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FARMING AT THE EDGE

DEVELOPMENT OF LAND MARKETS IN SELECTED EU-COUNTRIES AND LAND OWNERSHIP STRATEGIES ON THE FARM LEVEL

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Abstract

The development of the land markets for selected European Countries (B, DK, D-W, F, NL) and the effects of agricultural policy reforms on land prices are analysed in "Part I – Land Markets at the Country Level" of this article. The variables describing the agricultural land markets are land prices, prices for rental land and the share of rented land. Over a longer period of about two decades, the prices for agricultural land have been decreasing in real terms in general (exception NL) while rental prices have been more stable. A regression analysis shows increasing price effects on prices for agricultural land and on rental prices due to the ha-premiums, which were introduced by the Common Agricultural Policy(CAP)-Reforms in 1992.

In "Part II – Farm Level Strategies for Land Purchase" the economic effects of changing land ownership are analysed using the data base of Part I. Recommendations for farmers are to find out if long term rental contracts are available to avoid tying up capital. If land market prices are lower than a certain threshold, land can be bought considering the financial liquidity of the enterprise. Selling land could be appropriate to avoid financial liquidity stress, but this should be only temporary and restricted to a marginal amount of land stocks. If profitability of crop production is relatively low or land prices are relative high and rental contracts terminated, an entrepreneur should seek to rent new land, if possible, or find alternative investments which yield higher profits than crop production.

Introduction

The production factor land is essential for agricultural firms in crop production as well as in animal production. General availability of agricultural land (according to supply and demand on the land markets) and the prices for rental area as well as land purchase prices determine the profitability of enterprises and the development of farm size with repercussions on the structural change of the agricultural sector. The objective is to asses the development of land markets, analysing the prices for rental land and agricultural land purchased and the distribution between use of owned land and rental area. The main focus of "Part I - Land Markets at the Country Level" (Chapter 2) is the question if ha-premiums, which were introduced in the 1992-CAP-Reform of the EU, have influenced agricultural land prices. In "Part II – Farm Level Strategies for Land Purchase" (Chapter 3) optimal strategies are developed for land management of typical farms with the main focus on situations when rental contracts are terminated.

Part I – Land Markets at the Country Level

2 Development of land prices on the national level in five EU-Countries

Eurostat prices for agricultural land and prices for rented agricultural land for five EU countries (B, DK, D-W, F, NL) have been used for this analysis[4]. The deflated land purchase prices[5] in the selected five countries show a peak in the late 1970s and early 1980s (Fig. 1). After a period of stagnation or even decreasing land prices, the prices recovered in most countries at the end of the 1990s. Over the whole period from 1975 to 1999 the deflated land prices showed a decreasing trend in four countries (B, DK, D-W, F). Only in NL did they show an increasing tendency. The average land prices per ha, in real terms, have been highest in NL (20,981), followed by D-W (19,660), B (15,201) and DK (9,010). In F the price level was lowest with 4,782 .

Figure 1: Agricultural land prices (left) and prices for rented agricultural land (right) in real terms (/ha), 1975 – 1999; Source: Eurostat; own calculations

The deflated rental prices follow a negative trend in B, DK and F, while rental prices increased in the long term in D-W and NL. Average deflated rental prices per ha were highest in DK (319), followed by NL (265), D-W (229) and B (181). In France the lowest prices were also observed for this variable, with 133 / ha on average for the period 1975 to 1999.

The share of rented land[6] differs considerably among the selected countries. The highest average proportions, with more than 50 %, were in Belgium (70 %) and France (55 %), while the Netherlands (37 %) and Denmark (18 %) have the lowest values. A considerable increase in rental shares occurred in France (+17 % in 25 years) and Western-Germany (+20 % in 25 years), while the values for Belgium and the Netherlands show a decrease. On average for the selected five countries (not included D-E), the share of rented land increased from 41.8 % in 1975 to 47.3 % in 1997.

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[4] Excluded have been countries which distinguish between irrigated land and corresponding non-irrigated land, countries with missing data in the period 1975 to 1999 and Luxembourg, the last due to relative high land prices which are influenced mostly by off-farm factors.

[5] GDP deflator (1995 = 100)

[6] The proportion of cultivated own land is available every other year. By interpolation the corresponding **rental share** is calculated.

The panel data of the five countries over 25 years (1975 to 1999) provides 125 observations. A VAR[7]-like, two-equation system was selected to specify the interactions between land price and rental price and to determine the exogenous influence of policy changes due to reforms of the CAP and the structural change in agriculture (the latter should be covered by the rental share and its change). Endogenous variables are the price for agricultural land and the price for rented agricultural land, both deflated and in logs. As exogenous variables the rental share, the deflated price index for agricultural products[8] and the ha-premium[9] were selected. [10]

In-sample simulations on Eurostat data base

The estimated model is tested in-sample to show the accuracy according to the actual data and to isolate the effects of the ha-premiums on the dependent variables. The in-sample simulations (Fig. 2) start in 1975, 1980 and 1990, and provides one, two, etc. step-ahead forecasts, using the actual values for the exogenous variables. It is obvious that the model is not able to follow the actual development especially for the time series "land price" during periods of larger fluctuations as observed between 1975 and 1985. For the other periods, and for the other endogenous variables over the total observation time, a better forecast quality can be observed.

It is of interest to what extent the ha-premiums have been transferred to non-farming persons. Two simulations, one with and one without ha-premiums, can show what difference could occur in the price levels for agricultural land and for rented agricultural land (Fig. 2). Without ha-premiums, the land price in real terms could have decreased on average to about 8,100 /ha (1998) to 7,500 /ha (1999), which would have been a dramatic change which has to be interpreted with care. The change in rental prices would have reached dimensions of 48 to 58 /ha compared to the in-sample simulation in 1998 to 1999 and rental prices would have been decreased by 28 % to 35 % in these two years. In other words, the land owners, who lease agricultural land, got a share of about 15 % to 18 % (1998 to 1999) of the ha-premiums. The absolute figures should be interpreted with care. Most importantly, there seems to be no doubt that some part of the ha-premiums have been transferred to the non-farming sector.

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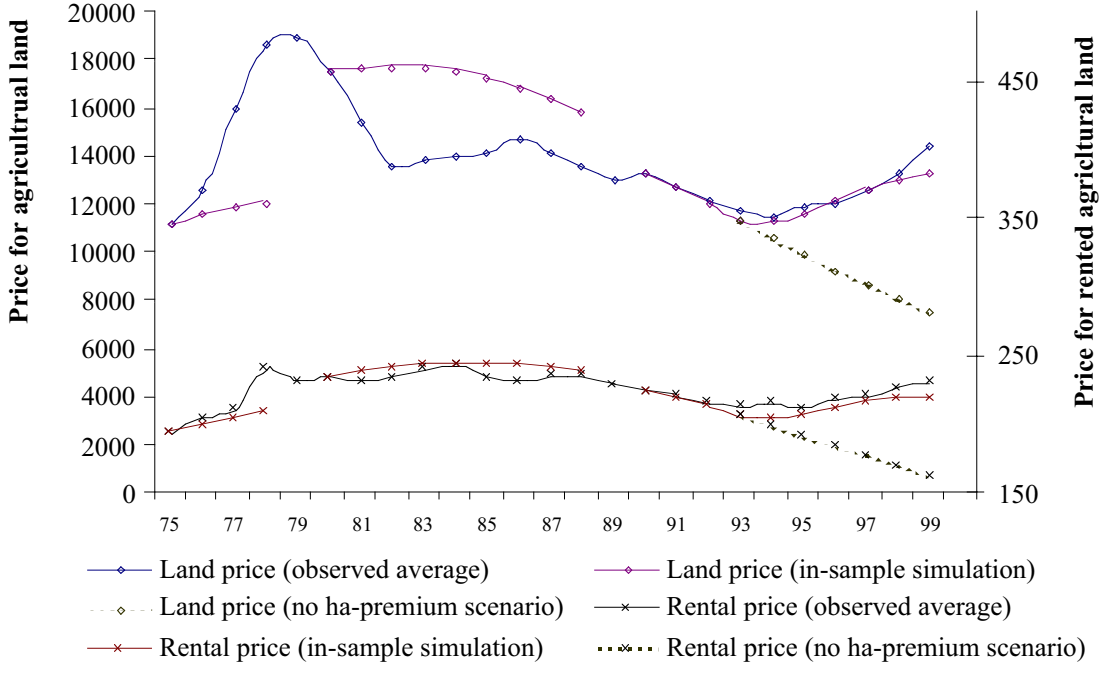
[7] vector auto-regressive

[8] Additionally, the deflated **price index for agricultural products** is used. This variable represents changes in income support by market measures in the CAP, which mostly reflects the decreasing income potential from market revenues.

[9] As a measure for the **ha-premium** the average premium for soft wheat in € per ha in the relevant country is taken.

[10] Besides Eurostat an other data source which has been used in a broader analysis is the **F**arm **A**ccountancy **D**ata **N**etwork (FADN) data. There are additional variables available as the "**livestock density"** and the **„farm income** (without premiums)", which have been used for the analysis. The results of the whole analysis are published in detail in FUCHS (2002).

The future development of land prices in the EU will be determined by the CAP-Reforms. Recently[11] the EU-Commission published the proposal for the Mid - term-review[12]. Here a de-coupling of most of the subsidies from the actual production is foreseen. The ha-premiums then will stay with the land – holder who used the land in the reference period 2000 to 2002. Because areas which are not eligible for ha-premiums will be excluded from the benefits of further subsidies (unless subsidy rights are transferred) it can be expected that prices for agricultural land will decline significantly, because markets orient by the marginal profitability of the land use (ISERMEYER, 2003).



[11] July 2002 and up-dated in January 2003
[12] COMMISSION OF THE EUROPEAN COMMUNITIES (21.01.2003)

Figure 2: In-sample simulations showing the development of prices for agricultural land and rented area (both in real terms, /ha) with and without ha-premiums from 1993 onwards; Source: Eurostat; own calculations

II – Farm Level Strategies for Land Purchase

3 Land availability on farm level with main focus on transformation countries

Agricultural enterprises compete for the production factor agricultural land. They acquire new production area by rental contracts or purchase of land. The advantages or disadvantages of each option are that rental contracts ensure financial liquidity, but the land may not be available for the farm in the future, whereas purchase adds land to the farm property permanently, but places a heavy burden on financial liquidity.

In transformation countries the state often administrates huge land areas. In the transition period, which is marked by the vanishing of most state farms and restructuring of the legal form of enterprises, the agricultural land also has to be redistributed in a short time period. In order to resolve distribution problems rapidly while retaining a measure of long-term flexibility, the agricultural land is initially distributed primarily on a rental basis. After a while, when the economic situation and the agricultural structure have stabilised, the firms may want to ensure their existence and obtain land with long rental contracts or even better by purchase. The new firms evaluate the land market and the competition for land increases.

Basically the problematic choice between "purchase or rental" is not restricted to transition countries, so all farms face "normal" structural changes and need answers about how to optimise their land area. . Economic guidelines to apply in the competition for land will be analysed for typical farms. The (initially exogenous) variables in the farm model are availability of land, share of net worth in percent of farming assets, land purchase prices, land price increase, prices for rental land, share of rental land, share of terminating rental area per year and gross margin in crop production (Table 1).

1: Parameters and initial position for typical farms: best case – worst case scenarios

Variable	Initial conditions		
	best case	median	worst case

Availability of agricultural land	Free land market with unrestricted access to rental contracts and land purchase	Restricted area is available for rental and purchase	Rental contracts terminated, land has to be purchased in order to keep farm size constant, no other land is available
Share of net worth in percent of farming assets	High (for example 75 to 100 %)	for example 50 %	Low (for example 25 %)
Land purchase prices	Low (for example 3,500 /ha*)	7,000 /ha	High (for example 25,000 /ha*)
Land price increase	1 % p.a.*	0.84 % p.a.	Zero *, no price increase
Prices for rental land	2.8 % of purchase price* (~ 98 /ha)	2.6 % (~ 129 /ha)	1.3 % of purchase price* (~ 325 /ha)
Share of rental land	Low (for example 60 %)	for example 80 %	High (for example 100 %)
Share of terminated rental area	Low (for example 0 to 5 % p.a.)	for example 15 %	High (for example 25 % p.a.)
Gross margin in crop production, including subsidies	550 /ha		700 /ha
Assumptions for the initial situation: 1,000 ha agricultural land, interest rate for loans 7 %, savings interest 1 %, 0.25 worker per 100 ha crop land, 1,000 /ha stock of fixed assets (buildings and machinery), income tax: 30 % of profits, planning period two decades. * The values of these three variables are linked.			

In order to offer a choice of options, a series of best case to worse case scenarios are analysed for typical farms. The calculations are done for a 1,000 ha farm model; for other farm sizes all determinants, variables and results could be down- or up-scaled (for example to 100, 500, ... ha). The calculations are done projecting the financial variables on a yearly base using a worksheet (Excel) and optimising land purchase and land leasing using the solver routine in Excel. The objective of all scenarios is to maximise net worth at the end of a planning horizon of two decades, considering the

restrictions due to financial liquidity, which means that new loans have to be covered by a two-fold ratio of farming assets as security on the debts. The endogenous variables of the model are the yearly purchase or sale of agricultural land.
In principle the following analysis can be structured in three parts. First a free land market is assumed (Chapter 3.1) followed by scenarios where rental and purchase opportunities are restricted (Chapter 3.2) and finally a discussion about alternative investments other than in agricultural land (Chapter 3.3).

3.1 Scenarios for free access to buy land due to high supply on land markets – On-farm-level results for strategies to acquire agricultural land

If an entrepreneur could choose between different options to acquire agricultural land, he should first consider rental area (long - term contract at a guaranteed rate) and only then consider purchasing land. Here a first restriction is introduced: The initial rental area can not be increased, the only way to further increase farm area would be to buy land. The first example for an optimal land purchase strategy is for a farm with a relatively high debt load (low net worth of 25 %) and relatively high land prices (7,000 /ha). Figure 3 shows that here it is recommended first to keep as much rental land as possible under contract (or stay with the 800 ha rental land), second to reduce liabilities in the beginning of the planning period by selling land and third to start land purchase at a very low level using financial liquidity surplus. The net worth of the farm will increase from 600 T to 2,372 T during a planning hor izon of 20 years.

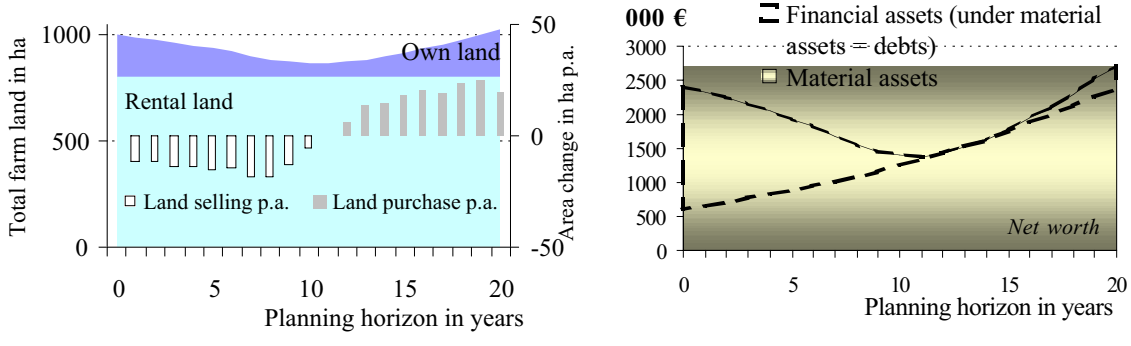


Figure 3: Optimal development of farm land, material and financial assets – initial situation: 80 % rental land, no rental contracts terminate, share of net worth 25 %, gross margin in crop production 550 /ha and agricultural land prices 7,000 /ha.

To demonstrate a more realistic scenario it is further assumed that rental contracts are terminated to a certain degree (for example10 % p.a.) and that a farm can buy land on a free market. The objective of optimising the development of a

farm is to maximise net worth at the end of the planning period (20 years) under the constraint of keeping the operation financially liquid. The endogenous variables are the trading of owned land through purchase or sale.

10 Examples are illustrated in Figure 4. All examples start with 1,000 ha farm land and the loss of rental area is 10 % p.a. With low land values (3,500 /ha) all farms are able to buy more than they lose in rental area, but with land prices over 7,000 /ha (and gross margins in crop production at 550 /ha) no farm could maintain farm size, even if there are higher shares of net worth and an initial stock of owned land. If land prices are very high (25,000 /ha) and the share of net worth 25 % or 50 % then farms will lose not only rental area but they are also forced to sell owned land. In the worst case there is a loss in net worth, which indicates bad investment strategy in the first place.

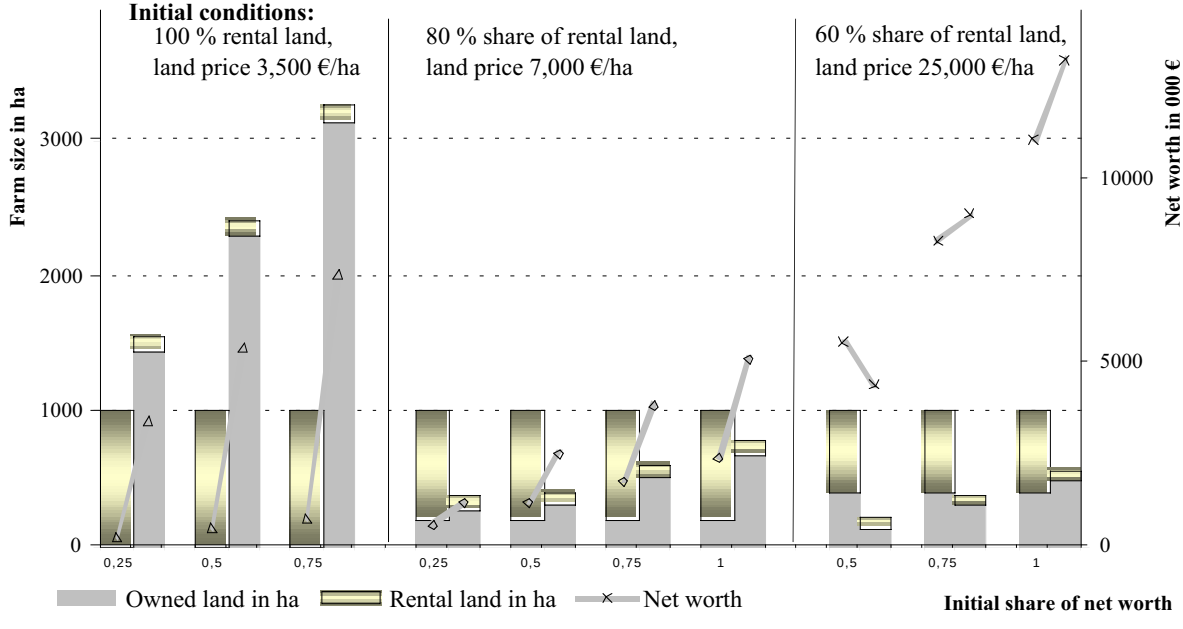


Figure 4: Optimal development of farm land and net worth depending on the initial situation of share of net worth, land price, share of rented land and assuming 10 % of rental contracts terminate p.a., unrestricted purchase of land and gross margins in crop production 550 /ha in the planning period of 20 years.

The growth of all the other examples is at the limit of their financial liquidity and is determined by their share of net worth, the profitability of crop production (gross margins) and the prices for land. In a free market for land the termination of rental land can be compensated as long as the land prices do not exceed certain levels. These thresholds will be analysed in detail in the next Chapter (3.2).

3.2 Scenarios when land purchase is restricted to terminated rental contracts

Restrictions on the development of farms are due to constraints outside the farms, for example supply of land on land markets and, inside the farm, e.g. financial liquidity, which in turn is driven by gross margins in crop production or the share of net worth of the farming assets. Under the objective of maximising net worth and the assumption that the farm area size (of a profitable farm) can only be kept constant when all land from terminated rental contracts is purchased (assuming the land would be bought otherwise by competitors), the maximum price of agricultural land is calculated for a wide range of initial situations (Fig. 5). The constraints of financial liquidity, a minimum of opportunity cost for capital (interest on debt or savings), have to be met as in all other calculations in this article.

With an initial low share of net worth (25 % of farming assets) and gross margins in crop production of 550 /ha, the maximum land price is about 3,279 /ha, if loss of rental land is about 10 % p.a. (Fig. 5, left side). Increasing terminated rental contracts up to 50 % p.a. would decrease the threshold for the maximum land price to 1,163 /ha. Here, within 4 years more than 90 % of the agricultural land can be purchased. Land purchase at a loss of 50 % of rental area p.a., but at an initial stock of 200 ha owned land out of 1,000 ha farm size, could be managed, if land prices are as low as 1,465 /ha (Fig. 5, right side).

Definitely higher land prices (for example 10,685 /ha) can be afforded to keep farm land size constant, if higher gross margins in crop production are obtained (for example 700 /ha) and, the share of net worth of farming assets is higher (for example 100 %) and, a minimum of owned land in the initial situation (for example 200 ha out of 1,000 ha farm size) and loss of rental area is limited (for example 10 % p.a.). In the latter case, when part of the land purchase is financed by loans, the share of net worth would decrease to 58 % at the end of the planning period of 20 years.

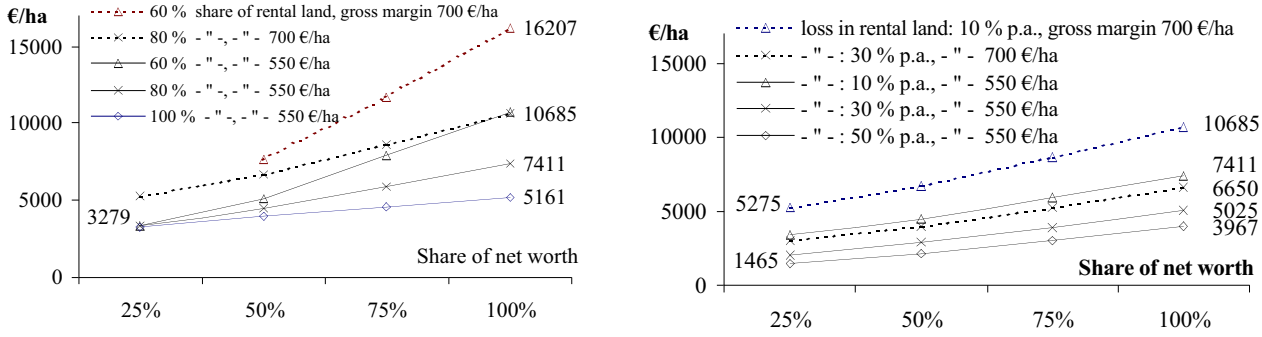


Figure 5: Maximal prices for agricultural land to keep farm size constant - under the assumption that all land from terminated rental contracts should be purchased – depending on the initial situation of share of rental land, gross margin in crop production, loss of rental area, share of net worth and,
left: loss in rental land: 10 % p.a. right: 80 % rental land (200 ha owned land)

The conclusions of this scenario are that high land prices as well as a high loss in rental area or a low share of net worth makes it difficult for farms to compete for land. Such initial situations make it possible to keep farm area size constant only if land prices stay below thresholds such as those calculated. Later on it will be discussed what optimal pattern of land purchase farms should choose, if these land price thresholds are passed.

Effects of an increasing share of terminated rental contracts

An increasing rate of terminated rental contracts is simulated by an annual constant rate of loss in rental land. A zero rate keeps the initial distribution of agricultural land, but the net worth is increasing due to a profitable crop production.

The optimal development of farm land (rental land and owned land) depending on the percentage of terminated rental contracts is derived under the objective to maximise net worth at the end of a planning period of two decades and considering financial liquidity constraints, In an initial situation with no owned land (Fig. 6, left side) and net worth share at the lower end of the range, (25 % of assets), net worth can be maximised if parts of the agricultural land of the farm were purchased. In the case of a gross margin in crop production of 550 /ha and agricultural land prices of 3,500 /ha, net worth increases the most (from 250 T up to 3,812 T in two decades planning period), if 2.9 % of the

rental contracts terminate and all together 445 ha were bought. Further increasing loss rates of rented land at first forces the farm to buy a greater share of land (842 ha at a rate of 8.8 % loss in rented land p.a.), but later on the considered constraints restrict farm development in land size and in net worth. At a loss of 30 % of rental land p.a. the agriculturally cultivated area decreases from 1,000 ha rented land to 250 ha mostly owned land by the end of the planning period.

In the case of very high rates of terminated rental contracts, the farm may be forced to sell owned land. In the example shown in Figure 6 (right side, initial size of 400 ha owned land), this would be the case if the loss rate of rented land is higher than 65 % p.a.

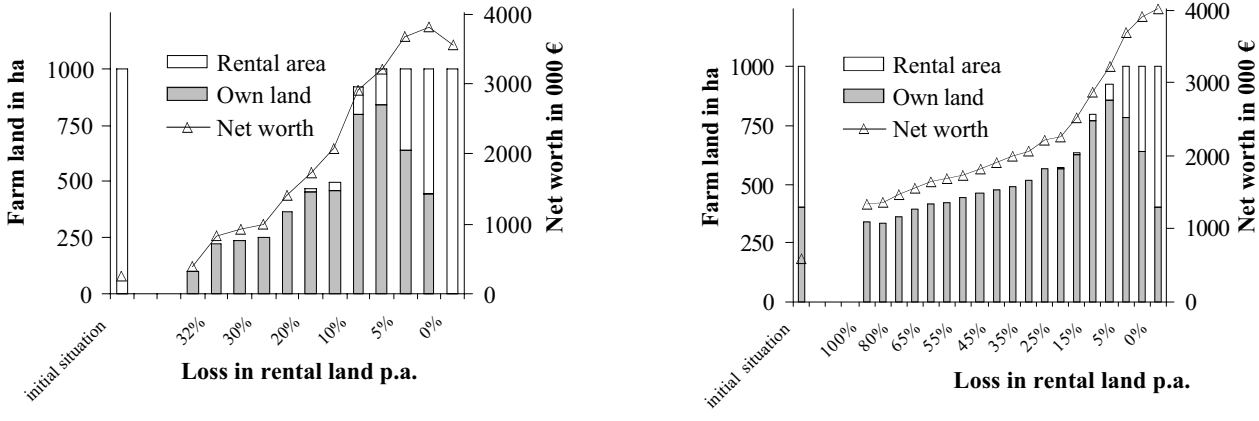


Figure 6: Optimal development of farm land (rented land and owned land) and net worth depending on the percentage of terminated rental contracts – initial situation: share of net worth 25 %, gross margin in crop production 550 /ha and agricu ltural land prices 3,500 /ha and,
left: 100 % rented land right: 60 % rented land (400 ha own land)

Optimal strategies to acquire agricultural land when access to land is restricted

Farms which are in danger of losing their rented land sooner or later should purchase agricultural land if they can increase net worth and financial liquidity over time. The preconditions are reasonable land prices(for example 3,279 /ha, see Fig. 5), sufficient gross margins in crop production and low rates of reduction of rented land, as shown

before. If there is sufficient financial liquidity to buy all land with terminated rental contracts and no competitive alternative investment is available, the optimal pattern of land purchase is to buy all available land. Which strategy would be optimal if not all of these condition are given will be discussed for typical situations. To demonstrate optimal purchase patterns for agricultural land the land price is set from 3,279 /ha to 3,500 /ha in a first step. Higher land prices in general limit the ability to purchase agricultural land. In this special case the ability to purchase agricultural land decreases in the third planning year by 15 %, in the fourth by 28 % and approaches 100 % again in the 10th year of planning (Fig. 7). The owned land reaches only 795 ha in the planning year 20 and net worth of the farm will increase from 250 T to only 2,898 T during the planning h orizon of 20 years.

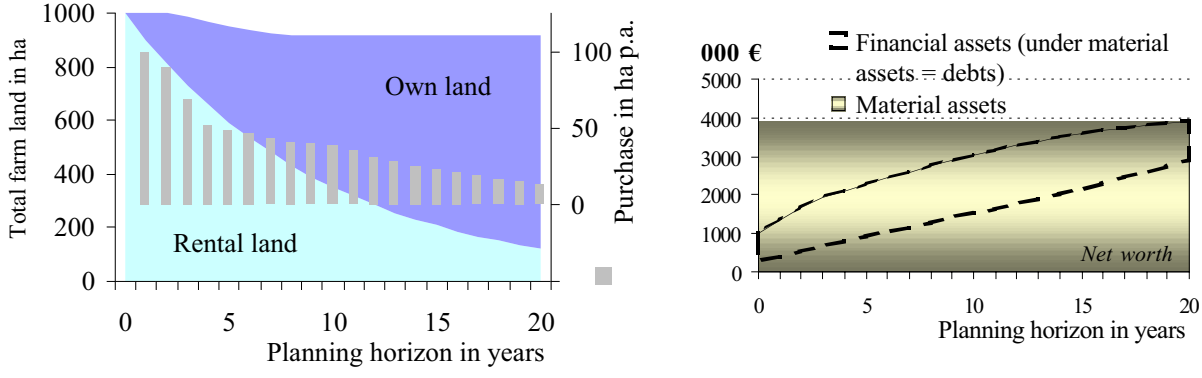
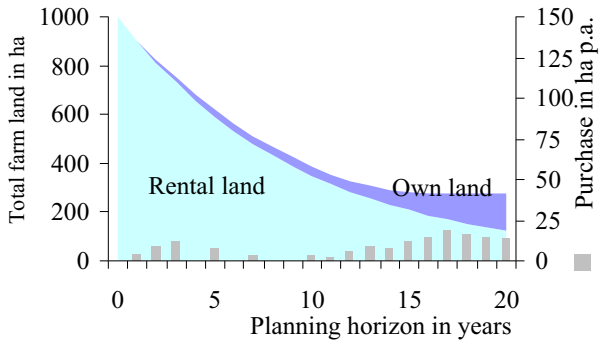


Figure 7: Development of farm land, material and financial assets – initial situation: 100 % rental land, 10 % of rental contracts terminate p.a., share of net worth 25 %, gross margin in crop production 550 /ha and agricultural land prices 3,500 /ha.

With even higher land purchase prices (7,000 /ha in Fig. 8) the profitability of crop production decreases and less land will be bought, even if all other factors remain unchanged. All in all only 152 hectares will be purchased during the planning period of 20 years and net worth of the farm will increase from 250 T to only 977 T (Fig. 8, left side). The major land purchase lies in the final years of the planning horizon, but it must be noticed that the size of the farm shrinks by about three-quarters.

Again more favourable initial conditions as an higher share of net worth (50 %), a minimum of already 20 % owned land (200 hectare) and higher gross margins in crop production (700 /ha) in turn enables the farm to buy about 330 hectares and increase the net worth from 1,200 T to 3,040 T after 20 years (Fig. 8, right side).



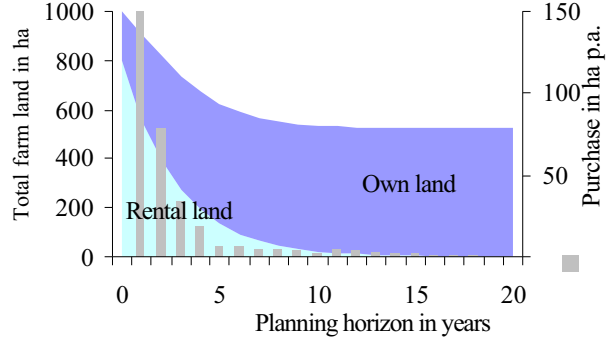


Figure 8: Optimal development of farm land – initial situations:
100 % rental land, 10 % of rental contracts terminate p.a., share of net worth 25 %, gross margin in crop production 550 /ha and agricultural land prices 7,000 /ha.
80 % rental land, 30 % of rental contracts terminate p.a., share of net worth 50 %, gross margin in crop production 700 /ha and agricultural land prices 7,000 /ha.

The general conclusion of this analysis is, that under the premise of profitable crop production, the ability to buy land is limited by financial restrictions in the beginning and later on by the limited opportunity to purchase land from the stock of terminated rental contracts (in the case of very restricted land market supply).

3.3 Competitiveness of alternative investment besides land purchase

Buying agricultural land is not the only investment alternative for a farmer. On the contrary many on-farm (intensive plant production such as gardening and horticulture or investment in animal production facilities) and off-farm investments are available. Here the analysis aims to calculate the "internal rate of interest" necessary for investments other than agricultural land to be competitive with investment in agricultural land. Again the optimal decision depends on many variables. To see the tendencies, once more typical situations are discussed. In Table 2 the price for agricultural land varies between 3,500 and 7,000 /ha, while the share of the initial net worth is 25 %, 50 % and 75 %. Other parameters are a share of 60 % of rental area, which declines at a rate of 10 % p.a. and a value of 550 /ha for gross margin in crop production. All further calculations assume that the initial rental area of 400 ha declines (to 73 ha after two decades), the owned area stays at 600 ha and surplus capital is invested in other activities.

At a low level of agricultural land prices crop production is relatively profitable and alternative investments have to offer relative high rates of internal interest (for example 37 % for No. (1) in Tab. 2). The lower the net worth rate the more scarce is capital and liquidity and the higher are the opportunity costs for capital. Higher rates of net worth lead to lower minimum internal rates of interest for alternative investments (such as 8.1 % for No. (3) in Tab. 2). This results from the leverage of net worth and is supported by the assumption that spare capital earns only 1 % interest on a savings account. Increasing prices for agricultural land also reduce the competitiveness of crop production on bought land which in turn reduces the necessary internal rate of interest for alternative investment (such as 3.6 % for No. (4) in Tab. 2).

: **Necessary internal rate of interest of alternative investments other than agricultural land depending on prices for agricultural land and on share of initial net worth**

No. of alternative investment	Share of the initial net worth	Prices for agricultural land in /ha	Necessary internal rate of interest
(1)	25 %	3,500	36,7%
(2)	50 %	3,500	11,0%
(3)	75 %	3,500	8,1%
(4)	75 %	7,000	3,6%
(5)	100 %	25,000	1,5%

Assumptions: Farm area 1000 ha with a share of 60 % rental area, the latter declines at a rate of 10 % p.a., gross margin 550 /ha in crop production; other a ssumptions see Table 1.

3.5 Conclusions

In situations such as in transition countries, where within a short period most land is leased through rental contracts, which could then could be taken over by purchasing the land, recommendations for farmers are as follows: (1) First one should find out if long term rental contracts are available to avoid tying up capital. One also should calculate the maximum price for agricultural land to keep or bring the farm to an intended size, according to the individual initial situation such as profitability of crop production, share of net worth, share of rental area and so on. (2) If land market prices are lower than this threshold, land can be bought considering the financial liquidity of the enterprise. (3) Selling land will be appropriate to avoid financial liquidity stress, but this should be only temporary and restricted to a marginal amount of land stocks. (4) If profitability of crop production is relatively low or land prices are relatively high, an entrepreneur should seek to rent land or to find alternative investments which yield higher profits than crop production.

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