios with high credit restrictions for each selected farm. However, it was not possible to provide each farm with exactly the same liquidity at the model initialization than in the reference scenario. Actually, selected farms are cloned during the initialization phase and therefore randomly differentiated regarding their assets' age. Thus equity and liquidity vary among cloned farms and liquidity cannot be exactly set at the same level than in the reference scenario.

Farms are assumed to withdraw a certain amount of money per family working unit from the household income for their own consumption. If this minimum withdrawal ($WD_{\min}$) is larger than the household income Y , farm's equity capital is reduced. If $WD_{\min}$ is smaller than the household income, an additional share ε of the remaining farm household income is consumed and the remaining share $(1-\varepsilon)\cdot(Y-WD_{\min})$ is then charged to the farm agent's equity capital. Thereby, farms can accumulate equity capital which can be used to finance investments.

At the beginning of the simulations some variables (age of farmer, age of buildings and machinery, managerial ability, location of farms and the duration of each plot's rental contract) are randomly initialized. As already mentioned the age of assets determines the date of re-investment. The farmer's age determines the time the handover of the farm to a successor will occur. It is assumed that the farmer can always find a successor. At such a generation change, opportunity costs of labour are assumed to increase by 25%. In this way, a potential successor's choice to work off-farm, where salaries are assumed to be higher than in agriculture, is considered. If the successor decides to take over the farm, opportunity costs for labour are set back to the level prior to the generational change. The location of the farm and its managerial ability (modelled as reduced variable costs) determines its competitiveness relatively to the surrounding farms.

3. Case study regions

For this study four regions with different characteristics have been chosen. The regions are the Altmark in Eastern Germany, the Allgäu, a grassland region in Bavaria (South Germany), Vysocina in Czech Republic and Borsodi Mezoseg in Hungary (see Figure 3-1). The latter two regions are characterised by a dual farm structure with a large number of small individual farms and a small number of large farms utilizing more than 50% of the agricultural land.

Figure 3-1 Location of the case study regions

Source: European Commission (2013).

These regions have been modelled in the EU-projects IDEMA[1] (Vysocina) and MEA-Scope[2] (Borsodi Mezoseg), a project financed by the federal state of Saxony-Anhalt (Altmark)[3] and the project "Structural Change in Agriculture" (SiAg, Allgäu) financed by the German Research foundation. The regions are calibrated for different years (see Table 1). To represent the regions structural data such as the distribution of farms regarding their size, specialisation, legal form, herds' sizes, as well as the share of grassland on the farms have been taken from agricultural statistics. To model the regions farms have been selected from the Farm Accountancy Data Network (FADN) and weighted to represent the structural characteristics as best as possible (Sahrbacher 2010, Balmann et al. 2010). The share of rented land in each region is therefore depending on the share of rented land of the selected farms and the weights assigned to the selected FADN farms. As this indicator has not been considered in the selection and weighting of the farms, there might be some discrepancies regarding the share of rented land between the region modelled and the real region.

Further economic indicators are based on FADN data and other model input data (share of hired labour, livestock density and other assets), from other statistics (land price, other assets) or from other statistics combined with model assumptions (liquidity, equity, borrowed capital, debt ratio and share of land assets in equity, see Table 1). For each model farm the amount of family labour available for agriculture is taken from the FADN. The amount of family and hired labour used in agriculture is determined by the MIP depending on the labour demand of the different production activities. Livestock density at the individual and regional level is depending on the solution delivered by the MIP as well.

Land price is the average for arable land and grassland. In the Allgäu it is taken from FADN data. In the other regions it is an intermediate value taken from statistics because strong dynamics can be observed from year to year on these land markets (Ciaian et al. 2012, Neue Landwirtschaft, several issues). Those land sales prices do not change during the simulation

[1] The Impact of Decoupling and Modulation in the Enlarged Union: a sectoral and farm level assessment, supported by the European Community's Sixth Framework Programme, SSPE-CT-2003-502171.

[2] Micro-economic instruments for impact assessment of multifunctional agriculture to implement the Model of European Agriculture, supported by the European Community's Sixth Framework Programme, SSPE-CT-2004-501516

[3] Analyse der Wettbewerbsfähigkeit der Milcherzeugung und -verarbeitung in Sachsen-Anhalt zur Ermittlung geeigneter Politikmaßnahmen und Politikoptionen im Rahmen des EPLR.

as there is no sales market for land in AgriPoliS. Land price together with the share of rented land determine the average value of land assets in the regions.

The value of other assets than land assets, i.e. machinery and buildings used for production, are based on standard investment costs (KTBL several issues). The other assets include only buildings and machinery directly needed for production in the model. In reality, this indicator very often includes more equipment and facilities not directly used for production. Thus, the value of other assets is not equivalent to the value of other assets found in the FADN.

In AgriPoliS liquidity is depending on equity, land assets and the equity share of other assets (equation 4). As in AgriPoliS the value of other assets is lower than in reality, equity had to be adjusted otherwise farms' liquidity would have been much higher in AgriPoliS than in reality. Equity has been adjusted so that the average liquidity is close to the liquidity observed in bookkeeping data.

The amount of borrowed capital is determined by the borrowed capital financing share ($A_{bc,l} = A_l \cdot (1 - v)$) of all other assets. The borrowed capital financing share is assumed to be of 70% in the reference scenario.

The debt ratio and the share of land assets in equity is a result of the above mentioned values and therefore depend on the assumptions on which these values are based.

Even if the economic data of the model regions do not exactly fit the real world data, they are based on plausible assumptions which still allow the simulation of farms' investment behaviour.

Table 1. Overview of the model regions

		Altmark	Vysocina	Allgäu	Borsodi Mezoseg
Base year		2006	2001	2006	2004
Av. Farm size	ha	290	190	27	37
Region size	ha	280,140	380,520	26,017	33,364
Number of farms		968	1,908	962	901
Grassland share	%	25	20	100	30
Share rented land	%	89	93	33	69
Land price	€/ha	5,791	2,570	10,226	824
Share hired labour	%	72	82	2	45
Livestock density	LU/ha	0.36	0.63	1.34	0.32
Labour intensity	AWU/ 100 ha	1.41	1.86	4.19	1.44
Dominant farm type		field crop, dairy (biogas), mixed	mixed, intensive livestock	dairy (biogas)	field crop, mixed, grazing livestock
Assets	€/ha	2,479	1,345	15,674	1,564
Land assets	€/ha	619	182	6,857	255
Other assets	€/ha	1,574	846	7,405	1,067
Liquidity	€/ha	286	317	1,412	242
Liabilities	€/ha	2,479	1,345	15,674	1,564
Equity	€/ha	1,361	874	10,391	812
Borrowed capital	€/ha	1,119	471	5,283	753
Debt ratio	%	45	35	34	48
Share of land assets in equity	%	46	21	66	31

Notes: LU = Livestock unit, AWU = annual working unit (1800 hrs/year).

Sources: FADN, KTBL, regional bookkeeping statistics and own calculations based on model data.

The model regions can be characterised as follows, based on the data listed in Table 1. The Altmark and Vysocina are dominated by large scale farms. The average farm size is of 290 and 190 ha respectively. In both regions farms rely on a high share of rented land (89% and 93%) and on a high share of hired labour (72% and 82%). The grassland share is a bit higher in the Altmark than in Vysocina (25% and 20% respectively). In the Altmark farms are specialised each by one third in field crop production, dairy production and mixed production systems. A minority of farms are specialised in pig production. Compared to Vysocina livestock density is almost 50% lower (Balmann 2010). In Vysocina most farms are field crop (50%) or mixed farms (35%), but there are also some intensive livestock farms keeping dairy cows or pigs and sows, which results in a livestock density of 0.6 LU/ha (Sahrbacher 2012).

The average farm size is lower in the Allgäu and in Borsodi Mezoseg than in the two preceding regions (27 ha and 37 ha respectively). However, Borsodi Mezoseg can be considered as intermediate between the Allgäu and the both large scaled regions Altmark and Vysocina, as there are also some large farms there which cannot be found in the Allgäu. The Allgäu is dominated by family farms which rely almost exclusively on family labour and own on average 67% of the land. Farms are specialized either in dairy production or beef fattening as all land in the region is exclusively used as grassland. The labour input of 4.2 AWU/100 ha is to be linked to the high livestock density of 1.3 LU/ha which is much higher than in the other regions (0.3 to 0.6 LU/ha).

Concerning the share of hired labour (45%) and the share of rented land (69%), Borsodi Mezoseg also lies between the other regions. Farms are specialized each by approximately one third into field crop production, grazing livestock production and mixed production.

The Renewable Energy Resources Act provides German farmers with a new investment alternative, namely the biogas production. This is intensively used in both German study regions.

Regarding investments regions can be further characterised according to the on-going investment activities. Therefore the development of specific production branches is first checked in the reference scenario (Table 2). Production branches indicated with plus are emerging while those indicated with minus are declining. In the Altmark and the Allgäu only the number of dairy cows is declining. All other production activities are emerging. In Vysocina the number of beef cattle and suckler cows is increasing, while the population of breeding sows, fattening pigs and dairy cows declines. This increase in beef cattle and suckler cows is policy induced as there have been top-up payments for these activities during the phasing in of payments between 2004 and 2011. In Borsodi Mezoseg all production branches are declining. Even if these developments do not fully represent the reality in the regions, they can be seen as case studies which can be transferred to other regions with similar characteristics to the described model regions.

Table 2. General development of production activities in the model regions in the reference scenario

	Altmark	Vysocina	Allgäu	Borsodi Mezoseg
Breeding sows	+ +	- -		
Fattening pigs	+ +	- -		
Dairy cows	- -	- -	-	-
Beef cattle	+	+		-
Suckler cows	+	+		-
Bull suckler			-	
Biogas plants	+ + +		+ +	
Agritourism			+ +	
Machinery	+	-	+	- -

Source: Own simulations.

The decline of production activities is caused by missing re-investments. The speed of decline depends on whether at least some farms re-invest in a production activity or whether no farm re-invests. The decline of production activities can be speeded up by higher borrowing interests or credit restrictions if some farms decide to re-invest in the reference scenario.

4. Scenarios

Two sets of scenarios are run in order to analyse a) how different levels of interest and b) credit constraints affect farms' investment behaviour. Therefore, a first scenario used as reference (REF) is run for all regions with a long-term borrowing interest rate of 4.5% and a short-term borrowing interest rate of 6.5%. In this scenario the borrowed capital financing share is of 70%, i.e. borrowing long-term capital is less restricted. Therefore, farms only have to finance 30% of an investment with equity capital. Short term savings interest rates are set at a country specific level and long-term saving interest rates considered for the calculation of opportunity costs of capital accounting for the exit decision of a farm are assumed to be 1% higher.

In the first set of simulations interest rates of borrowed capital are either reduced by 2% or increased by 2 and 4%. This allows us to cover different situations where the agricultural credit market is subsidized e.g. as in Lithuania, Latvia, Hungary, Poland, Czech Republic, Bulgaria and France and where interest rates on the agricultural credit market are much higher than on the general credit market (Sweden, Cyprus, Slovakia, Denmark, Greece and Estonia Pietola 2011). Savings interest rates are not changed as neither credit subsidies nor imperfections on the credit market are assumed.

In the second set of simulations the borrowed capital financing share is reduced stepwise from 70% to 50%, 25% and 10%. However interest rates are kept at the reference level (4.5 and 6%).

5. Results

5.1 Variation of interest rate level

First we analyse the investment behaviour and then the impacts of variations in interest rates on borrowed capital on structural change and economic indicators. To analyse the impacts of varying interest rates investments are classified in two groups depending on whether they are expanding or declining in the reference scenario. The detailed development of the different production activities is plotted in graphs in the appendix. The following tables only present the situation at the end of the simulations, i.e. after 25 simulation years. The results are an average of 10 replications[4].

Investment behaviour

As already mentioned in section 3 not all declining production activities are affected by higher interest rates. In Vysocina breeding sows, fattening pigs and dairy cow production and in Borsodi Mezoseg beef cattle and suckler cow production see their decline not affected by higher interest rates. This means already in REF no farm re-invests in these production activities (Table 3, Figure 0-1, Figure 0-5). However, in the Altmark, the Allgäu and Borsodi Mezoseg the decline of dairy production has been accelerated by a 4% higher interest rate on borrowed capital (Figure 0-2). Credit subsidies (or a relatively low interest rate of 2.5% for long-term credits) slow down the decline of some production activities but not of dairy and pig production in Vysocina as well as suckler cows and beef cattle in Borsodi Mezoseg.

[4] In each replication following random parameters have been varied: localisation of farms in the region, managerial ability of the farmer or farm manager, age of assets (buildings and machinery) and the duration of each plot's rental contract. Replications allow minimizing the influence of those random parameters on results and therefore improve results' reliability.

Table 3. Impact of 4% higher interest rates on production activities declining in REF after 25 years

	Altmark	Vysocina	Allgäu	Borsodi Mezoseg
Breeding sows		no		
Fattening pigs		no		
Dairy cows	- -	no	- -	- -
Beef cattle				no
Bull suckler			- -	
Suckler cows				no

Legend: "- -": decline speeded up; "no": no change; blank: production not present in the region

Source: Own simulations.

On the other hand expanding production activities are much more affected by an increase in the interest on borrowed capital. An increase by 4% of interest rates slows down the expansion of all production activities except suckler cow production in Vysocina. The slowing down of this expansion is more or less strong and can even lead to a stagnation of some production activities e.g. fattening pigs and breeding sows in the Altmark (Figure 0-1). Beef fattening in Vysocina constitutes a special case. The production strongly increases in the reference scenario due to the introduction of coupled payments with the EU accession in 2004 (Figure 0-4). At the beginning of 2008 these payments are stepwise reduced and thus beef fattening production declines. Therefore this decline is not caused by missing re-investments but rather by unused stable capacities for this production. However, when higher interest rates are introduced, farms invest much less in this production from 2004 and rather with a delay if at all. Instead they choose to invest more intensively in suckler cow production from 2008 with increasing interest rates. This investment option seems therefore to be more profitable relatively to beef cattle production; it is the only production activity expanding with higher interest rates as well as investment costs are the lowest.

Table 4. Impact of 4% higher interest rates on production activities expanding in REF after 25 years

	Altmark	Vysocina	Allgäu
Breeding sows	- - -		
Fattening pigs	- - -		
Beef cattle	- -	- -	
Suckler cows	- -	+ +	
Biogas plants	- -		- -
Tourism			- - -

Legend: "- -": expansion slowed down; "- - -": expansion much slowed down; "+ +": expansion speeded up; blank: production not present in the region

Note: there is no expending production in Borsodi Mezoseg in the reference scenario.

Source: Own simulations.

Investments into biogas plants as well as into facilities for tourists become less profitable with higher interest rates (Table 4). However, the structure of biogas production also changes. There are less small biogas plants but larger ones. Actually, as farm growth (due to more numerous farm closings, see Figure 0-15) speeds up with higher interest rates and the remaining farms gain land and thus can invest into larger biogas plants for which more agricultural area is needed. This holds for the Altmark as well as for the Allgäu.

On the other hand with low interest rates of 2.5% for long term borrowed capital more farms invest into biogas plants in both regions and much more accommodations are provided in the Allgäu (Figure 0-6 and Figure 0-7).

Machinery capacities decline in all regions at the beginning of all the simulations. However, this is model specific. Actually during the initialization many farms have some machinery overcapacities, which are progressively reduced in the sense that some farms close down and land moves to other farms that can use their overcapacities of machinery.

In the reference scenario machinery capacities are increasing in total in the Altmark and the Allgäu because of the increasing demand for additional machinery for biogas plants. In Vysocina and Borsodi Mezoseg machinery equipment is declining (Figure 0-8 and Figure 0-9). In the scenario with 4% higher interests farms invest a bit less in machinery in the Altmark because they also invest less in biogas plants which require additional machinery (Table 5). In Vysocina, investments in machinery are not affected by higher interest rates. In the Allgäu and Borsodi Mezoseg however, farms re-invest much less with higher interest rates. In Borsodi Mezoseg instead of acquiring their own machinery farms resort to agri-services (Figure 0-10), but this does not fully compensate the reduction in machinery though. The strong reduction in machinery in the Allgäu and Borsodi Mezoseg is caused by a land use extensification. Farms do not produce any more on low quality land. Instead they keep it only in good agricultural and environmental conditions (GAEC) which requires less machinery (Figure 0-11). Most of this low quality land is grassland (in the Altmark, Borsodi Mezoseg and the Allgäu) but some low quality arable land in Borsodi Mezoseg is also not used for production.

Table 5. Impact of 4% higher interest rates on machinery demand and land use compared to REF after 25 years

	Altmark	Vysocina	Allgäu	Borsodi Mezoseg
Machinery	-	no	- - -	- - -
Agri-services	no	no	no	+ +
Minimum land use	+	no	+ + +	+ +

Legend: "+": demand increased; "+ +": demand much increased; "+ + +": demand very much increased; "-": demand slowed down; "- - -": demand much slowed down; "no": no change

Source: Own simulations.

To summarize, higher interest rates have a negative impact on the total amount of investments. Some production branches are more affected than others depending on their profitability. But higher interest rates could also improve the relative profitability of some production branches as it happened in Vysocina. Looking at the development of fixed assets (Figure 0-12 and Figure 0-13), representing the total investment development, shows that agriculture in Vysocina is hardly affected by higher interest rates. This is due to the low profitability of pig fattening, breeding sows and dairy cow production. Already in the reference scenario no re-investment occurs. On the other hand the decline of beef fattening is partially compensated by an increase in suckler cow production. In Borsodi Mezoseg and the Altmark the value of fixed assets becomes lower with higher interest rates. The strong decline in fattening pigs and breeding sows' productions has not such a strong impact on the total amount of investments in the Altmark, because the share of field crop production is relatively large. The impacts on fixed assets are the largest in the Allgäu. There, the reduction is mainly determined by the decline of dairy cow production, but all other production activities are declining as well. The average value of fixed assets per hectare is the highest in the Allgäu, because it is a quite intensive and small structured region. The livestock density is with 1.3 LU/ha three times higher than in the Altmark and Borsodi Mezoseg and two times higher than in Vysocina (Figure 0-16). Additionally, small facilities and machinery are much more expensive than larger ones.

The average liquidity however is only affected in the Allgäu by higher interest rates (Figure 0-14). This can be explained by the increase in farm closings in the Allgäu. The closing farms take equity and liquidity out of the sector. Liquidity is in general increasing because of the model assumption which states that investments are financed by fixed shares of equity and borrowed capital.

Overall structural and economic development

It has already been mentioned that the number of farm closings increases with higher interests in the Allgäu (Figure 0-15). The same trend can be observed for the Altmark but not that strong. In Vysocina and Borsodi Mezoseg farm exit rate is not affected by the interest rates. In the Allgäu more farms are exiting because agricultural land is made of grassland which can only be used by cattle. High interest rates means that farms invest less, thus their income is lower and they may be forced to close down during the simulation. The same holds for the Altmark, but there thanks field crop production as an alternative fewer farms close down than in the Allgäu when the interest rates are higher.

Following the impacts on investments for livestock production there is a general decline in livestock production due to higher interest rates when looking at the development of livestock density (Figure 0-16). This affects the labour input in the same way (Figure 0-17).

From the economic perspective it is surprising that farms do not suffer income losses in the long run in the Altmark, Vysocina and Borsodi Mezoseg (Figure 0-18). But it is the case in the Allgäu, i.e. farms' profits per hectare are significantly lower with higher interest rates. This is due to the capital intensive production in the Allgäu. There the asset value is four to eight times higher than in the other regions and the share of interest costs is much higher at the beginning of the simulations. Later on farms in the Allgäu re-invest less when interest rates are higher and thus their profits are lower. In general profits per hectare are much higher in the Allgäu because of the high share of unpaid family labour which salary has not been subtracted from profit yet. In the Altmark and Borsodi Mezoseg profit losses at the beginning can be compensated over time by lower rental prices (Figure 0-19). However, this adjustment takes some time as rental contracts duration is between 5 and 18 years. In the Allgäu rental prices are much lower when interest rates are higher, which is due to a lower demand for land because of the decrease in dairy cow production.

5.2 Variation of credit restrictions

Investment behaviour

A general finding of the simulations of credit restrictions is that the overall impacts (structural change, farm income) are less strong than the impacts of higher interest rates. However, this can also be model specific as in AgriPoliS farms tend to accumulate liquidity over time, which allows them to finance investments with a high equity share at a later stage of the simulations. However, this might not happen to the same extend in reality. Concerning investment behaviour one can say that cheap/small investments (suckler cows, fattening pigs and breeding sows stables) are less affected than expensive/large investments (biogas plants, dairy cows stables). The impact of credit restrictions on expensive investments is even stronger than the impact of higher credit restrictions.

A peculiarity of high credit restrictions is that they do not necessarily lead to fewer investments. The decline of fattening pigs' production in Vysocina (Figure 0-1) and dairy cows' production in Borsodi Mezoseg (Figure 0-2) is slowed down by higher credit restrictions (Table 6). In the Allgäu there is even an increase in the number of bull suckler instead of a slight decline in the reference scenario with low credit restrictions (Figure 0-3). This development can be explained by the before mentioned relation of low impacts on cheap investments and strong impacts on expensive investments. For example in the Allgäu farms invest much less in dairy cows and biogas plants in case of credit restrictions. But they still have enough liquidity to invest in cheaper/smaller investments like bull suckler. In Borsodi

Mezoseg there is no such replacement. High credit restrictions have no impact on the decline of beef cattle and suckler cows but nevertheless farms invest more in dairy cows (Figure 0-5). At the same time fewer farms leave the sector (Figure 0-15). Thus, less liquidity leaves the sector (Figure 0-14) and farms have more capital to invest despite credit restrictions. These replacements cause that the overall impact of credit restrictions is not that strong.

Table 6. Impact of financing restrictions on production activities declining in REF after 25 years

	Altmark	Vysocina	Allgäu	Borsodi Mezoseg
Breeding sows		no		
Fattening pigs		+ +		
Dairy cows	- -	no	- - -	+ +
Beef cattle				no
Bull suckler			+ + +	
Suckler cows				no

Legend: "- -": decline slowed down; "+ +": decline speeded up; "+ + +": decline much speeded up; "no": no change; blank: production not present in the region

Source: Own simulations.

In Vysocina, we can also observe a replacement of beef cattle by suckler cows (Table 7 and Figure 0-4). The Altmark is the only region where there is no such development to be observed. Except fattening pigs, all expanding production activities in the Altmark decline with higher credit restrictions.

Table 7. Impact of financing restrictions on production activities expanding in REF after 25 years

	Altmark	Vysocina	Allgäu
Breeding sows	- -		
Fattening pigs	+/-		
Beef cattle	- - -	-	
Suckler cows	-	+	
Biogas plants	- - -		- - -
Tourism			+ +

Legend: "-": expansion moderately slowed down; "- -": expansion slowed down; "- - -": expansion much slowed down; "+": expansion moderately speeded up; "+ +": expansion speeded up; "+/-": expansion slowed down at the beginning of the simulation; blank: production not present in the region

Note: there is no expending production in Borsodi Mezoseg in the reference scenario.

Source: Own simulations.

Like in the case where higher interest rates are applied, investments in machinery are affected by changes in other production branches (Table 8). In the Altmark and the Allgäu the higher the credit restrictions the fewer farms invest in machinery because less additional machinery for biogas plants is needed (Figure 0-8 and Figure 0-9). Biogas production is directly affected by credit restrictions indeed (Figure 0-6). In Borsodi Mezoseg farms even invest more in machinery than in the reference scenario in order to feed the higher number of dairy cows. The utilization of agri-services is not affected in the long run but over time. Actually, in presence of credit restrictions farms in the Altmark and Borsodi Mezoseg use more agri-services (Figure 0-10). Concerning the share of land in GAEC a diverse picture can be observed (Table 8 and Figure 0-11). Credit restrictions do not affect the share of land in minimum use in Vyscocina and Borsodi Mezoseg but they do have an impact in Altmark and

Allgäu. In these two regions land use is affected in the sense that fewer investments in biogas plants and dairy cows release grassland which is then kept in GAEC.

Table 8. Impact of financing restrictions on machinery demand and land use compared to REF after 25 years

	Altmark	Vysocina	Allgäu	Borsodi Mezoseg
Machinery	- -	no	- - - -	+
Agri-services	no	no	no	no
Minimum land use	+	no	+ + +	no

Legend: "+": demand increased; "+ +": demand much increased; "+ + +": demand very much increased; "-": demand slowed down; "- - -": demand much slowed down; "no": no change

Source: Own simulations.

The impacts of credit restrictions on the different production branches can be summarized by the development of fixed assets' value (Figure 0-12 and Figure 0-13). There is no impact of credit restrictions in Vysocina and Borsodi Mezoseg to be observed. However, in the Altmark and the Allgäu farms are affected by credit restrictions, i.e. the value of fixed assets is lower because of the decline of large/expensive investments such as biogas and dairy stables. The impact of credit restrictions is even stronger in the Altmark than the impact of higher interest rates. In the Allgäu the impact of credit restrictions is similar to the impact of higher interests even though biogas and dairy cow productions are more affected than in the case of higher interest rates. Actually this strong impact on biogas and dairy cow production can be compensated by an increase in bull suckler production and the provision of accommodations for tourists (Figure 0-7).

Contrary to high interest rates farms' liquidity is increasing with credit restrictions (Figure 0-14 and Figure 0-14). This is due to farms postponing investments to save more money to finance them later. In the Allgäu for example farms use this money to invest in accommodations for tourists at the end of the simulations.

Overall structural and economic development

Credit restrictions have no impact on the number of farm closings in Vysocina and only small impacts in the Altmark and Borsodi Mezoseg (Figure 0-15). In Borsodi Mezoseg however, less farms close down with higher credit restrictions. In the Allgäu impacts are a little stronger but not as strong as with high interest rates. The latter also holds for the Altmark. The lower impact of credit restrictions than of higher interest rates can be explained by less investments in large/expensive facilities but in smaller/cheaper investments instead.

This reaction can also be observed when looking at livestock density (Figure 0-16). Credit restrictions do not affect livestock density in Vysocina and Borsodi Mezoseg. In the Altmark and Allgäu small negative impacts can be observed. Whereas the impacts in the Altmark are similar to the case where interest rates are high, they are lower in the Allgäu (Figure 0-16 and Figure 0-16).

On the other hand the impact of credit restrictions on labour input is to be compared to the impact on livestock density which is slightly stronger in the Altmark and the Allgäu (Figure 0-17). The production branches in which farms invest in case of credit restrictions are less labour intensive than the production activities in which they would normally invest in the reference scenario. This trend is much more visible by comparing livestock density and labour input between the scenarios with varying interest rates and high credit restrictions. In the Allgäu for example livestock density is declining much stronger in case of high interest rates (Figure 0-16) compared to a situation with credit restrictions (Figure 0-16), but it is the contrary when observing the decline in labour input, which is even stronger in case of credit restrictions (Figure 0-17 and Figure 0-17).

The impacts of credit restrictions on farms' income are similar to the impacts of higher interest rates on farms' income and are rather low (Figure 0-18 and Figure 0-18). In Vysocina and Borsodi Mezoseg no impacts can be observed. In the Altmark farms even save some money with credit restrictions which can be explained by lower rental prices (Figure 0-19). In the Allgäu profits are much lower with high credit restrictions. This is mainly caused by the switch from dairy cow production to bull suckler production. In principle the impact of this switch on farm incomes would have been much stronger if it would not have been partially absorbed by the decline in rental prices, i.e. lower costs for rented land (Figure 0-19).

6. Discussion and conclusion

Whereas variations of interest rates have in general already been tested with a sensitivity analysis (Happe 2004) the variation of credit restriction is new. Especially, the latter appeared to be a challenge as some aspects of the model had to be improved. The values of land assets have been updated, liquidity has been adjusted so that it better fits to real data and a new restriction to avoid the use of short-term credits for investments has been introduced in the MIP. These adjustments also helped to improve AgriPoliS in general. Furthermore, liquidity had to be adjusted for the credit restriction scenarios by changing the equity. However, as mentioned before it was not possible to provide exactly the same liquidity at the initialization of each credit restriction scenario. Here, the model can still be improved in a way that farms' liquidity is independent of the other assets value and that liquidity of each farm is exactly the same in all scenarios. Another possible improvement suggested by the results of this study is to make the financing of investments more flexible, i.e. set only a maximum share for borrowed capital and let farms decide whether they want to use this maximal share or whether they use more equity. However, this also requires a restriction on the minimal level of liquidity a farm should have.

The analysis of the variation of interest rates is more detailed than in Happe (2004) whose purpose was a general analysis of the models sensitivity to different input data. In conclusion, in AgriPoliS higher interest rates have stronger impacts on farms investment behaviour and on structural change than credit restrictions. Credit restrictions have been implemented in a way that farms get less credit to finance investments. For the analysis it was useful to distinguish between declining and expanding production branches. Results show that higher interest rates have less impact on declining production branches especially if farmers do not invest with lower interest rates anyway. Expanding production branches are more affected by higher interest rates. But it was also observed that with high interest rates farms invest less in one production branch to expand in another one. This is due to a change in the relative profitability of the production branches with each other, which causes the expansion of one whereas another expands less when interest rates are higher.

Results also show that the impact of higher interest rates on structural change differs depending on the region and the initial situation. In Vysocina and Borsodi Mezoseg the decrease in the number of farms is hardly affected because in these regions the impacts of higher interest rates on investments are also quite small. The Altmark and the Allgäu are stronger affected and thus the number of farms exiting the sector also increases with higher interest rates. In the long run there have been no impacts on farm income in less capital intensive regions where field crops are still important (the Altmark, Vysocina and Borsodi Mezoseg). Fewer investments in livestock production thus have no stronger impact. But in capital intensive regions without field crop production such as the Allgäu impacts on farm income are much stronger because the decrease in livestock production cannot be balanced by non-livestock production. There, higher interest rates also cause significantly higher investment costs. Only the development of rental prices has a dampening effect as with less intensive livestock production the pressure for land is lower and therefore rental prices tend to decline.

The analysis of different levels of credit restrictions showed that large/expensive investments are stronger affected than smaller/cheaper investments. The latter could even gain from

credit restrictions in a way that their decline is slower or they even start to expand. This shows that credit subsidies might influence production in a way that it supports investments in some branches, which would not be the case without credit subsidies. Furthermore, this also explains why credit restrictions might in general have a lower impact than higher interest rates. Farms can absorb losses of some production branches by extending others. Another result is that different investments can also be coupled. For example investments in biogas plants or dairy cows require additional machinery. Thus, impacts on one production branch affect further investments and even land use. The impact of credit restrictions on structural change is relatively low as farms have the possibility to switch to other production branches, which is more difficult with higher interest rates. The same holds for farm income which is not affected in Vysocina and Borsodi Mezoseg; with credit restrictions farm incomes even slightly increase in the Altmark. Again in the Allgäu the impacts are stronger as farms cannot switch to field crop production but income losses are partially absorbed by lower rental prices.

The variation of interest rates and credit restrictions showed that they can cause relatively complex reactions. Nevertheless, they confirm the assumptions of Hüttel et al. 2010 and Pietola et al. 2012 that with credit restrictions investments will be postponed, e.g. in the case of investments into agri-tourism in the Allgäu. Furthermore, the results confirmed that high interest rates and credit restrictions lead to under production through the underuse, or even the misuse, of production factors.

References

Balmann, A., F. Appel, R. Franz, M. Graubner and A. Ostermeyer (2010), "Analyse der Wettbewerbsfähigkeit der Milcherzeugung und –verarbeitung in Sachsen-Anhalt zur Ermittlung geeigneter Politikmaßnahmen und Politikoptionen im Rahmen des EPLR", Projektbericht, Halle (Saale).

Ciaian, P., d'A. Kancs, J. Swinnen, K. Van Herck and L. Vranken (2012), "Key Issues and Developments in Farmland Sales Markets in the EU Member States and Candidate Countries", Factor Markets Working Paper No. 12, CEPS, Brussels.

European Commission (2013), "Map European Union", European Commission, Directorate General for Press and Communication, Brussels (http://europa.eu/abc/maps/index_de.htm).

Happe, K. (2004), "Agricultural policies and farm structures - Agent based modelling and application to EU-policy reform", *Studies on the Agricultural and Food Sector in Central and Eastern Europe*, Vol. 30, IAMO, Halle.

Happe, K., K. Kellermann and A. Balmann, (2006), "Agent-based Analysis of Agricultural Policies: An Illustration of the Agricultural Policy Simulator AgriPoliS, its Adaptation and Behaviour", *Ecology and Society* 11(1), Art. 49 (http://www.ecologyandsociety.org/vol11/iss1/art49/).

Hüttel, S., O. Mußhoff and M. Odening (2010), "Investment reluctance: irreversibility or imperfect capital markets?", *European Review of Agricultural Economics* 37(1): 51–76.

Kellermann, K., K. Happe, C. Sahrbacher, A. Balmann, M. Brady, H. Schnicke and A. Osuch (2008), "AgriPoliS 2.1 - Model documentation", IAMO, Halle.

KTBL (several years), Kuratorium für Technik und Bauwesen in der Landwirtschaft (http://www.ktbl.de/index.php?id=135).

Neue Landwirtschaft (several issues), Bodenmarkt. Sonderheft der Zeitschriften Neue Landwirtschaft und Briefe zum Agrarrecht, Ausgaben 1-5.

Petrick, M. and M. Kloss (2012), "Drivers of agricultural capital productivity in selected EU member states", Factor Markets Working Paper No. 30, CEPS, Brussels.

Pietola, K., S. Myyrä and A.-M. Heikkilä (2011), "The Penetration of Financial Instability in Agricultural Credit and Leveraging", Factor Markets Working Paper No. 2, CEPS, Brussels.

Sahrbacher, A. (2012), "Impacts of CAP reforms on farm structures and performance disparities: An agent-based approach", *Studies on the Agricultural and Food Sector in Central and Eastern Europe*, Vol. 65, Halle (Saale) (http://www.iamo.de/dok/sr_vol65.pdf).

Sahrbacher, C., A. Sahrbacher, K. Kellermann, K. Happe, A. Balmann, M. Brady, H. Schnicke, A. Ostermeyer, F. Schönau and C. Dong (2013), "AgriPoliS: An ODD-Protocol", IAMO, Halle (http://www.iamo.de/agripolis/documentation/ODD_AgriPoliS.pdf).

Stiglitz, J.E. and A. Weiss (1981), "Credit rationing in markets with imperfect information", *American Economic Review* 71(3): 393–410.

Appendix A. Graphs about variation of interest level

Figure 0-1 Number of fattening pigs and breeding sows

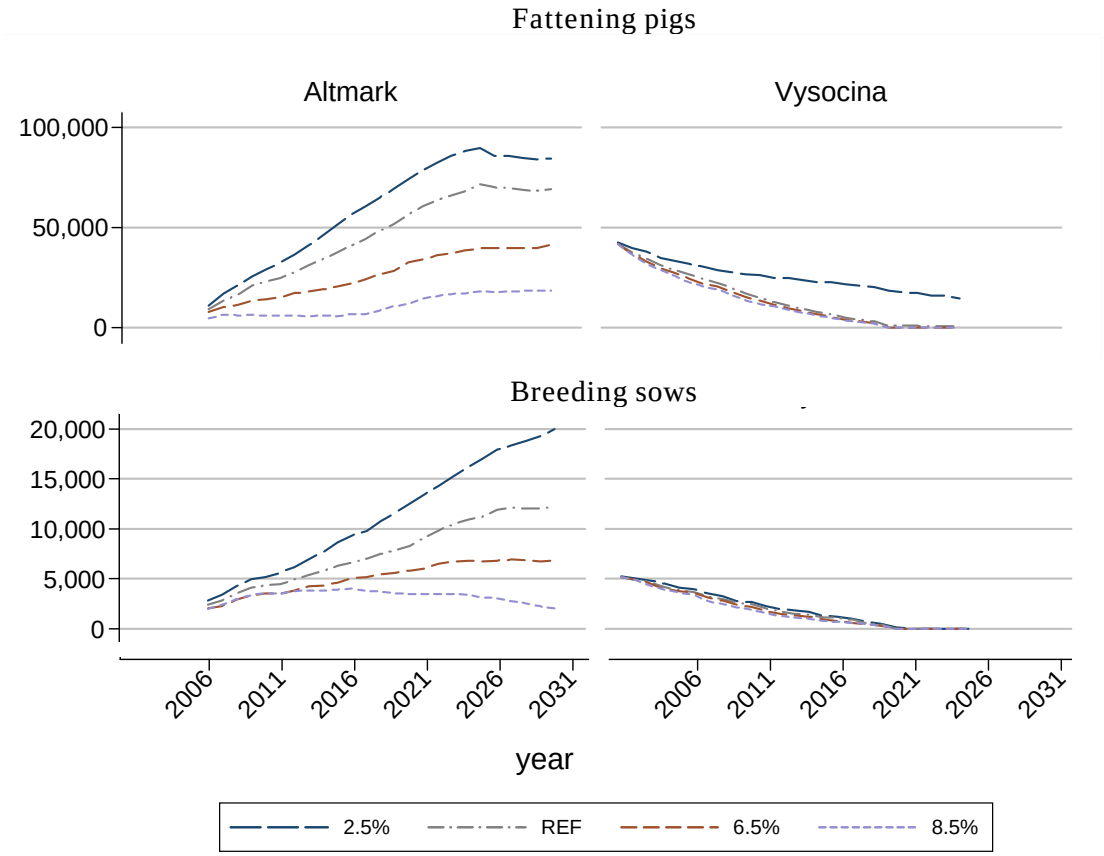


Figure 0-2 Number of dairy cows

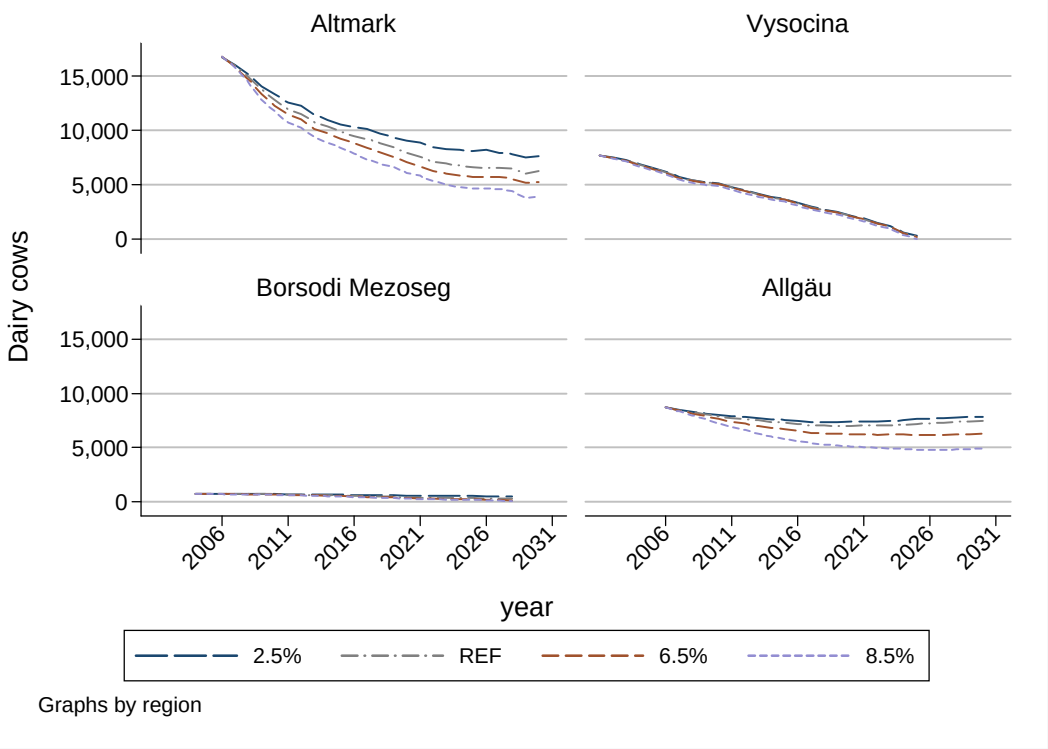


Figure 0-3 Number of dairy cows in Borsodi Mezoseg and number of bull suckler in Allgäu

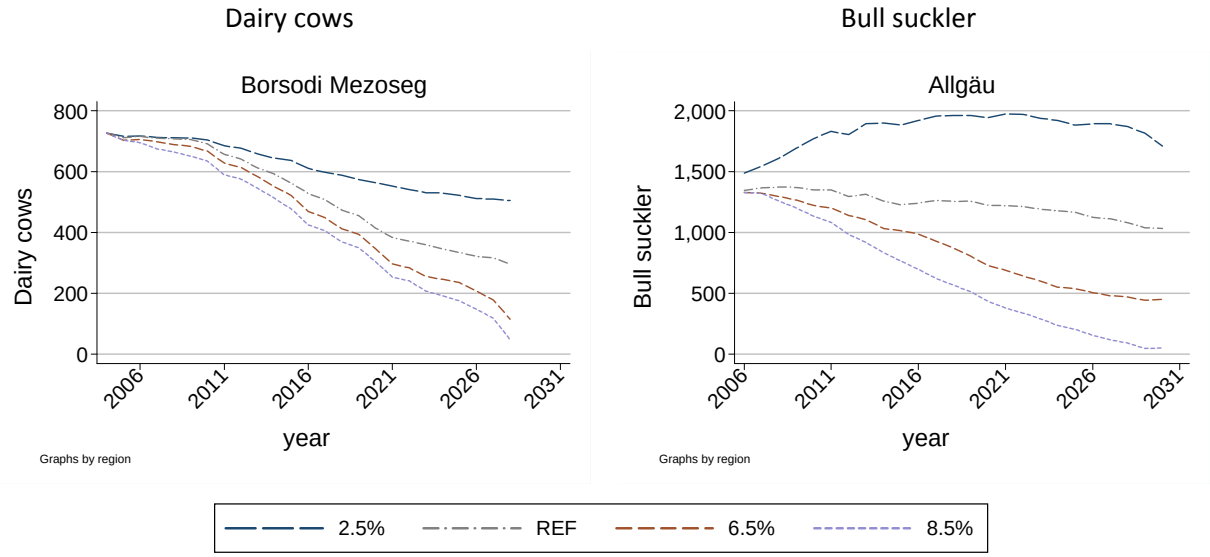


Figure 0-4 Number of suckler cows and beef cattle in Altmark and Vysocina

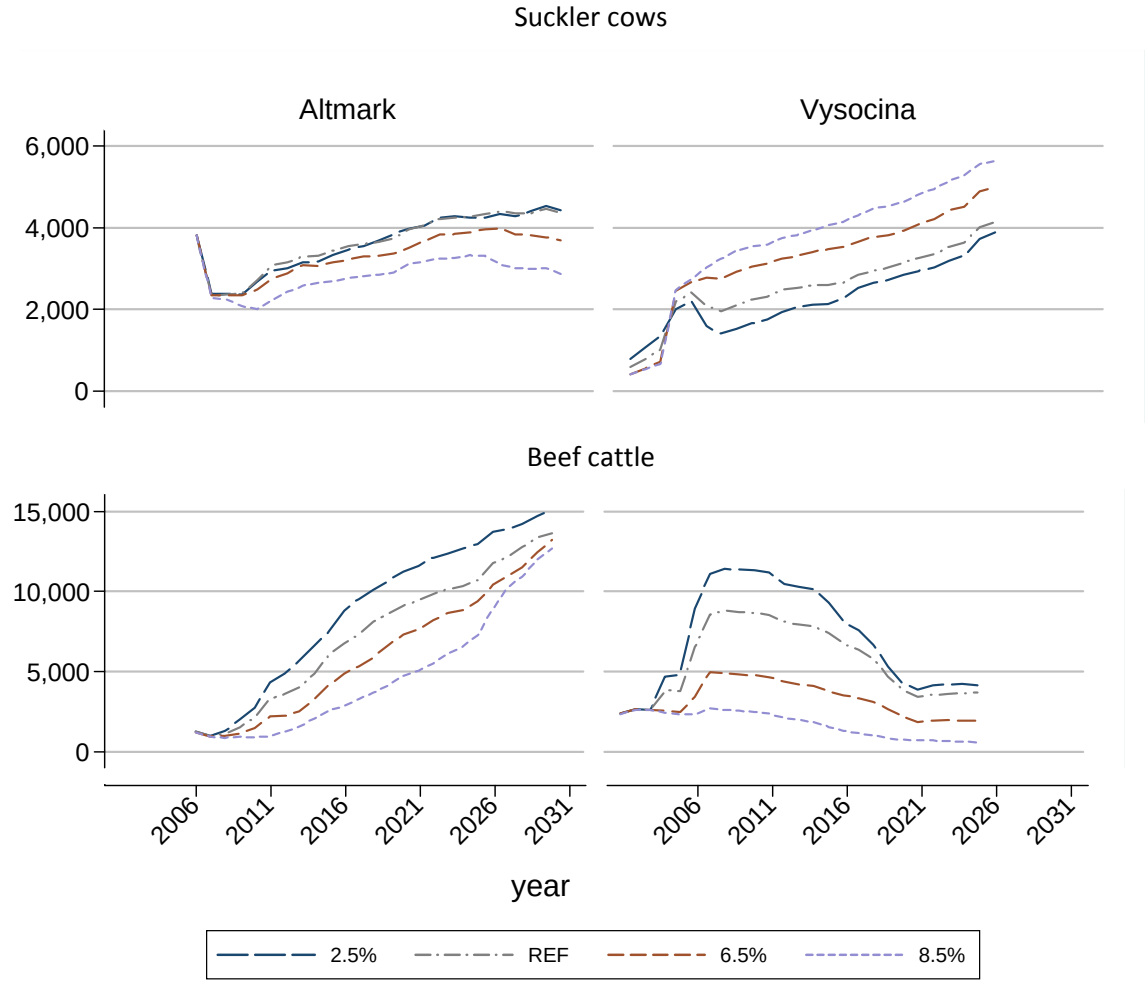


Figure 0-5 Number of suckler cows and beef cattle in Borsodi Mezoseg

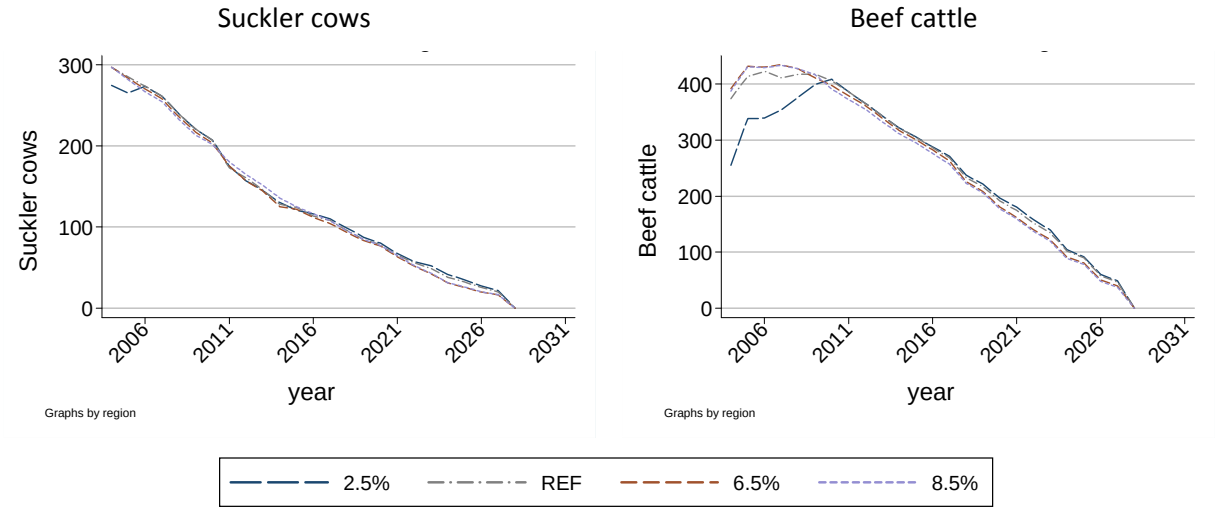


Figure 0-6 Electricity production with biogas plants per hectare in Altmark and Allgäu

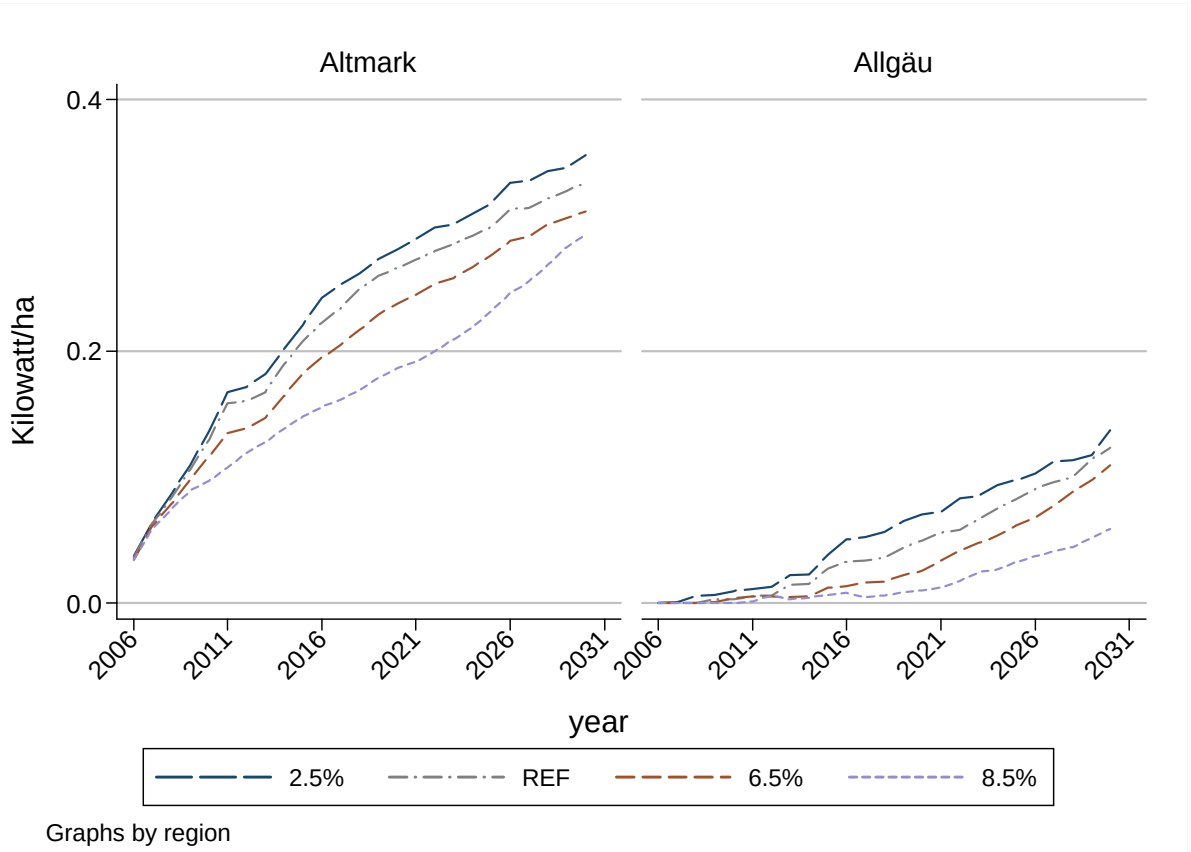


Figure 0-7 Number of beds for tourists in Allgäu

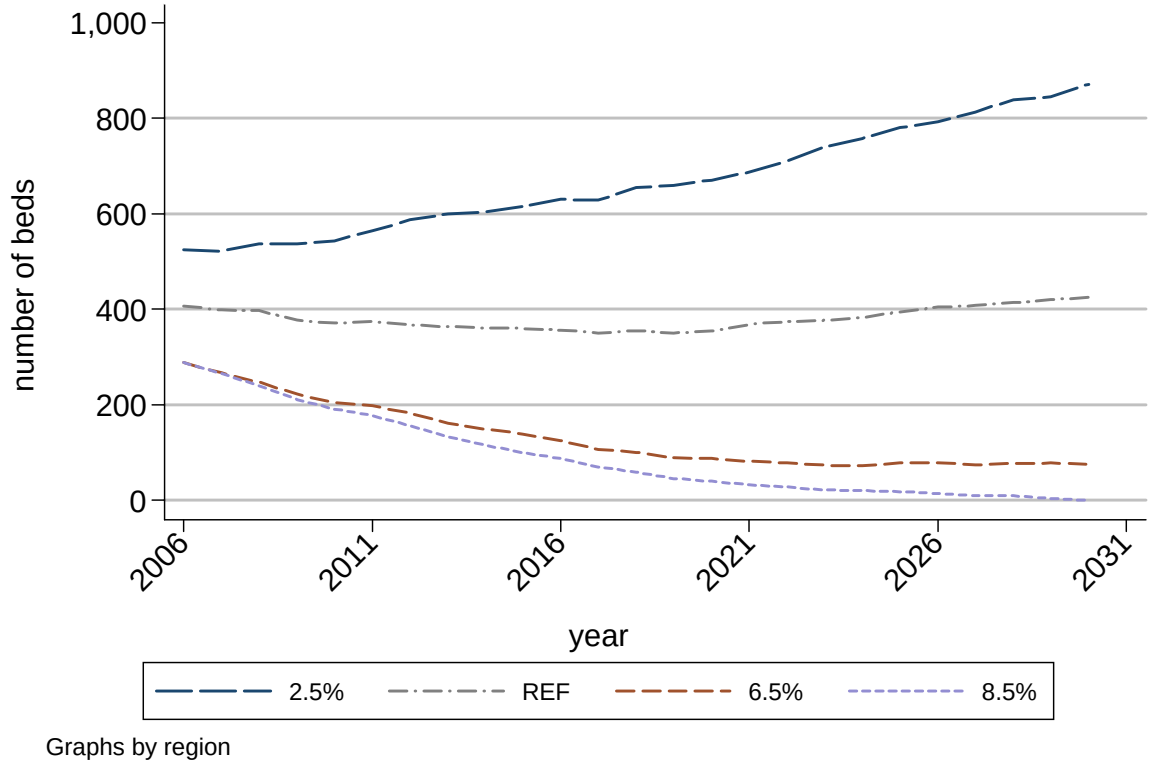


Figure 0-8 Development of machinery capacity in Altmark and Vysocina

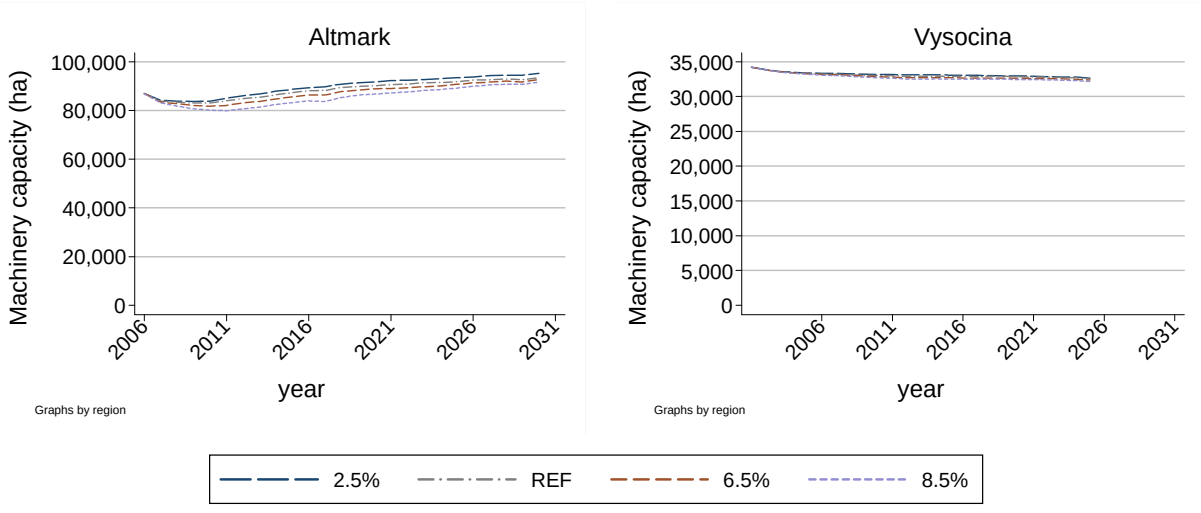


Figure 0-9 Development of machinery capacity in Borsodi Mezoseg and Allgäu

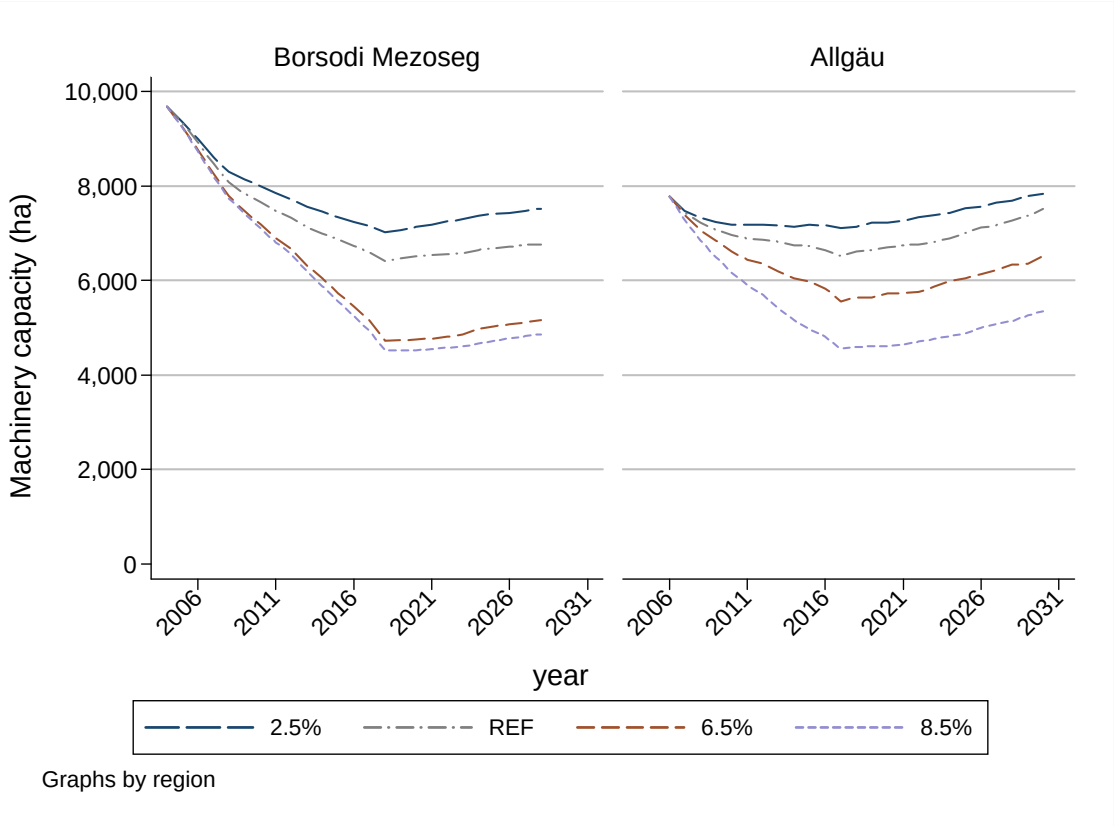


Figure 0-10 Utilization of agri-services in ha

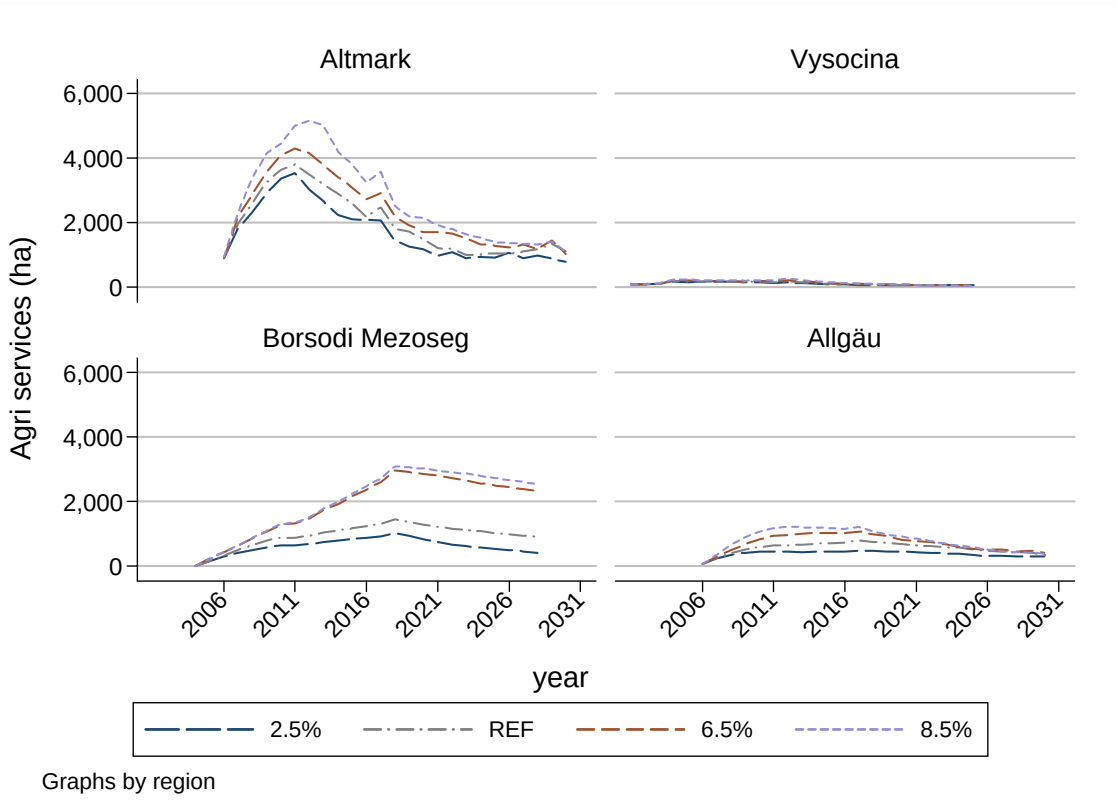


Figure 0-11 Share of land in minimum use

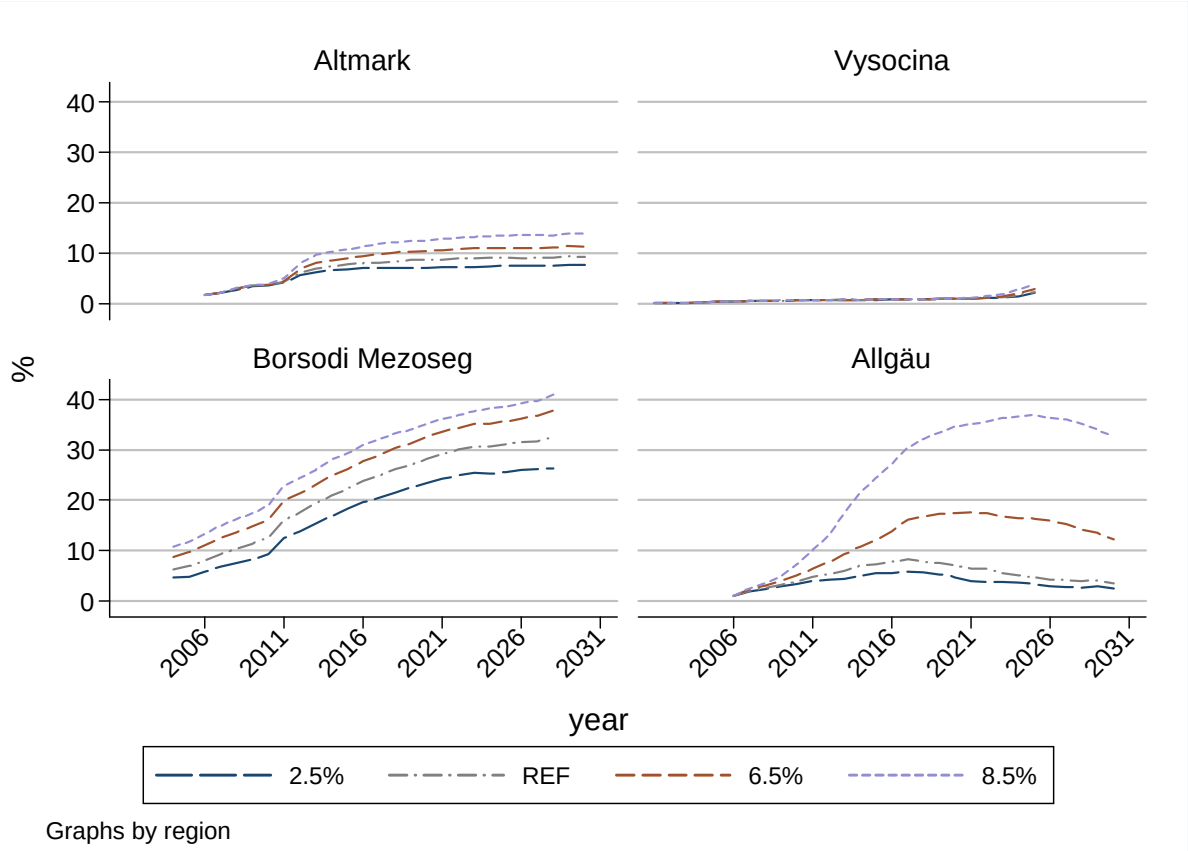


Figure 0-12 Development of fixed assets Altmark, Vysocina and Borsodi Mezoseg

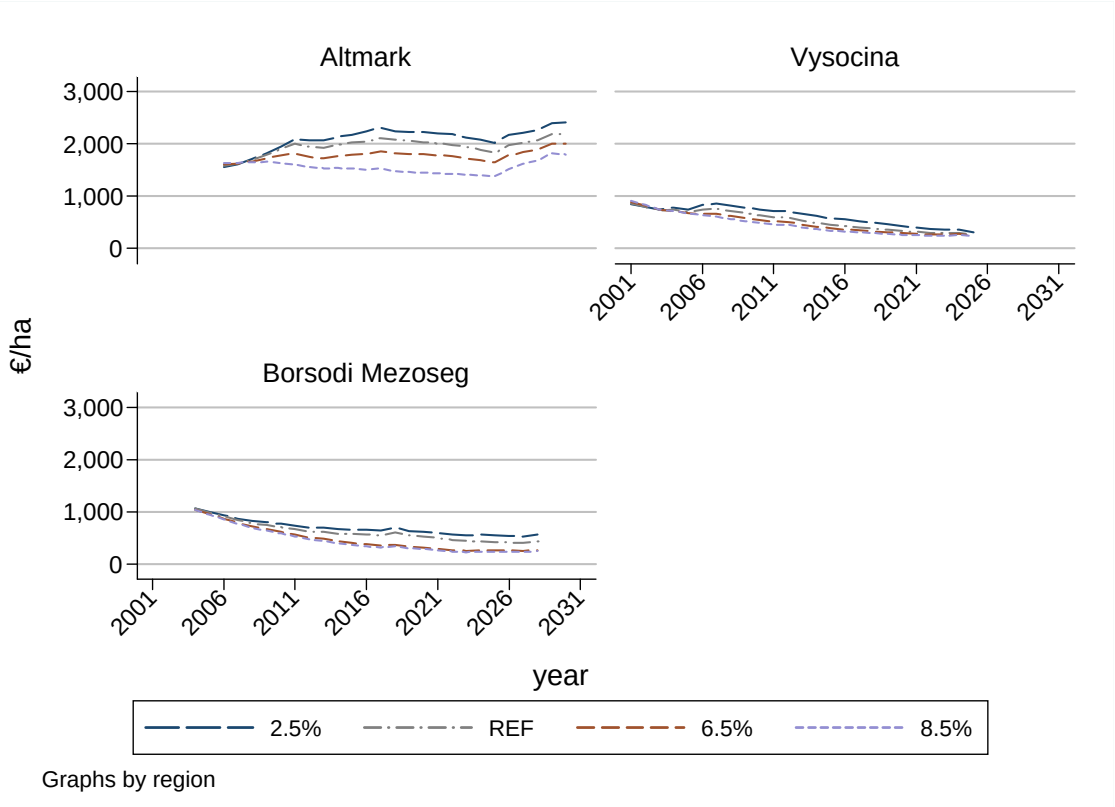


Figure 0-13 Development of fixed assets Allgäu

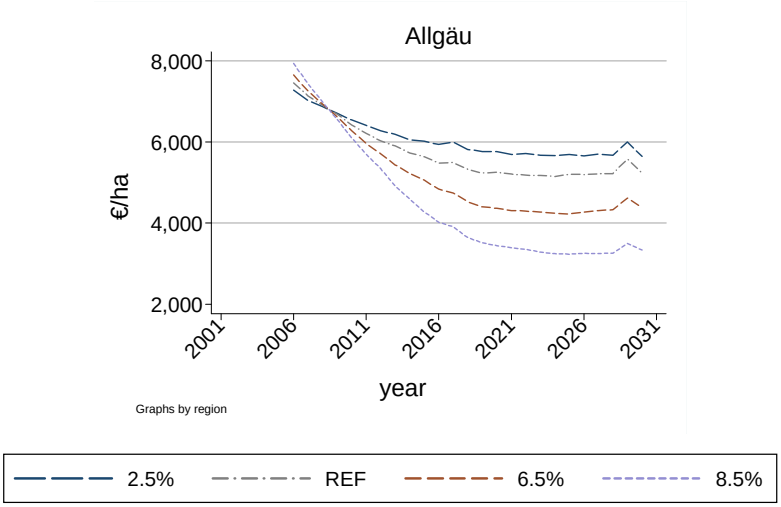


Figure 0-14 Development of liquidity

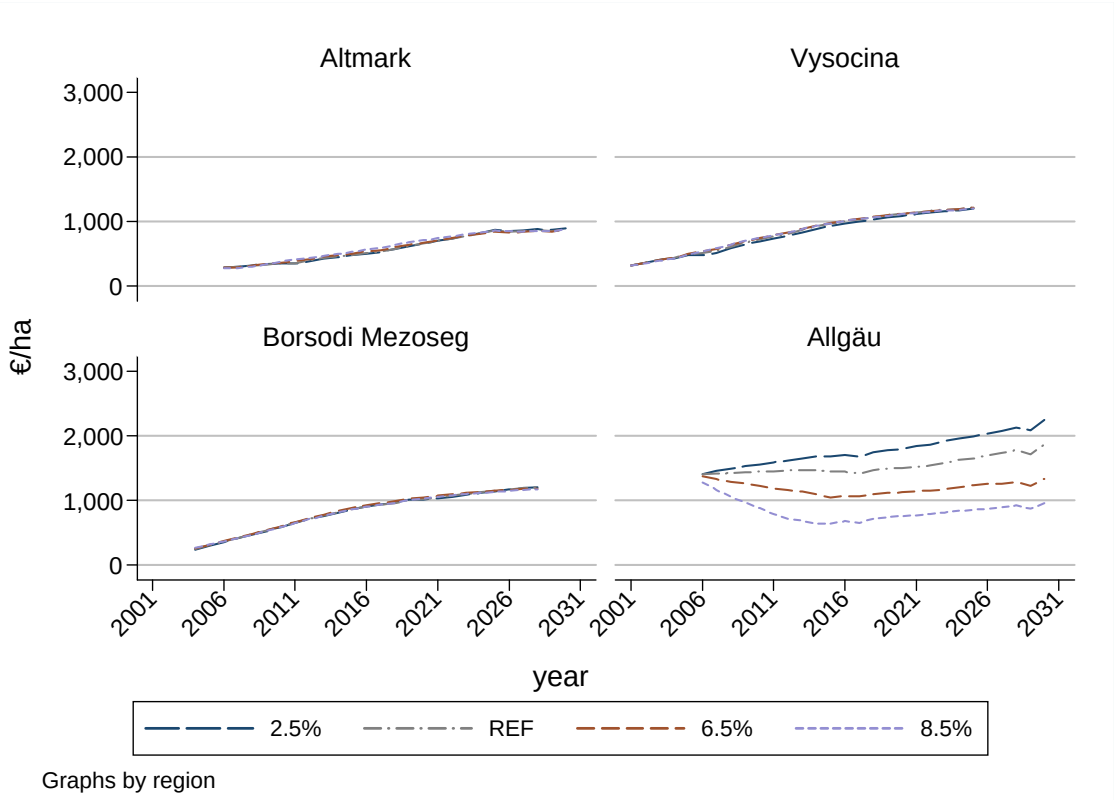


Figure 0-15 Relative decline in number of farms

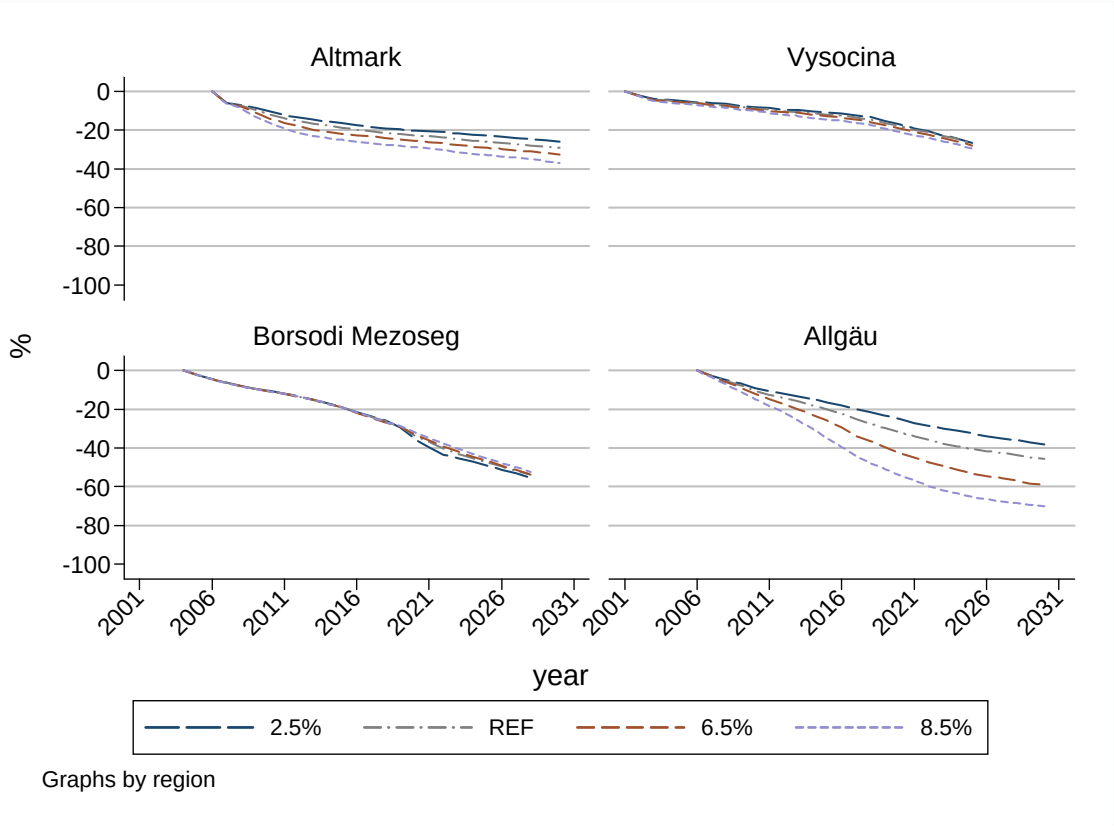


Figure 0-16 Development of livestock density

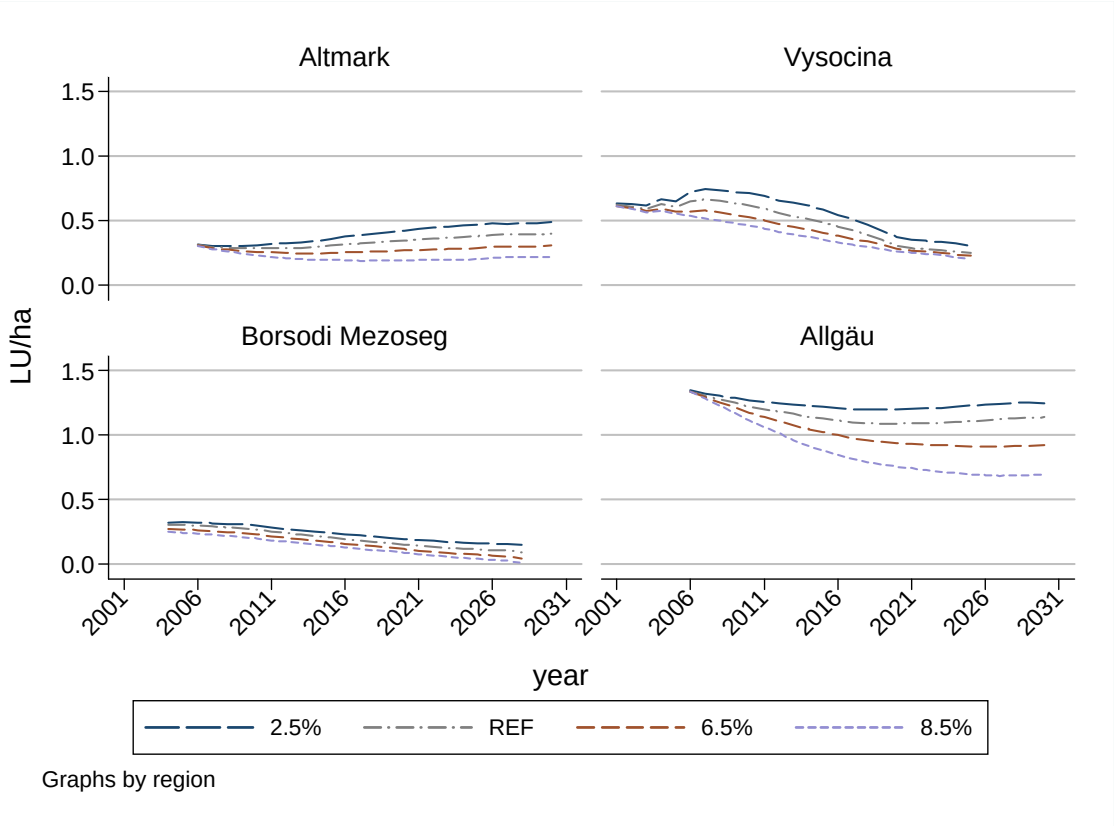


Figure 0-17 Development of labour input

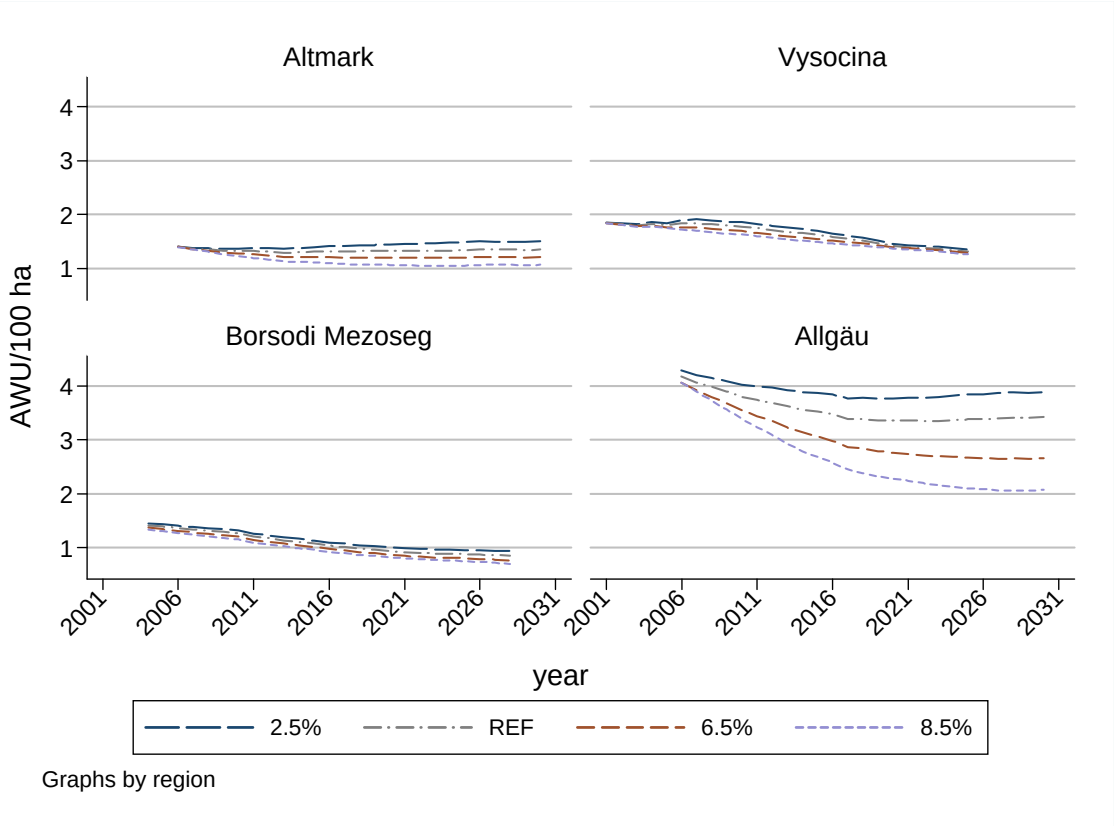


Figure 0-18 Development profit per hectare

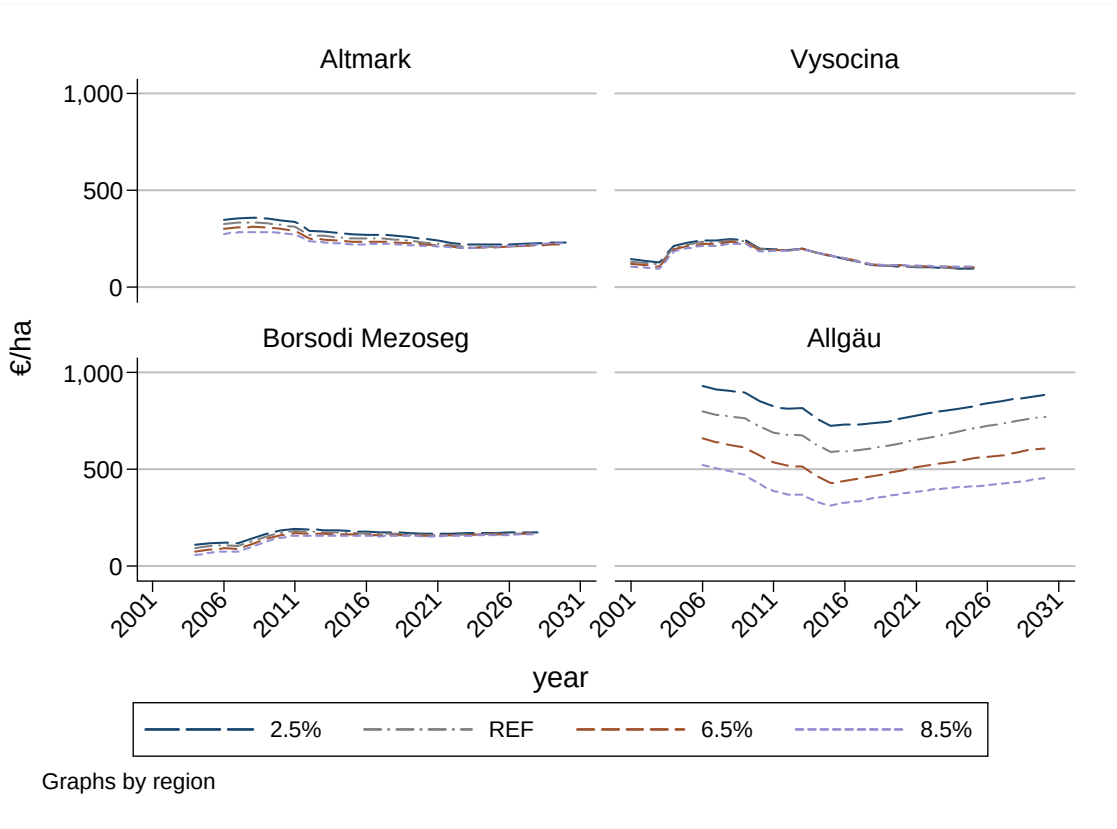
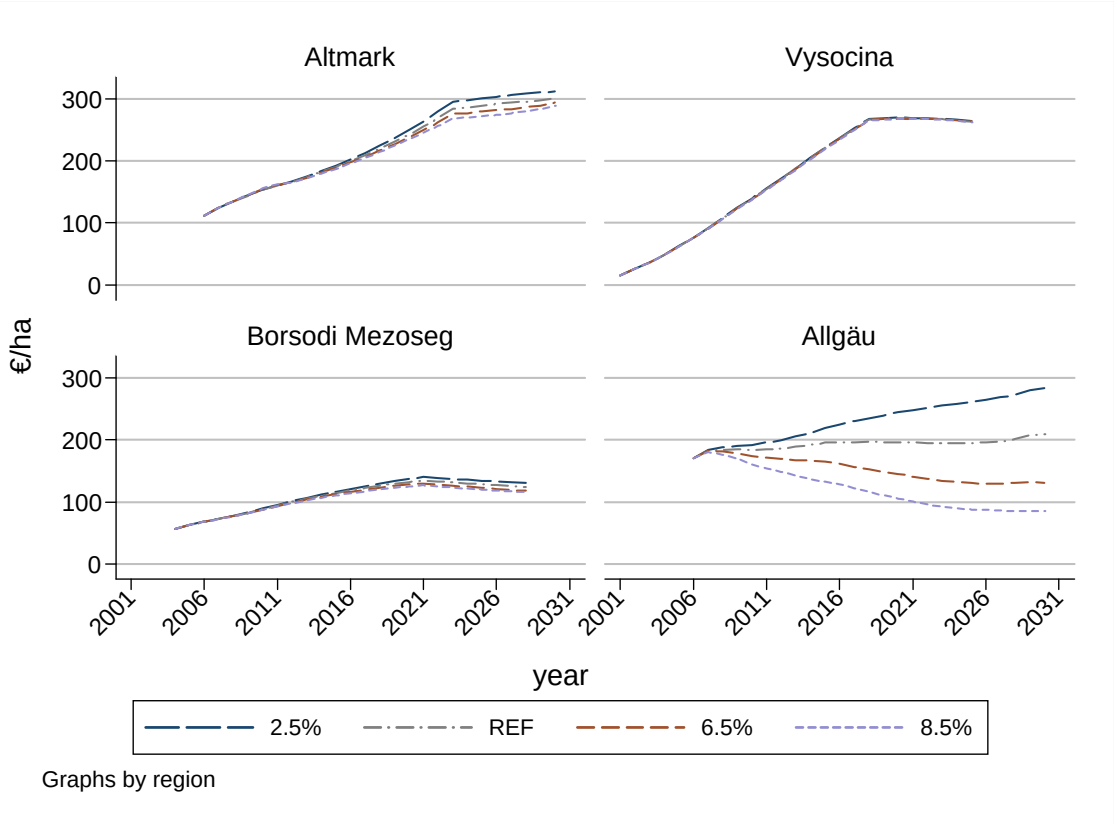


Figure 0-19 Average rental price



Appendix B. Graphs about variation of credit restrictions

Figure 0-1 Number of fattening pigs and breeding sows

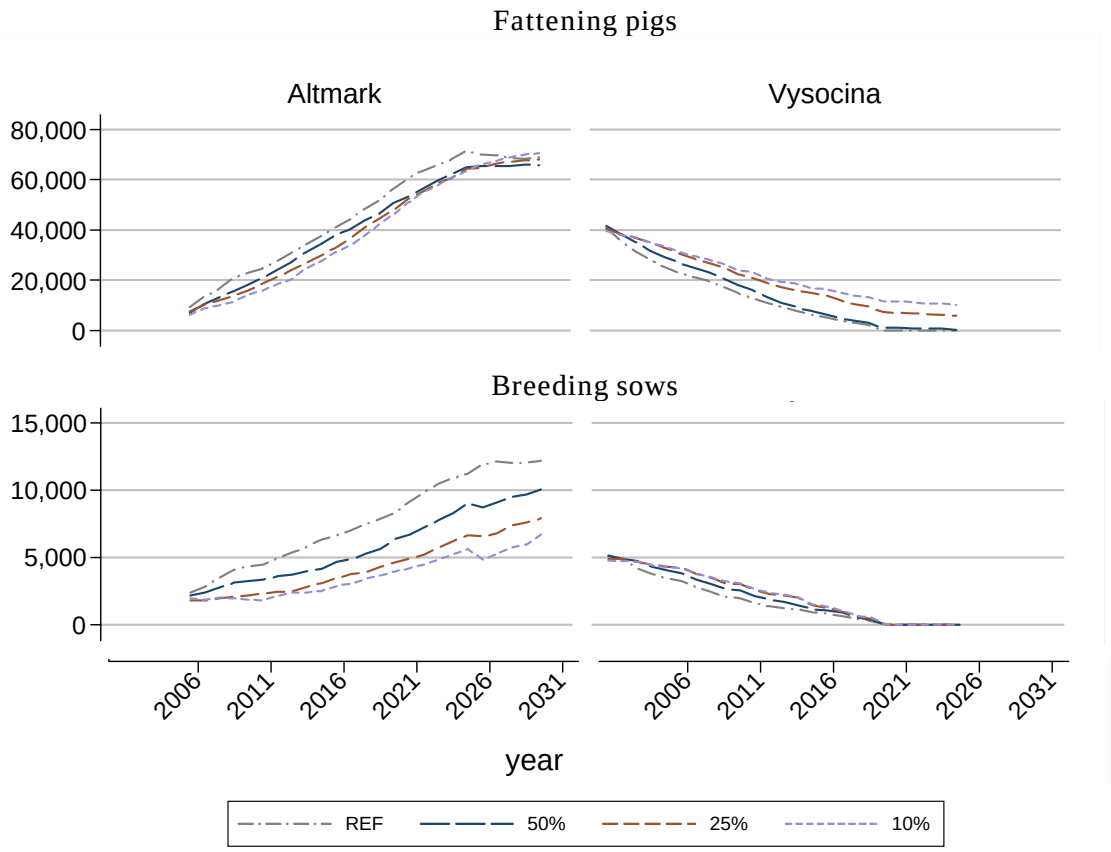


Figure 0-2 Number of dairy cows

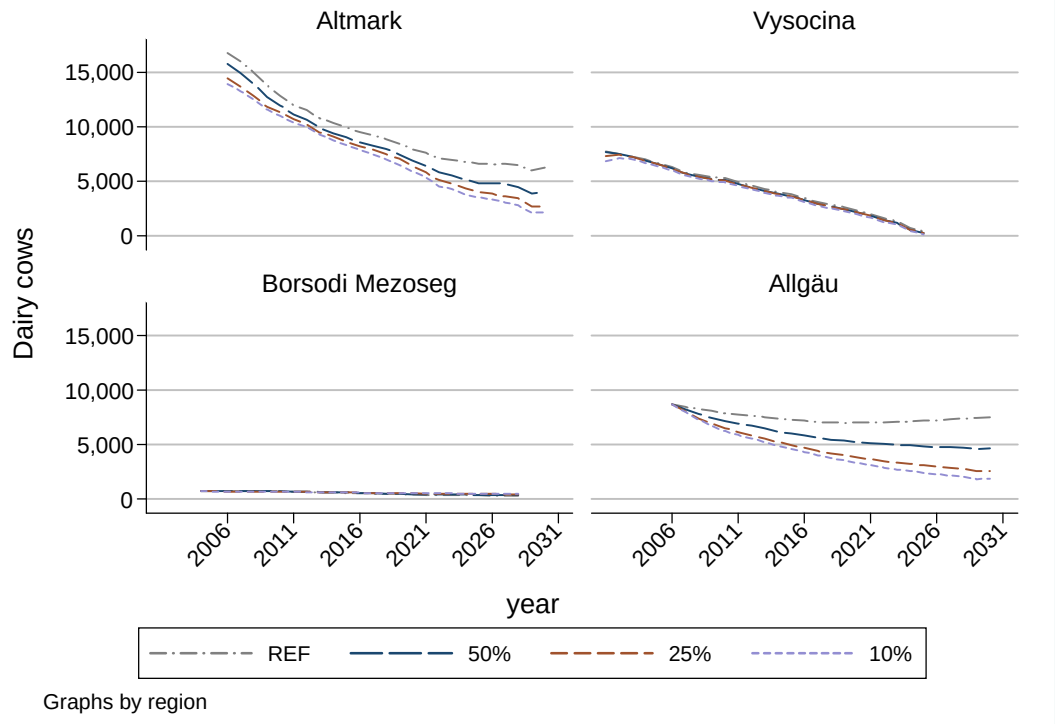


Figure 0-3 Number of dairy cows in Borsodi Mezoseg and number of bull suckler in Allgäu

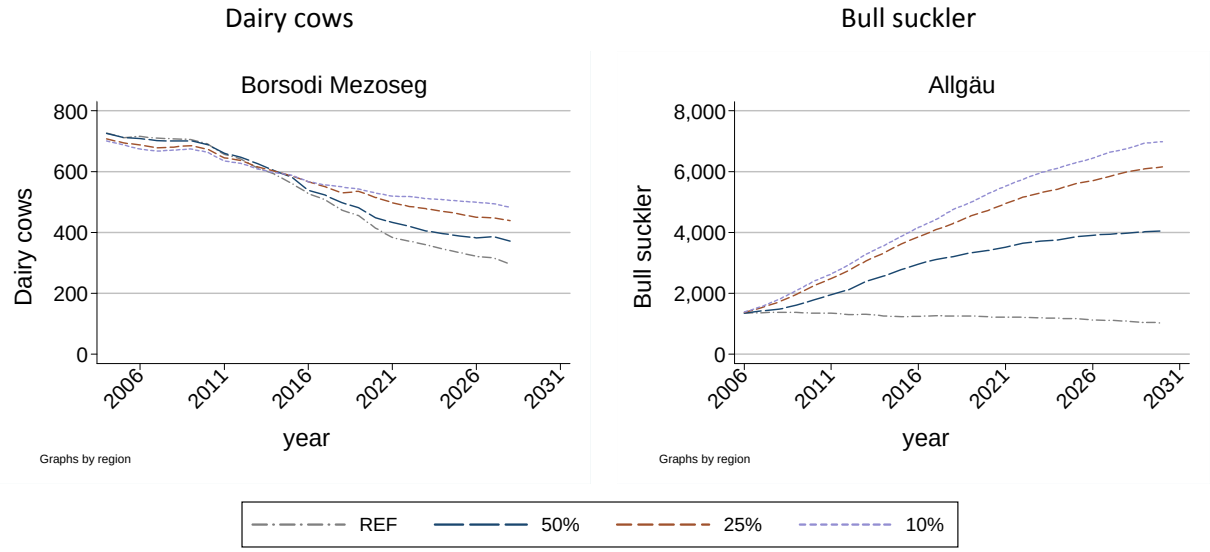


Figure 0-4 Number of suckler cows and beef cattle in Altmark and Vysocina

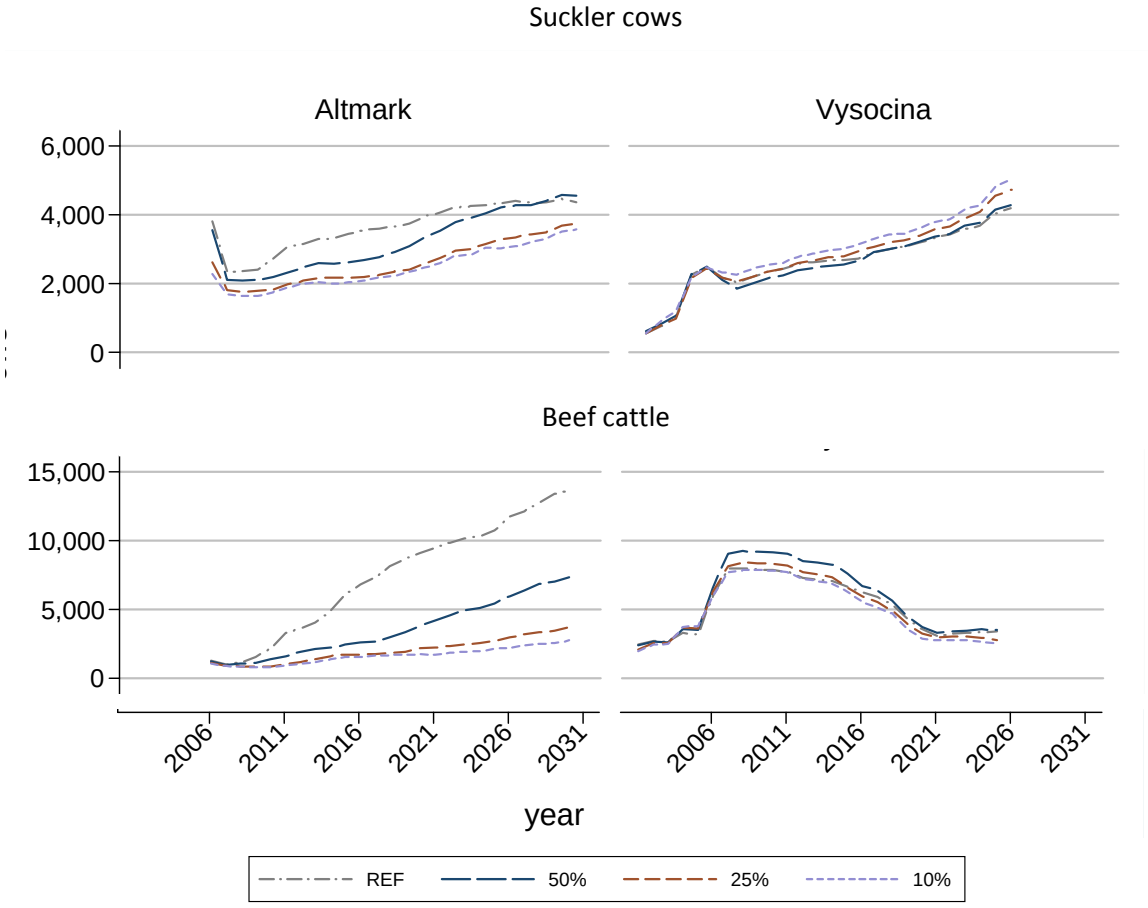


Figure 0-5 Number of suckler cows and beef cattle in Borsodi Mezoseg

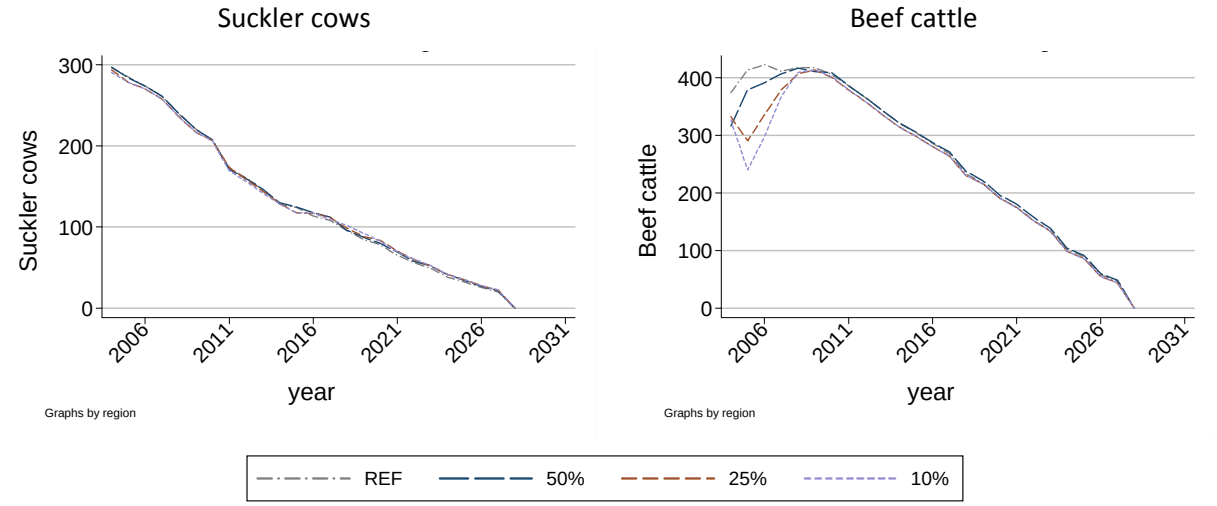


Figure 0-6 Electricity production with biogas plants per hectare in Altmark and Allgäu

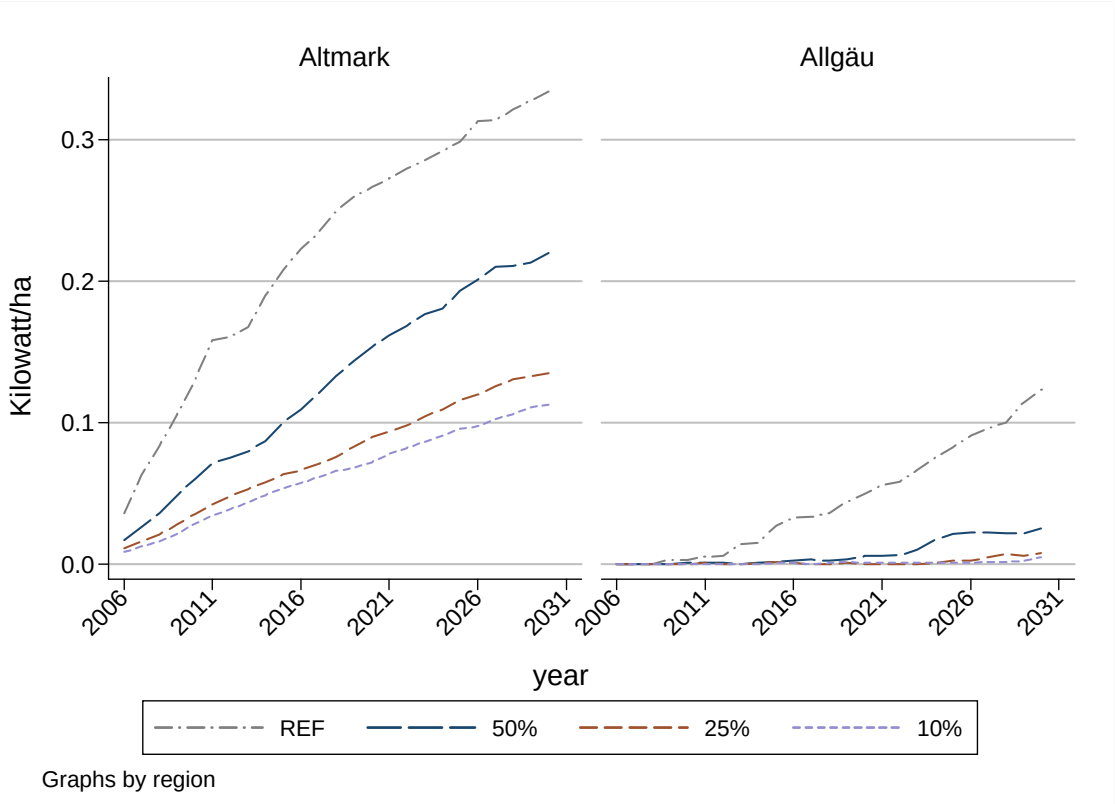


Figure 0-7 Number of beds for tourists in Allgäu

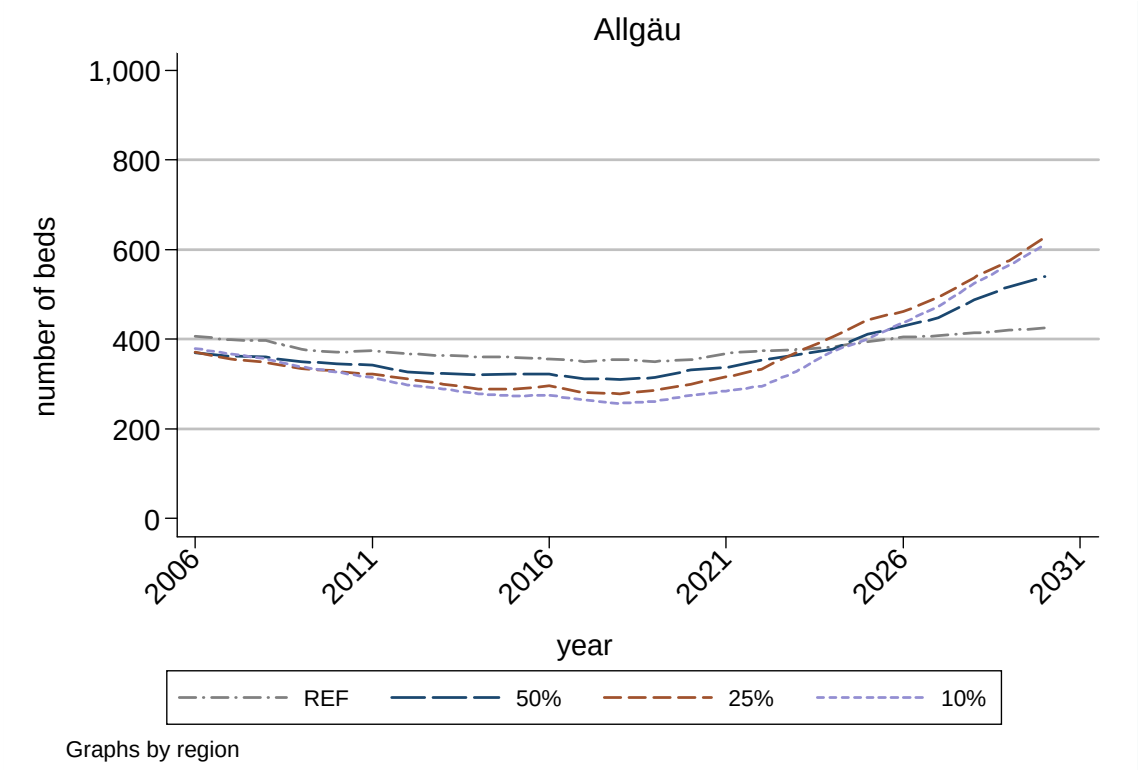


Figure 0-8 Development of machinery capacity in Altmark and Vysocina

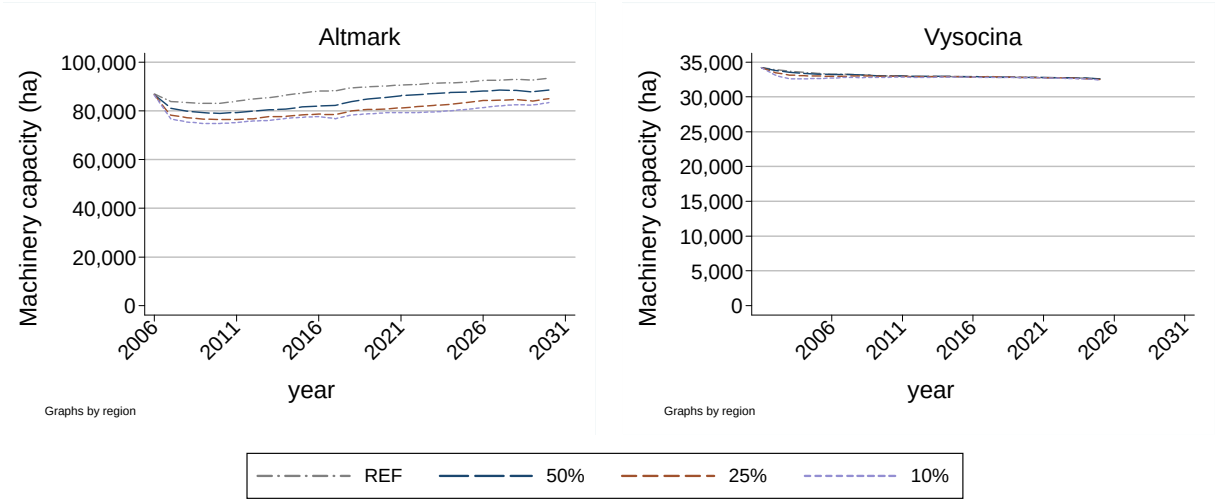


Figure 0-9 Development of machinery capacity in Borsodi Mezoseg and Allgäu

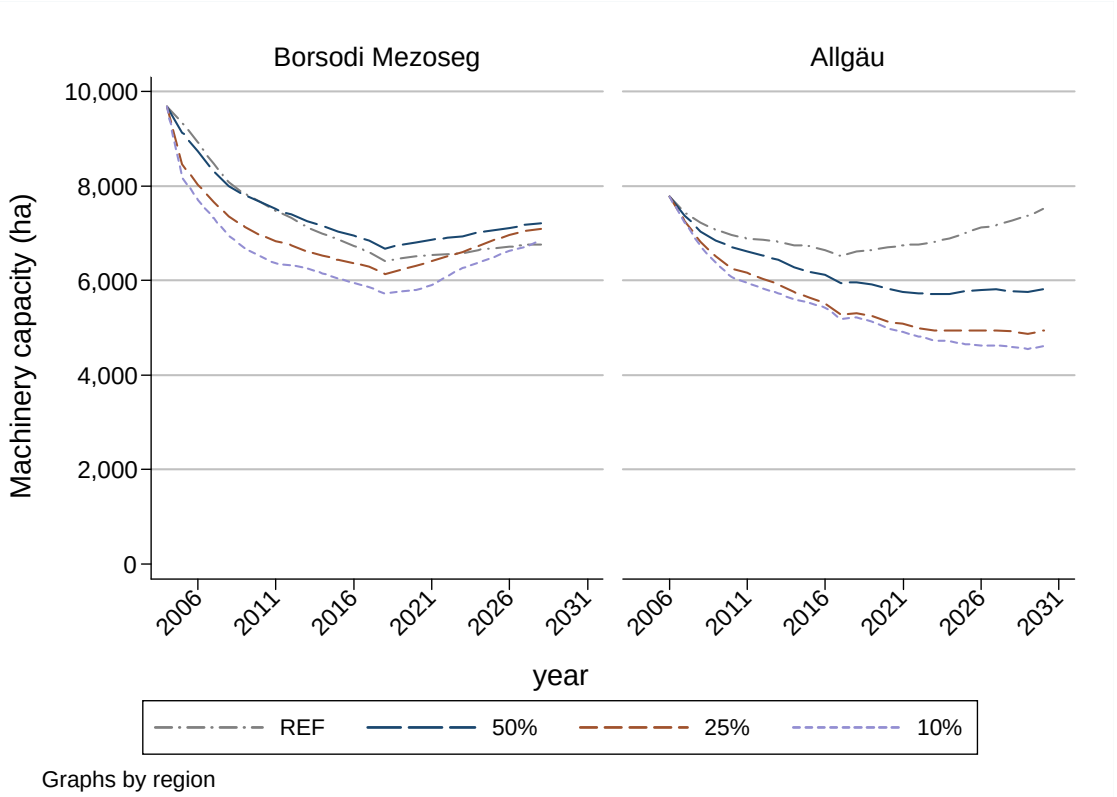


Figure 0-10 Utilization of agri-services in ha

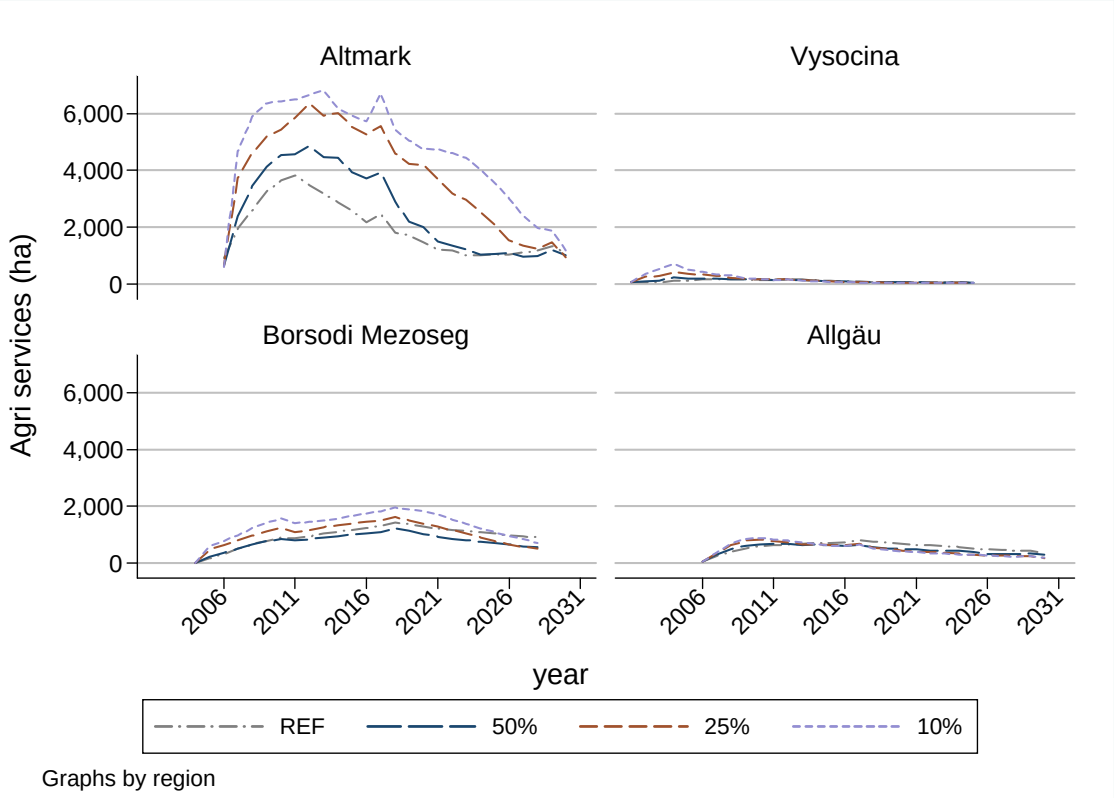


Figure 0-11 Share of land in minimum use

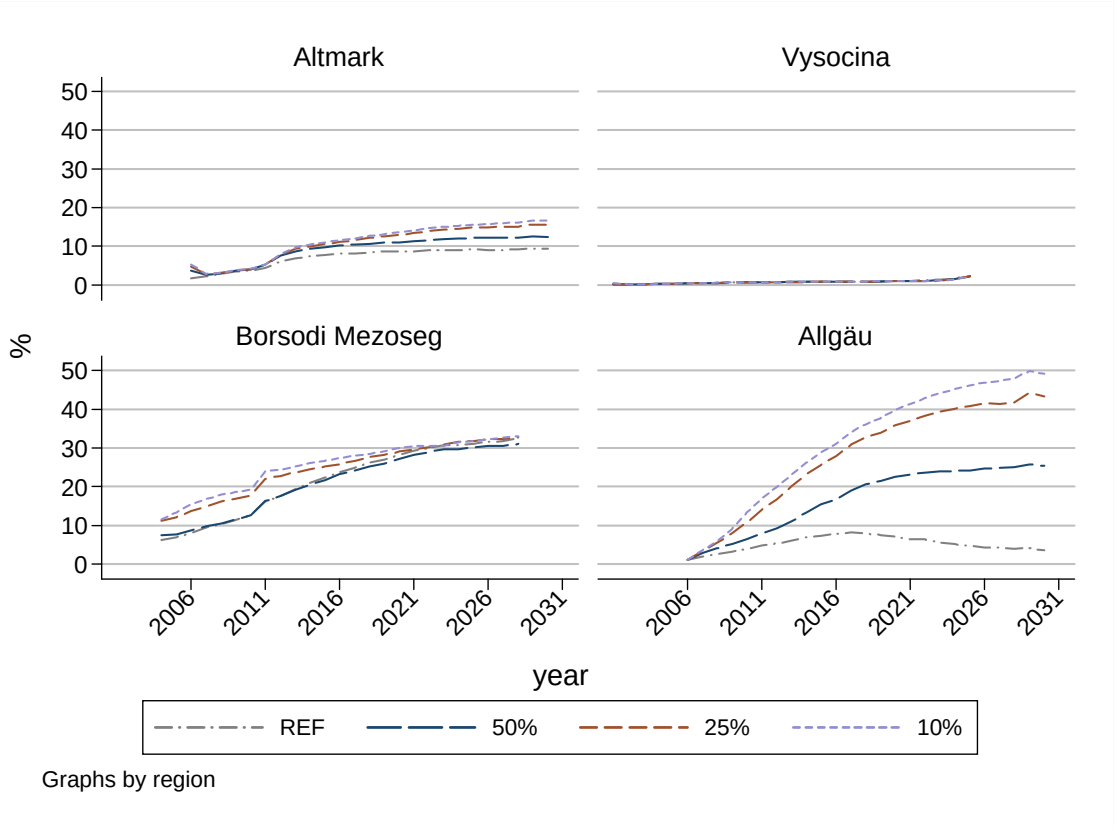


Figure 0-12 Development of fixed assets Altmark, Vysocina and Borsodi Mezoseg

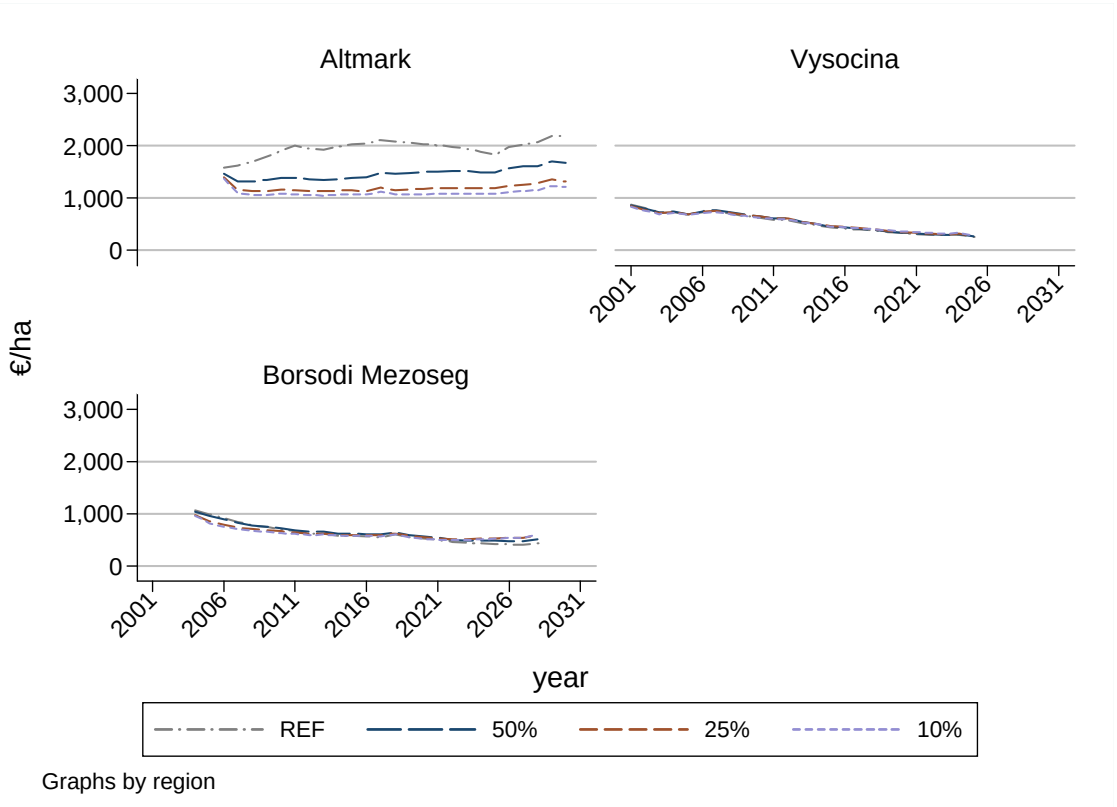


Figure 0-13 Development of fixed assets Allgäu

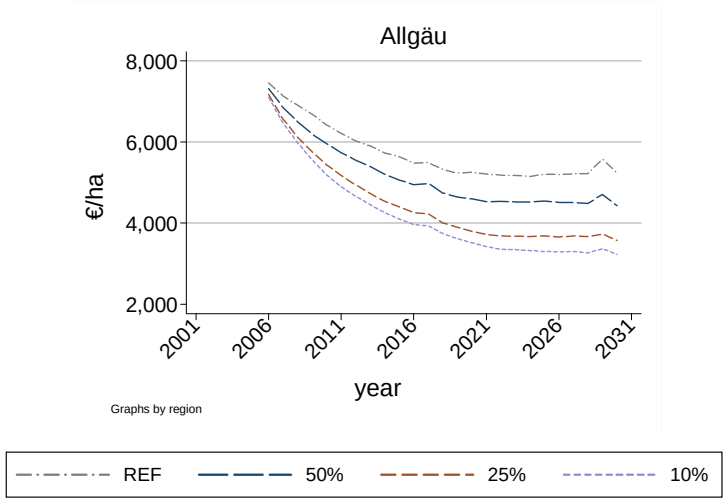


Figure 0-14 Development of liquidity

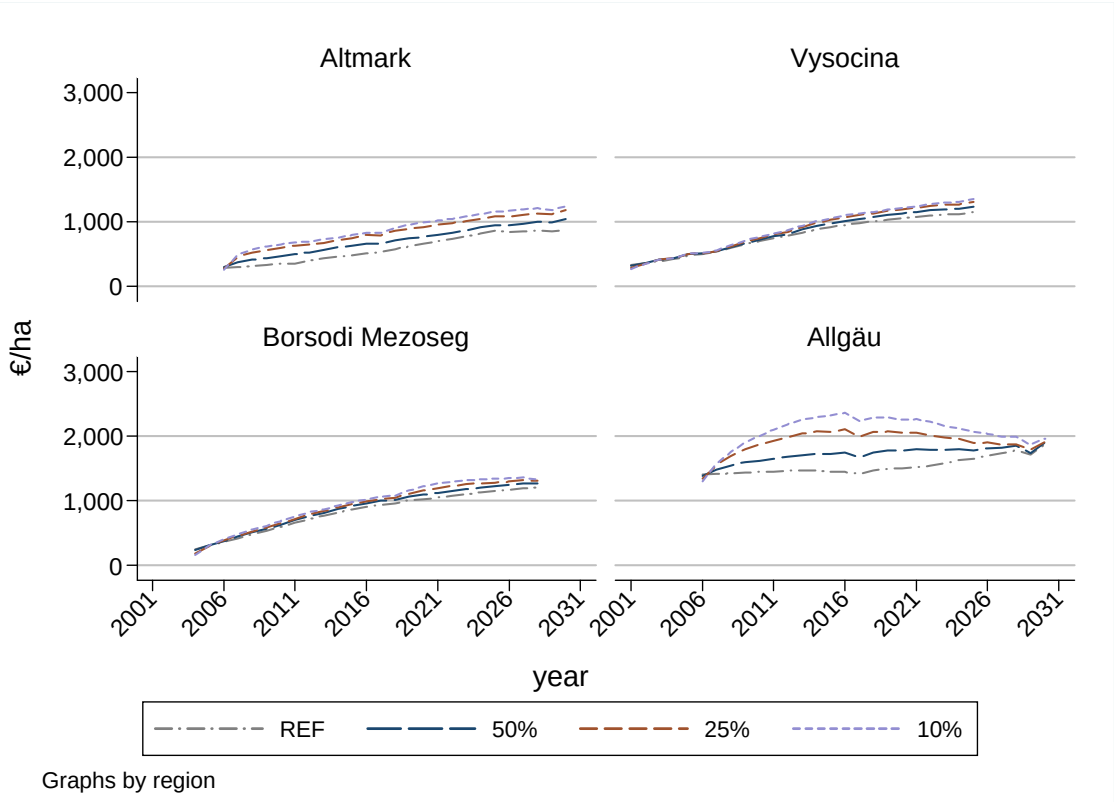


Figure 0-15 Relative decline in number of farms

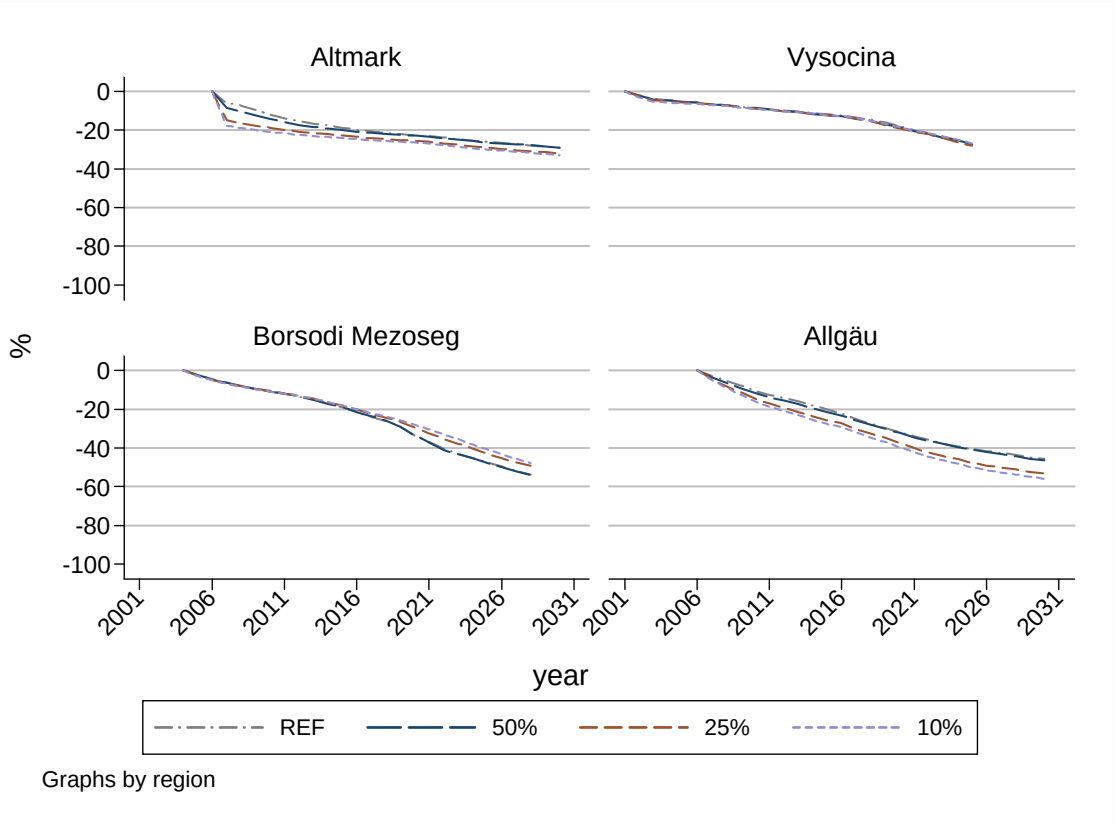


Figure 0-16 Development of livestock density

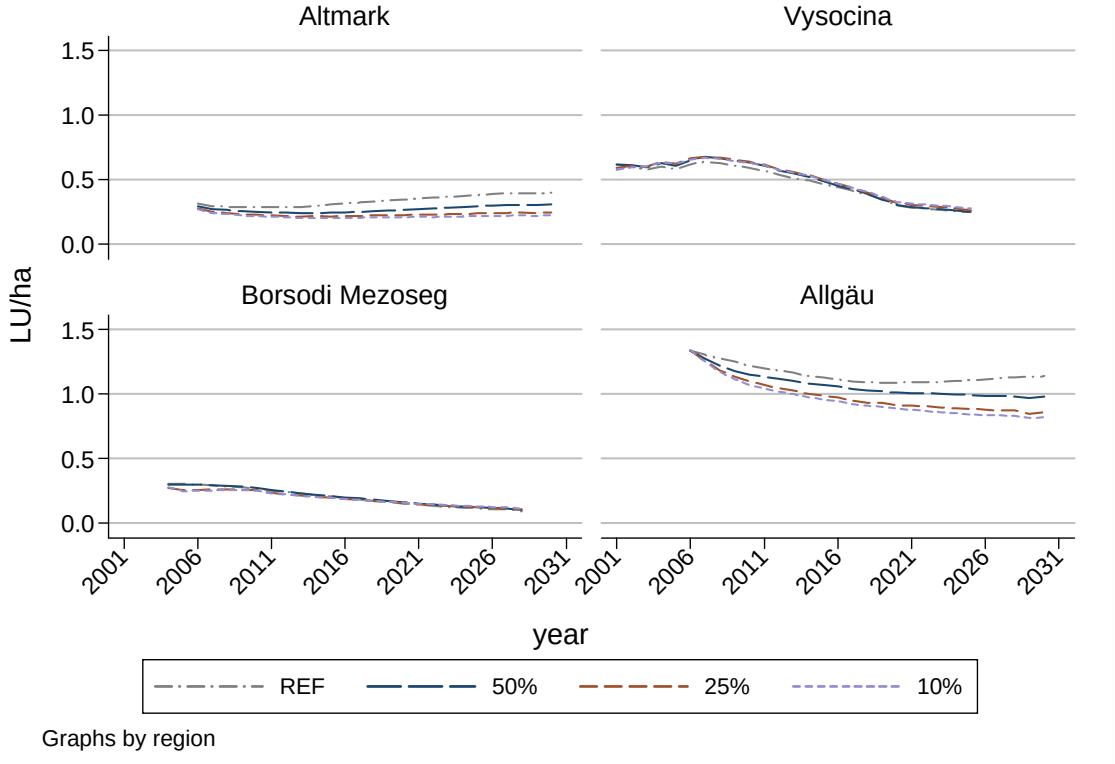


Figure 0-17 Development of labour input

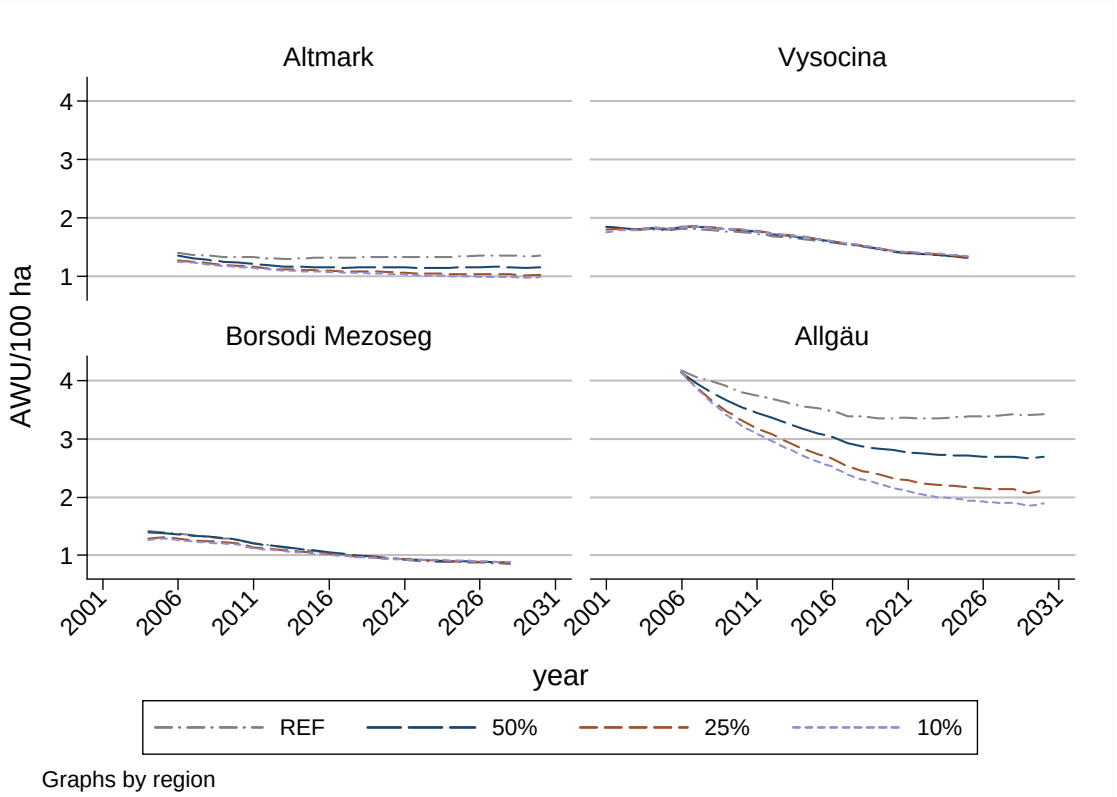


Figure 0-18 Development profit per hectare

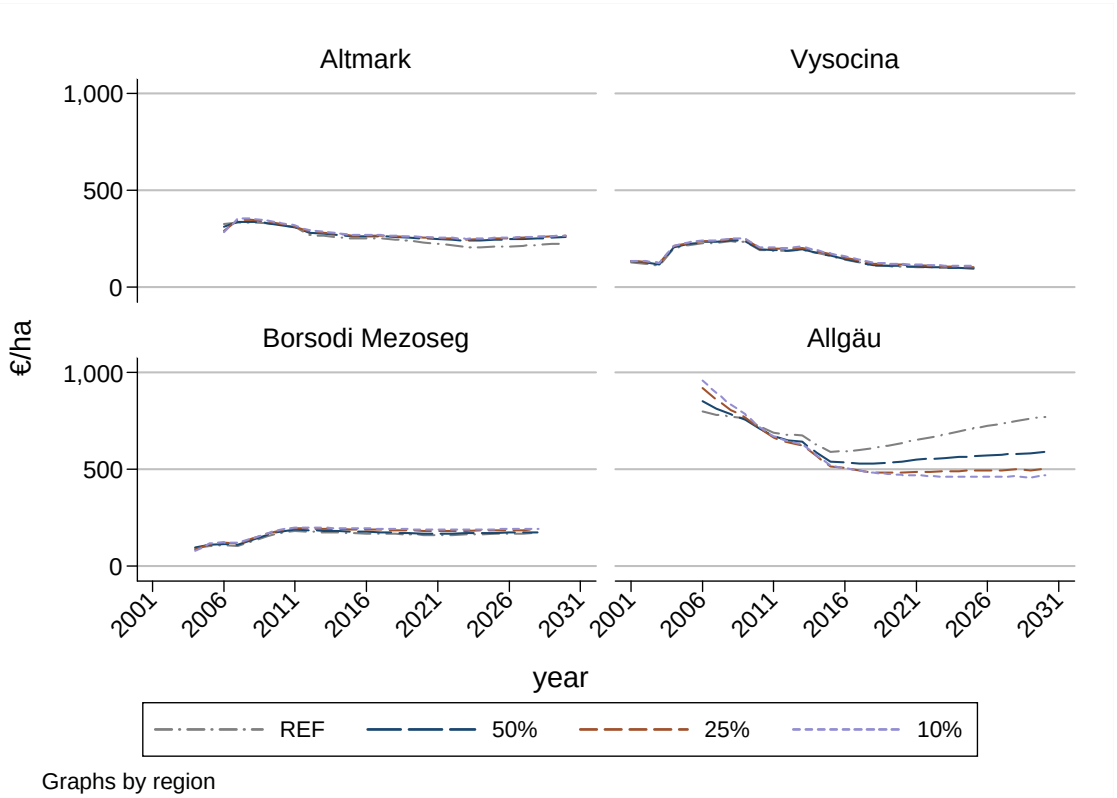
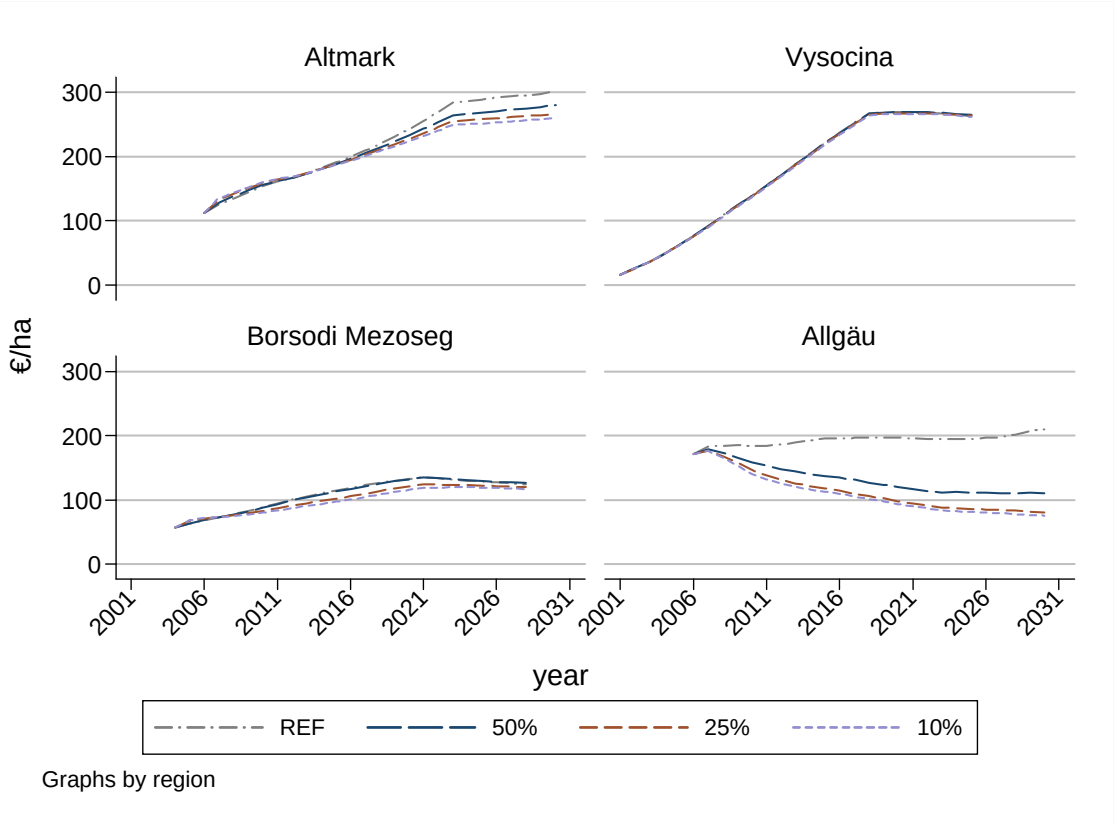


Figure 0-19 Average rental price



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.
Contact e-mail	info@factormarkets.eu
Website	www.factormarkets.eu
Partners	17 (13 countries)
EU funding	1,979,023 €
EC Scientific officer	Dr. Hans-Jörg Lutzeyer