http://dx.doi.org/10.7896/j.1328 Studies in Agricultural Economics 116 (2014) 1-12

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The reflexive relationship between land markets and farmers' strategies in Germany

The specific conditions of local land markets could support strategic interaction among farmers. In this case, ideas from strategic competition imply that currently observed regional differences in farmers' strategies should partly be explainable by reference to historical farm size distributions. We test respective hypotheses in a regression approach based on data on the *Landkreis* (district) level (NUTS 3) in Germany from a standardised survey among farm advisors and from secondary statistics. The results confirm the expected reflexive relationship between local land markets and farmers' strategic orientation. Moreover, a complex relationship between farmers' strategies, their general attitudes and farm development dynamics is identified. Thereby those explanations of regional differences among farmers' strategies which rely solely on factors exogenous to agricultural production, be it alternative employment possibilities or cultural differences, are contested.

Keywords: land market, strategic competition, social interaction, economic behaviour, path-dependence, structural change

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Introduction

Land is of fundamental importance for agricultural production. Its relevance from an analytical point of view stems from its characteristic immobility and from the fact that it is not producible. Its local availability is naturally restricted and in terms of land endowment the decline of one local producer is a necessary prerequisite for the growth of another. Accordingly, on the local land market[1] there is direct interaction among a restricted number of producers. This situation opens up the possibility that not only farmers' strategies affect the local land market but that the local land market conversely affects farmers' strategies. Most studies on structural change in agriculture consider the former, but not the latter.

Fundamental differences in farm development strategies are frequently reported (Margarian, 2010a). For Germany, these strategies are described mainly in sociological studies (e.g. Patrick *et al*., 1983; Hildenbrand *et al*., 1992; Hermann, 1993; Sinkwitz, 2001). The observed differences are often explained by assumed exogenous differences in attitudes, which can be subsumed under the labels 'conservative' vs. 'growth-oriented'. Jürgens (2010) critically considers this strict dichotomy and its genesis. Van der Ploeg (1994) introduced the more differentiated concept of 'styles of farming'. This concept acknowledges the existence of a large number of rationalities, which are assumed to reflect the specific surrounding conditions and own capabilities of farmers. This insight paves the way for the idea of a reflexive relationship between environment and behaviour. The hypothesis of such a reflexive relationship would be supported if significant differences in strategies could be observed, not only between farms but at a regional level as well.

Spatially differing dynamics of farm structure developments (Huettel and Margarian, 2009) as well as anecdotal evidence[2] and sporadic scientific observations (e.g. Ohe, 1985; Weiss, 1999; Goetz and Debertin, 2001; Tietje, 2004; Roeder *et al*., 2006) hint at regional differences / spatial covariances in farmers' strategies. Corresponding to the identified differences in attitudes, these covariances are sometimes explained by exogenous regional differences in cultural backgrounds (e.g. Roeder *et al*., 2006). Attempts to explain these behavioural covariances with 'hard' exogenous factors, especially regional labour market situations, have produced ambiguous results (e.g. Weiss, 1999; Goetz und Debertin, 2001; Glauben *et al*., 2006; Breustedt and Glauben, 2007).

The specific characteristics of the land market have so far seldom been applied in order to explain regional variances in farm development strategies. The present paper tries to empirically document the proposed reflexive relationship between the land market and farmers' strategies. It thereby questions the approach of taking different strategies as given in economic models and attributing them solely to exogenously given differences in fundamental conditions and preferences. The answer to the question whether strategies are endogenously or exogenously determined is of fundamental importance for explaining structural change.

The following section outlines why the land market's characteristics cause a direct interconnectedness among farmers' decisions on growth, regional covariances in their strategies and thereby path dependence. The relationship between farmers' strategies and the land market is tested empirically based on data from a standardised regionalised survey among farm advisors and on additional data from secondary statistics. Firstly, the impact of the land market and of the initial farm size distribution on farmers' observed strategies is analysed in a regression approach. Then the reversed impact of the observed strategies, as mitigated by observed attitudes, upon the contemporaneous situation on the land market is analysed. Finally the implications of these findings are discussed.

[1] We refer to rental markets. Sale markets are much more influenced by strategic long term considerations and by activities of non-local investors.

[2] See e.g. *dlz agrarmagazin* 2/2007, p.147; *Frankfurter Allgemeine Zeitung* 126/2007, p.15 and *Süddeutsche Zeitung* 135/2006, p.V2/4.

An economic rationale for a reflexive relationship between markets and strategies

If markets were perfect in the neoclassical sense, prices would transport all information necessary in order to develop perfect strategies and the unrestricted mobility of factors would allow all factors to be transferred immediately to those places were they generate the highest possible private and social value. Global price signals would direct the development towards global equilibria. In the presence of non-marketable values such as rents of the *status quo*, global prices no longer effectively coordinate the decisions of economic actors and local price information (Makowski and Ostroy, 1995) and local interaction among actors becomes relevant. In the consequence, "economic actors are connected not by several main highways, but by a myriad of individual byways of their own construction" (*ibid*. p.811), i.e. different strategies evolve endogenously and the relationship between strategies and markets becomes reflexive.

As land is immobile and its availability delimited, the number of potential market participants in the local rental market for land is restricted. Moreover, the growth of one farm in terms of land depends on the decline of another. The decisions on growth or decline thereby depend heavily on the anticipated strategies of local competitors (Margarian, 2010a, b). This direct interaction in an oligopolistic market enables strategic behaviour, i.e. market participants anticipate expected decisions of others in their own course of decision making (Woeckener, 2007). In this case, reflexivity in markets arises as market structures determine decisions on market entry and market exit as well as decisions on growth.

Additionally, sunk costs, specific competences of farmers, non-pecuniary preferences for farming and other possible causes of rents of the *status quo* cause heterogeneous valuation of additional units of land by different producers. Under these conditions, supply of land does not react totally elastically towards higher prices. The most efficient farmers cannot simply overbid (technically) less efficient farmers (competition on prices or 'Bertrand competition', Woeckener, 2007) but need to take into account higher prices of each additional unit of demand (Margarian, 2010a, b). As is well known from the monopolistic case, the farmer in this situation takes into account rising prices and adjusts his/her demand downward. Those farmers that want to stabilise their farm in order to support the future realisation of rents of the *status quo*, might then have the opportunity to afford the necessary growth, although at a relatively high price. In the case of symmetric growth, the situation mirrors what has come to be known as quantity competition or the 'Cournot' case (e.g. Varian, 1992; Woeckener, 2007).

Nevertheless, incomplete information and rents of the *status quo* enable some market participants to manipulate expectations concerning their own current and future market position and to thereby induce asymmetric growth. Especially sunk investments allow some actors to believably signal their strong will for future growth; at the same time, others anticipate the resulting stronger limitation of market access and restrict their own supply, respectively demand. In the oligopolistic setting this differentiation in quantity leaders and quantity followers is called, after its inventor, the 'Stackelberg' case (e.g. Varian, 1992; Woeckener, 2007).

Consequently, the actual differentiation of strategies and the resulting development in the farm size distribution depend on the heterogeneous ability of producers to believably signal their future demand for land. Farmers have the ability to signal believably a strong will for growth in land to competitors if they invest in large facilities, because the profitability of a specific type of production at a given scale in family farms with their quasi-fixed labour pool depends on the farm's endowment with land. Regional differences in farmers' strategies could then be explained in terms of the share of farmers that act as quantity followers or as quantity leaders analogously to the Stackelberg case.

These shares are expected to depend on the initial farm size distribution. If farm land historically was distributed unevenly among farms, large farms would initially act as natural quantity leaders due to their larger capacities and financial power, while small farms would be natural quantity followers that anticipate their restricted access to additionally available land. If no quantity leaders existed, the local situation would mirror the oligopolistic situation in symmetric quantity competition in the Cournot case. In this case, all farms would act as quantity adopters, but their potential for growth would be higher and costs of growth lower than that of the quantity followers in the Stackelberg case. Thereby, a sustainable impact of the initial farm land distribution on local farmers' strategies could be explained. An additional unknown factor is the direction and size of scale effects. Actually, it has been shown theoretically and empirically that structural development in agriculture might be largely determined by the initial structural situation due to existing rents of the *status quo* and strategic interaction on the land market (Huettel and Margarian, 2009; Margarian, 2010a).

According to the argument, observed strategies are expected to represent rational adaptations to given conditions. Strategies that express themselves in a slow expansion in land result from a tight land market and the existence of high rents of the *status quo*, due to low opportunity costs of labour, for example. Producers that follow these strategies might be judged as 'conservative' by observers, while their behaviour might be perfectly rational given the farm's situation and the situation of surrounding farms. 'Growth oriented' producers, on the contrary, leave an entrepreneurial impression on observers. Nevertheless, unconditional growth orientation could be highly irrational if the land market is tight and neighbouring farms show similar ambitions. Beyond these rough classifications into conservative and growth oriented farmers, depending on specific and sometimes idiosyncratic circumstances, countless individual strategies of adaptation evolve. This multifariousness, in accordance with Makowski and Ostroy (1995), is a direct consequence of imperfect markets, resulting uncertainty and direct interaction among market participants.

Based on these considerations, some simple hypotheses are derived for the following analysis: (a) with a historically uneven distribution of land among farms, the majority of local farms act as quantity followers and is thereby perceived as conservative; (b) farmers are assessed as more conserva-

tive if rents of the *status quo* are high and exit mobility is consequently low; and (c) as fundamental market conditions affect producers' ability to stabilise their farms, they also affect the attitudes of surviving producers, which in turn affect the local land market.

Two rationales form the basis for the third hypothesis: Firstly, competition induces a process of selection. If competition is fierce, only the most growth oriented farms survive. If competition is less intense, the variance in attitudes of surviving farms naturally increases. Secondly, human culture adapts to given economic and structural conditions. Specific values are ascribed to given occupations and structures, which are charged with additional meaning depending on further social and economic conditions. Thereby, the observed fundamental strategies might be accompanied by different additional values and attitudes. These would in turn impact upon the local land market, leaving a role, albeit reduced, for exogenous cultural differences in the explanation of structural development. Nevertheless, the extent of this role again depends on the type of local competition.

Empirical analysis of farmers' strategies

The derived hypotheses shall be tested with data from a standardised survey among farm advisors that was conducted in 2007. Agricultural advisors usually work within a restricted area. Here they are natural experts on the farmers' restrictions and opportunities, their strategies and processes of decision making. Two hundred and twenty-one advisors took part in an email survey that consisted of about 120 statements that were to be evaluated on a scale from 1 (corresponding to 'in (nearly) no case') to 7 ('in (nearly) every case'). The experts were asked to concentrate on the situation in a NUTS 3 level district (*Landkreis*) of high familiarity. Their assessments concerned 145 different districts from across western Germany.

A validation of the assessments was possible due to the multiple references of different experts to 61 of these districts. With a variance analysis[3], the significance of the variation of the advisors' assessments between districts as compared to the variance of the assessments between advisors was determined. After dropping assessments for the same districts that deviated from each other by more than two points, the significance of differences in the assessments between districts was guaranteed for nearly all statements. In this manner, about 13 per cent of all statements were judged as deviating values and replaced by missing values. The same rate of misjudgement is expected for districts covered by only one expert. From the remaining values, the mean value was calculated for each district in order to reach a univocal assessment on the district's farming sector. The resulting data set consists of one set of assessed statements for each of the 145 districts. Based on these data, we create factors that capture farmers' situations and strategies, explain farmers' observed strategies with regional indicators related to initial farm structure and economic opportunities and finally analyse the relationship between the strategies and the current situation on the land market.

[3] This and all other statistical calculations were conducted in the statistical programme package SAS 9.2.

Creation of factors

In the survey, two dimensions served the rough classification of farmers from the observers' point of view. One dimension was traditional or conservative behaviour ('conservative'), which was ascribed towards farmers whose main aim consists of stabilising their farm, who therefore avoid risk and make small steps of growth (Figure 1). Observers perceive such a strategy as traditional, but it would also be consistent with the strategy of quantity followers in strategic competition on the land market. Of the 221 respondents, five did not assess the corresponding statement. In more than half of the assessments, farmers in the respective districts were classified as *rather conservative* (five or more points on the scale), in less than a quarter as *rather not conservative* (three or less points on the scale). The remaining assessments were *intermediate* (four points on the scale). Even before removing 17 deviating assessments, the differences in the assessment of conservative behaviour of farmers between the districts according to the variance analysis were highly significant. Obviously, the dimension of conservative behaviour corresponded to an existing common mental construct among farm advisors.

The second dimension for a rough classification of farmers according to their strategic behaviour was an entrepreneurial attitude, which was ascribed to farmers who invest capital and labour where they are most profitable ('entrepreneur', Figure 2). Four assessments were missing for the

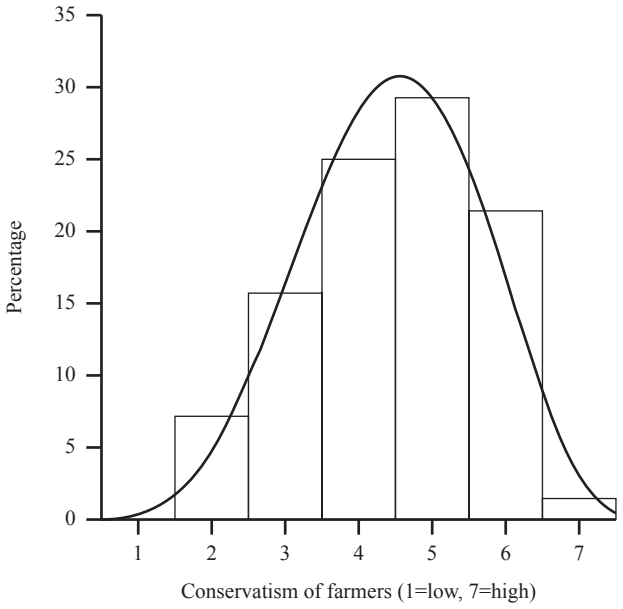

Figure 1: Assessment by farm advisors of farmers' conservatism in NUTS 3 districts of western Germany in 2007.

CONSERVATIVE: 'Farmers here are rather conservative/traditional: Their main goal is their farm's stability. They avoid risk and make small steps of growth in existing branches'.

Missing values: 5; deleted 'outliers': 17; share of variance that can be attributed to differences between districts in raw data: 56%, Pr > F 0.0008; between Mean Square 2.5; within Mean Square 1.23

Source: own data

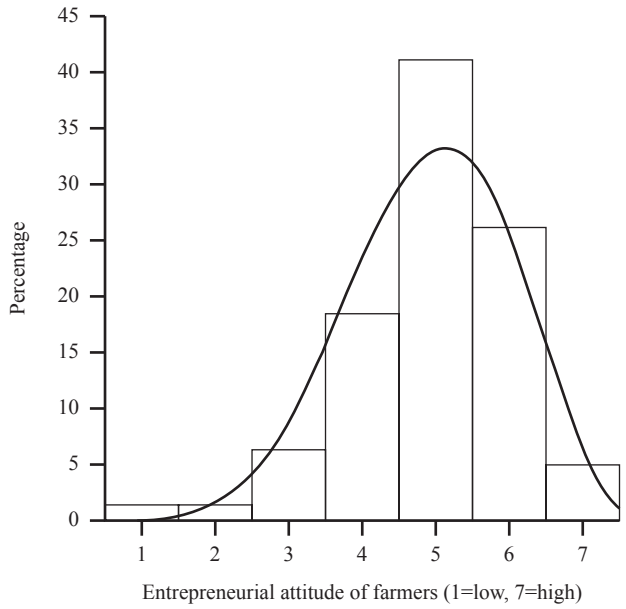

Figure 2: Assessment by farm advisors of farmers' entrepreneurial behaviour in NUTS 3 districts of western Germany in 2007.

ENTREPRENEUR: 'Farmers here are entrepreneurially oriented: They invest labour and capital where it is most profitable'.
Missing values: 4; deleted 'outliers': 24; Share of variance that can be attributed to differences between districts in raw data: 41%, non-significant; between Mean Square 1.67; within Mean Square 1.44
Source: own data

corresponding statement. The distribution of assessments revealed that this dimension clearly measured something different from the first dimension. The variance of assessments in this case was rather low, with 40 per cent of all assessments concentrated at five points on the scale. Differences between districts in entrepreneurial attitude were not significant before removing 24 deviating values.

While the first dimension determined the farmers' attitude with respect to their farm, this second dimension is concerned with general behaviour. Clearly, a high ranking of general conservative behaviour is rather rare; underlining the assumption that observed conservative behaviour of farmers is due to special conditions and restrictions of agriculture. Only if conservatism has a high and entrepreneurial attitude a low assessment are the farmers in a district assessed as conservative in every respect. If both received high points on the scale, the respective farmers are conservative in agriculture but otherwise entrepreneurial. The case of low values in both dimensions did not occur (Figure 3a). Finally, if the first dimension received low values while the second was ranked highly, farmers' entrepreneurial behaviour generally dominates. By subtracting values of 'conservative' from values of 'entrepreneur', a single factor (MODERN) was created that captured all of these nuances. Owing to the fact that the case of low values in both dimensions did not occur, the middle values of MODERN are non-ambiguous in their interpretation. Therefore, MODERN shows a strong negative correlation with assessments on conservative attitudes ('tradition') (Figure 3b) and a strong positive correlation with entrepreneurial attitudes (Figure 3c). It was therefore possible to replace two seemingly loosely related dimensions (Figure 3a) by a single factor. Moreover, this new indicator could remove possible biases in the assessments due to different interpretations of the scale of different experts.

While the factor MODERN for the assessment of farmers' general attitude was constructed by simply differencing the assessments concerning two separate dimensions from the survey, other factors characterising specific restrictions, opportunities and strategies of farmers were created by factor-analysis. Therefore, in a first step those statements of the survey were selected that were assumed to relate to a common underlying concept. The concepts relevant for the following analysis are 'Behaviour', 'Dynamics' and 'Opportunities'. With the assessed statements of each conceptual group, one factor-analysis has been conducted separately. Usually four to five factors were identified that describe different dimensions of each concept (Table 1).

The creation of factors serves the aim of condensing a multiplicity of variables with similar implications in order to avoid, for example, problems of multicollinearity in subsequent analyses. Here, it also served the aim to raise the validity of the experts' subjective assessments by compensating erroneous assessments of single statements with other

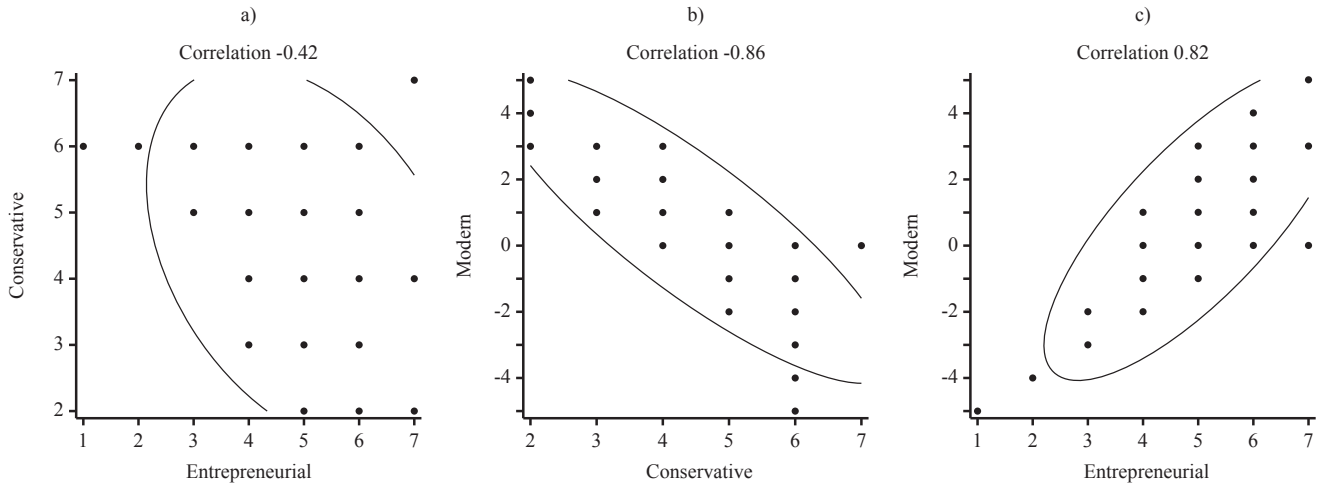

Figure 3: Scatter-plots of conservative and entrepreneurial behaviour of farmers in NUTS 3 districts of western Germany in 2007 and of the factor MODERN.

Number of observations: 137, 95% in ellipse
Source: own figure

Table 1: Factors and their underlying statements that describe the observed behaviour of farmers, observed farm dynamic in the districts, and observed opportunities for farmers in NUTS 3 districts of western Germany in 2007.

Behaviour (total communality or common variance: 2.84; explained share in total variance 0.28)	**N**	**Factor loading**
Habitual behaviour [HABITUAL] (0.65)		
"Underinvesting farmers lack faith and/or interest in their farm's ability for sustainable development."	138	0.69
"Such unprofitable farms are kept up because exiting farming seems unthinkable."	137	0.50
"Underinvestment in farms is due to risk-aversion of farmers."	138	0.47
Entrepreneurial behaviour [ENTREPRENEUR] (0.41)		
"Farmers here are entrepreneurial: they invest labour and capital where it is most profitable."	141	0.61
"Farmers here are rather conservative: they mainly want to stabilise their farms. They avoid risk and usually develop slowly in approved fields."	140	-0.36
"The necessary employment of non-family labour is a hindrance because farmers here view it sceptically."	131	-0.37
Commitment of farmers and their family [COMMITMENT] (0.41)		
"Farms here support each other based on mutual trust (neighbourly help)."	135	0.45
"Farm families are willing to sacrifice profit and consumption in the short term in order to sustain the farm in the long term."	139	0.44
"Income from non-farm labour is also employed in order to stabilise the farm financially."	140	0.42
Esteem of farmers and farming [ESTEEM] (0.20)		
"The exit from agriculture brings with it a loss of esteem for the farmer."	134	0.46
Dynamics (total communality or common variance: 1.84; explained share in total variance 0.26)		
Danger of rupture in structural change [RUPTURE] (1.21)		
"Exiting farms are characterised by below-average endowment with land."	141	0.58
"Middle size farms are left behind here. They need to exit or change into part-time farming in the medium term."	138	0.55
"Exits from farming occur with the alternation of generations."	141	0.48
"Growing farms are large farms."	144	0.41
"Exiting farms are characterised by good non-farm income opportunities of the farmer, e.g. its successor."	135	0.38
Stability of farms [STABILITY] (0.61)		
"Farms with low growth potential are continued by farm successors."	139	0.55
"Stable farms with growth potential are continued by farm successors."	144	0.44
Opportunities (total communality or common variance: 3.84; explained share in total variance 0.35)		
Lacking profitability of agriculture [NOPROFIT] (1.67)		
"In arable crops profitability of necessary investment would be questionable without farm investment aid."	124	0.78
"In pork and poultry profitability of necessary investment would be questionable without farm investment aid."	142	0.65
"In specialised cultivation profitability of necessary investment would be questionable farm investment aid."	142	0.58
"In dairy farming profitability of necessary investment would be questionable without farm investment aid."	139	0.51
Situation on local land market [LANDMARKET] (0.95)		
"Demand for land is larger than supply."	138	0.55
"Change to part-time farming is a reaction to lacking growth possibilities due to a tight land market."	132	0.52
"The necessary employment of non-family labour is a hindrance because the necessary abrupt growth not possible."	132	0.43
Investment opportunities [INVESTOPTION] (0.58)		
"More investments in new farm activities would be reasonable."	132	0.52
"Full-time farms have additional income sources to farming."	136	0.39
Availability of additional income [ADINCOME] (0.57)		
"Farmers that look for a non-farm job are usually successful."	138	0.41
"Underinvestment of farmers is due to risk averse banks."	135	-0.46

Note: Pairwise deletion of missing values: Minimum number of observations used for correlations is N = 113
The number in brackets after factors gives the common variance explained by each factor after oblique rotation
Source: based on data from responses to a farm-advisor survey conducted by the author in 2007

assessments for additional statements. Moreover, in the factor analysis, continuous variables (factors) are created from the discrete assessment values of the original variables. Therefore, the subsequent linear regression is more appropriate if it is based on factors. Factor-analysis is based on the correlation between single variables. If correlations are low, subsuming the respective variables in common factors might not be adequate. Nevertheless, the 'measure of adequacy' (MSA) showed that the variables from the experts' assessments were suitable. Owing to the facts that unbalanced correlation matrices were used because of many missing values and that the subjective assessments are expected to be erroneous, a common factor (CF) analysis was conducted rather than an analysis of principal components (PC) (Backhaus *et al*., 2003). In CF, the common variance of all variables is explained rather than total variance; therefore, expected communalities and eigenvalues are below one. The necessary priors for expected communalities were estimated with the 'squared multiple correlations' (SMC) technique (Loehlin, 2004). Table 1 presents the explained shares of common variance in total variance for each analysis; with about 0.3 it is clearly below one for all three CFs as expected due to measurement errors and missing values. The judgement on the number of extracted factors relied on a balanced assessment (a) of the factors' absolute eigenvalues, which should equal at least one according to the Kaiser-criterion in PC but not necessarily in CF and (b) of a Scree-Test (Backhaus *et al*., 2003), which graphically compares each factor's relative

contribution to the explanation of variance. Considerations concerning the factors' content provided additional guidance. Factors were rotated orthogonally and obliquely (*ibid.*) in order to reach unambiguously interpretable factors. Factors were interpreted considering all variables with a loading of 0.3 or higher.

Four of the factors in Table 1 describe the opportunities of farmers in the district: NOPROFIT describes deficits in regional profitability of agricultural production. INVESTOPTION describes alternative opportunities to invest in the region within or outside agriculture. ADINCOME describes the probability of an advantageous non-agricultural employment, which also reduces willingness to invest in agriculture even though accessibility to credit might be good. LANDMARKET describes the situation on the land market. It has high values if demand is high as compared to supply and if growth is restricted by scarcity in land.

Four factors were extracted that describe the observed behaviour of farmers: ESTEEM describes whether being a farmer is, in the farmers' eyes, related to a positive social standing. COMMITMENT describes whether belonging to the farmers' community is associated with special values. ENTREPRENEUR is very similar to MODERN, which was constructed by a naïve unweighted aggregation of the two original variables 'conservative' and 'entrepreneurial'. The main difference between MODERN and ENTREPRENEUR is the discrete character of the first and the continuous character of the latter variable. Finally, HABITUAL describes a situation where farms are kept up due to lacking alternatives rather than due to development potentials.

Four factors (NOPROFIT, LANDMARKET, INVESTOPTION and ADINCOME) relate to opportunities. Two factors deal with the observed farm dynamic in the districts. RUPTURE describes a situation that signals retarded structural change with few viable farms and many non-viable farms that are expected to leave the sector in the nearer future. High values of STABILITY in contrast signal that farms in the district are stable. The distributions of values of the ten factors are presented in box and whisker plots in Figure 4. Mean values are indicated by a cross and outliers are plotted as individual points.

Explanation of farmers' observed strategies

A strategy that aims at farm stabilisation rather than at farm growth is defined as conservative. Often, conservative behaviour is judged as non-entrepreneurial. Nevertheless, the risk-avoiding stabilising behaviour of reduced growth might be a rational strategy of farm/firm development in the presence of rents of the *status quo* and quantity competition on the land market. Whether these conditions actually explain the perceived conservatism of farmers is analysed in a regression analysis. This analysis aims at a substantiation of the idea of a reflexive relationship between farmers' strategies and the land market.

As endogenous variables we use the original variable 'conservative', which is based on a single statement, as well as the two factors MODERN and ENTREPRENEUR, which are constructed from two, respectively three statements. With the estimation of these different models the robustness of results shall be demonstrated with respect to different specifications. The discrete variables MODERN and 'conservative' with 10, respectively 7 ordered levels are explained in multinomial logistic models with proportional odds. This model type implies that identical coefficients can be applied in order to explain the relative probabilities of all levels. A score test showed that the assumption on proportional odds for a multinomial model was not justified for MODERN and 'conservative' on the original scale. Therefore, the values of MODERN were aggregated into three (< 0, 0 - 1, > 1) and those of 'conservative' were aggregated into four classes (<= 3, 4, 5, >= 6). For the three- and four-class models the assumption of proportional odds were not rejected. The factor ENTREPRENEUR is a continuous

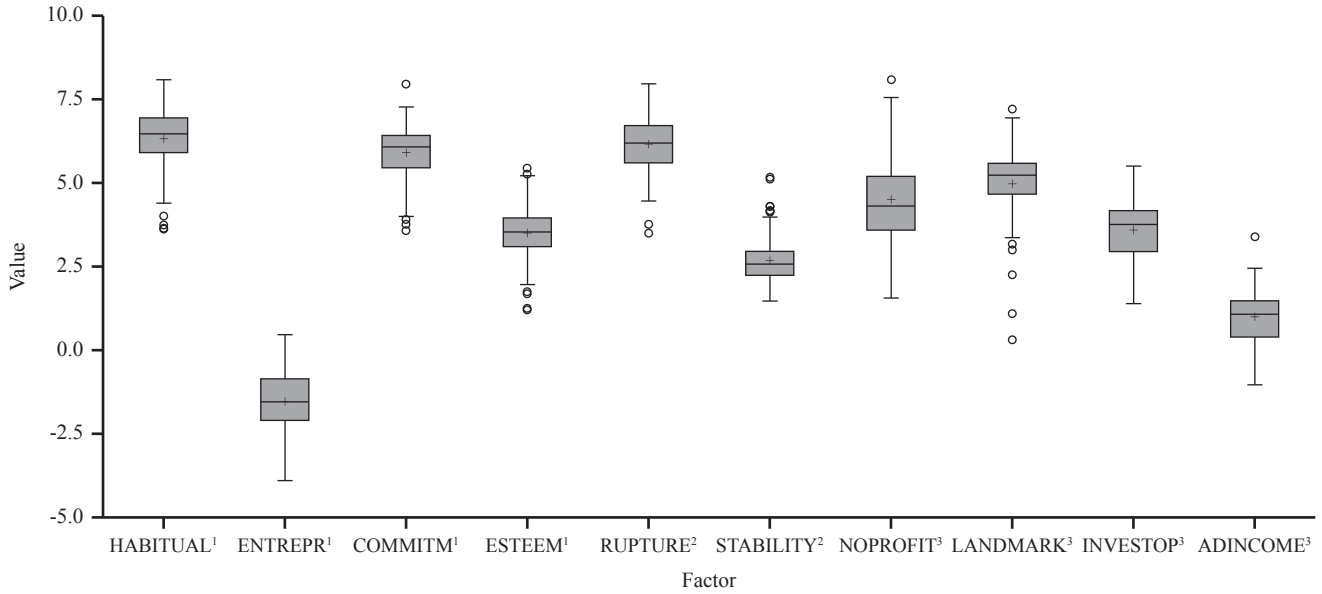

Figure 4: Box and whisker plots of the factors presented in Table 1.
N = [1]101; [2]121; [3]81
Source: own figure

Table 2: NUTS 3 district level variables explaining the strategic behaviour of farmers in western Germany in 2007.

Name	Meaning	Possible range	Mean	Std. dev.	Min	Max
GINI79	Inequality in land distribution in 1979	0-1	0.41	0.05	0.33	0.59
LESSFAVOURED	Share of less favoured land	0-1	0.50	0.38	0.00	1.00
LANDQUALITY	Normed quality of land	0-100	47.47	10.46	28.62	75.44
MEANSIZE	Mean farm size (hectares)	> 0	30.32	12.35	9.46	70.11
COWS	Dairy cows per 100 hectares	>= 0	27.95	18.27	0.26	83.56
VALUEADDED	Agric. value added per 10 hectares (EUR 1000)	>= 0	15.79	8.16	4.63	47.62
RENTEDLAND	Share of rented land cultivated by farmers	0-1	0.43	0.10	0.20	0.71

Number of observations: 145
Source: FDZ (1999), Federal Statistical Office (VALUEADDED), and Agricultural Census 1979 (GINI79)

variable and has as such been explained by a linear least square model.

Exogenous variables are presented in Table 2[4]. The Gini coefficient in our case describes the distribution of land in hectares with respect to different farm size classes (Margarian, 2010a). Principally, a higher value of the Gini coefficient indicates a higher inequality in the distribution. We introduce the Gini coefficient for land distribution in 1979 into our model in order to reflect the initial or historical situation. Earlier data were not available. The initial farm size distribution (GINI79) is expected to have a high impact on the growth history of farms in the districts due to its impact on strategy differentiation between quantity leaders and quantity followers. The growth history determines the strategic regime or the growth orientation of farms in the district. Specifically, a high Gini coefficient, i.e. strong inequality in historical land distribution is assumed to cause a differentiation into few farms with strong growth (quantity leaders on the land market) and many farms with restricted growth (quantity followers on the land market) if rents of the *status quo* are considerable. The value added of land (VALUEADDED) contributes positively to possible rents of the *status quo* of agriculture. At the same time, it also makes a potentially positive contribution to the possible rents of growth. Its expected impact is therefore ambiguous. The share of less favoured land (LESSFAVOURED) relates negatively to the potential rents of the *status quo*[5]. The share of rented land (RENTEDLAND) reduces possible rents of the *status quo* as it contributes to a potential instability of the *status quo* situation. Milk production (COWS) is characterised by a relatively low land-intensity of production. Additionally, high capital and labour intensity and specificity contribute to higher rents of the *status quo* due to sunk costs in milk production. The mean size of farms in land (MEANSIZE) determines the present full-time farms' necessity for growth and is therefore negatively related to the realisable rents of growth. A larger mean size should accordingly be related positively to conservatism. Nevertheless, as smaller farms result from restricted growth in the past, the factor could also support the conflicting hypothesis and has ambiguous implications.

The logistic model explains the probability that a district's farmers are characterised by conservative behaviour according to external observers (low values of MODERN and high values in 'conservative'). The least square model reversely explains the more entrepreneurial orientation of a district's farmers. In the estimation, interactions among variables were controlled since these interactions allow for the test of conditional hypotheses (Brambor *et al*., 2006). They therefore allow us to test the interplay between rents of the *status quo* and initial farm size distribution and their common impact upon farmers' strategic orientation. In order to make coefficients in the presence of interactions easily interpretable, variables have been centred on their mean (Jaccard, 2001)[6]. Some of the variables have been rescaled to create comparable values in order to facilitate convergence. Considering the test statistics at the foot of Table 3, the models are highly significant: The differences in experts' assessments on farmers' conservatism in different regions are explainable by the theoretically relevant variables from secondary statistics. The results are stable with respect to the different models estimated.

As expected, the historical distribution of land has a strong impact upon the observed behaviour of farmers, but this impact depends on additional conditions. Those variables that are assumed to capture existing rents of the *status quo* (LESSFAVOURED and RENTEDLAND) are insignificant themselves but have a highly significant role in moderating the effect of GINI79. Figure 5 illustrates the conditional relationship between the Gini coefficient (unevenness in land distribution) in 1979 and the estimated values of the factor ENTREPRENEUR. The figure is based on the coefficients of the last model in Table 3. It shows that there is the expected negative relationship between observed entrepreneurial behaviour and historical unevenness in land distribution in regions with low relevance of less favoured land: In these regions with potentially high rents of the *status quo*, a higher Gini coefficient contributes to stronger conservatism in the observed behaviour. Here, the multitude of smaller farms reacts by reduced growth to the original unevenness in land distribution (quantity followers in Stackelberg competition) and simultaneously shows a reduced exit mobility. In regions with a high relevance of less favoured areas, in contrast, there is a positive relationship between the Gini coefficient and entrepreneurial orientation. In these regions where the expected rents of the *status quo* are lower, the original

[4] Other covariates had originally been included. One example is the share of arable land. Nevertheless, those variables that did not add to the explanatory power of the models have been removed subsequently in order to fight the problem of multi-collinearity.

[5] The same models have alternatively been estimated with a measure for the mean quality of arable land (the German EMZ value) in the district, which are expected to be positively related to rents of the *status quo*. Results were as expected inversely related to those with the share of less favoured land. It was not possible to include both indicators in the model because of their strong multi-collinearity.

[6] The assessment of the significance of interaction terms is usually rather tedious in linear models as well as in logistic models (see for example Margarian, 2012). Nevertheless, the application of models with moderator variables and mediator variables has recently been largely facilitated by a newly developed macro (PROCESS) for SPSS and SAS (Hayes, 2013).

Table 3: Explanation of conservatism, respectively entrepreneurial attitudes of farmers in NUTS 3 districts of western Germany in 2007.

		Logistic proportional odds models		Generalised linear model
	Outcome:	**MODERN**	**CONSERVATIVE**	**ENTREPRENEUR**
	Number of classes:	**3**	**4**	
Parameter	Interaction with ...	Directed at most conservative class		Reversed
Intercept		-1.19 *** (0.243)	-1.78 *** (0.251)	-1.57 *** (0.095)
Intercept		1.08 *** (0.239)	-0.15 (0.196)	
Intercept			1.24 *** (0.225)	
GINI79		0.17 *** (0.048)	0.09 * (0.038)	-0.02 (0.020)
LESSFAVOURED		0.006 (0.006)	0.004 (0.005)	-0.004 (0.003)
	GINI79	-0.004 *** (0.001)	-0.002 * (0.001)	0.001 *** (0.001)
RENTEDLAND		0.04 ° (0.024)	0.02 (0.021)	-0.01 (0.011)
	GINI79	-0.01 ** (0.004)		0.004 * (0.002)
VALUEADDED		-0.13 ** (0.043)	-0.10 ** (0.034)	0.03 * (0.015)
	RENTEDLAND	0.01 ** (0.004)	0.01 ** (0.004)	
MEANSIZE		-0.03 ° (0.018)		
COWS		0.05 *** (0.014)	0.04 *** (0.012)	-0.02 * (0.006)
(Pseudo) R-square		0.31	0.24	0.25
Likelihood-Ratio		<.0001	<.0001	
Score		<.0001	<.0001	
Wald		<.0001	<.0001	
R-square change due to interaction 1				0.07 ***
R-square change due to interaction 2				0.04 *
Number of observations		135	138	100

Note: Standard errors in parentheses below coefficients. ***, **, *, and ° denote significance at the 0.1%, 1%, 5%, and 10% level
Source: own calculation

unevenness of land distribution contributes to faster growth of some farms and accelerated exits of others and thereby to higher mobility and an accelerated dynamic in structural change. Higher mobility and faster growth are associated with entrepreneurial strategies by observers. These results support the notion that conservative strategies represent a rational reaction towards specific land market situations and environmental conditions.

An analogous interpretation applies to the interaction between RENTEDLAND and GINI79, as RENTEDLAND, like LESSFAVOURED, is associated with reduced rents of the *status quo*. The positive coefficient for VALUEADDED shows that a higher potential to realise value added contributes positively to a dynamic development, i.e. an entrepreneurial impression upon observers. Nevertheless, this positive relationship is attenuated by a high share of rented land as the negative coefficient on the interaction between VALUEADDED and RENTEDLAND implies. A high share of rented land signals potential instability of farms and also a tightness of the local land market. Dairy farms (COWS) are characterised by high investments and sunk costs and therefore by high rents of *status quo*. Accordingly, they contribute significantly to observed conservatism of producers.

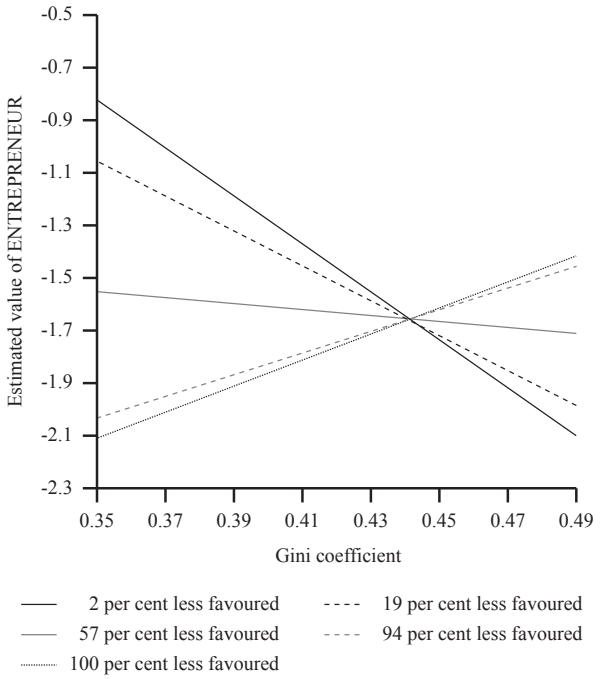

Figure 5: The differentiated effect of historical land distribution (Gini coefficient) on observed entrepreneurial behaviour amongst farmers in NUTS 3 districts of western Germany in 2007.
Source: own figure

Relationship between strategies and the current land market situation

The previous section assessed the impact of the land market upon farmers' observed behaviour. This section, in contrast, analyses the possible impact of farmers' observed general strategic orientation upon the current land market, possibly mitigated by attitudes, which might be collateral consequences of the long term strategic orientation of local producers. The development of such attitudes in a quantity competition regime might support the sustainability of regional differences in farm development strategies and therefore strengthen path dependence in farm structure development. This second causal direction completes the proposed reflexive relationship between strategies and land market. Interest now focuses on the relationship between farm structure, the economic environment and farmers' observed behaviour on the one side and current dynamics in structural change and the situation on the land market on the other. The analysis relies on the factors described above. The construction of the model to be estimated is guided by a simple logic of causation. Thereby BEHAVIOUR is assumed to impact upon farm structure DYNAMICS which influences the situation on the LANDMARKET (compare Table 1). The remaining three factors that describe farmers' OPPORTUNITIES (NOPROFIT, INVESTOPTION and ADINCOME) and relevant indicators from secondary statistics (see Tables 4 and 2) enter the model as covariates.

The model is formulated in a mediation approach, which allows testing direct impacts of variables upon each other as well as indirect effects, i.e. effects that are mediated by another additional variable. The idea of mediation is conceptually a challenge while it is rather easy to implement technically. Mediation models simply consist of a series of regressions with a subsequent inclusion of mediation variables (Hayes, 2013)[7]. In order to identify the indirect effects of the exogenous variable on the endogenous variable via the *m* mediators, *m+1* models are estimated in an overarching logical model with a hierarchical causal structure. The first model explains the first mediator in terms of the exogenous variable and the *n* covariates:

$$HABITUAL = \beta_0^1 + \beta_1^1 ENTREPRENEUR + \sum \beta_{1+n}^1 COVARIATE_n + \varepsilon^1 \quad (1)$$

The second model explains the second mediator in terms of the exogenous variable and the first mediator:

$$ESTEEM = \beta_0^2 + \beta_1^2 ENTREPRENEUR + \beta_2^2 HABITUAL + \sum \beta_{2+n}^2 COVARIATE_n + \varepsilon^2 \quad (2)$$

The third model explains the third mediator in terms of the exogenous variable and the first and second mediator and so on:

$$MEDIATOR_m = \beta_0^m + \beta_1^m ENTREPRENEUR + \sum_1^{m-1} \beta_m^m MEDIATOR_m + \sum \beta_{1+m+n}^m COVARIATE_n + \varepsilon^m \quad (3)$$

The final model explains the endogenous variable in terms of the exogenous variable and all mediators:

$$LANDMARKET = \beta_0 + \beta_1 ENTREPRENEUR + \sum \beta_m MEDIATOR_m + \sum \beta_{1+m+n} COVARIATE_n + \varepsilon \quad (4)$$

In this last equation, β_1 determines the direct effect of the exogenous variable (ENTREPRENEUR) upon the endogenous variable (LANDMARKET). The indirect effect of the exogenous upon the endogenous variable via selected mediators *m* is calculated by the multiplication of β_1^1 with β_{m-1}^m with β_m, i.e., by the multiplication

- of the estimated effect of the exogenous variable upon the first mediator in the causal chain
- with the estimated effect of mediator *m* upon mediator *m+1* in the causal chain
- with the estimated effect of the last mediator in the causal chain upon the endogenous variable.

A summation of all direct and indirect effects gives the total effect. The total effect could also be estimated as:

$$LANDMARKET = \beta_0^T + \beta_1^T ENTREPRENEUR + \sum \beta_{1+n}^T COVARIATE_n + \varepsilon^T \quad (5)$$

The total effect may be insignificant despite significant direct and indirect effects if the signs of single effects are oppositional. This case applies in our model. The assessment of the significance of indirect effects necessitates some further calculations, which have been largely facilitated by the new Macro PROCESS that is available for SAS and SPSS (Hayes, 2013)[8]. This macro applies bootstrap confidence intervals for inference about indirect effects as the frequently applied Sobel test is assumed to rely on unrealistic assumptions[9]. The calculated significances that are presented in the following rely on these 95 per cent bias-corrected bootstrap confidence intervals. The number of bootstrap samples was set to 10,000.

Our model asks whether the principal strategic orientation of a region's farmers (ENTREPRENEUR) impacts upon other attitudes of a region's farmers, specifically upon HABITUAL and upon ESTEEM. ENTREPRENEUR and HABITUAL are both supposed to impact upon ESTEEM. A mediation of the effect of ENTREPRENEUR on LANDMARKET by HABITUAL and ESTEEM is theoretically expected, as non-price competition contributes to low values of ENTREPRENEUR and supplies the possibility for a larger variety of 'surviving' attitudes; but it does not necessarily imply strength of specific attitudes. At the same time, the passive behaviour indicated by HABITUAL reduces demand for land and relaxes the land market while high ESTEEM provides additional rents of the

[7] In Margarian (2010a) the alternative approach of a structural equation model (SEM) was applied, which is more flexible but also more demanding in terms of assumptions. Owing to partly justified concerns with respect to complex SEMs, in this paper we decided for a reduction in model complexity that in turn allows for the application of the more robust mediation approach.

[8] Similar tasks are provided by the 'sgmediation' command in STATA. Nevertheless, the most flexible and easily accessible approach in technical terms is via a combination of the sureg command and the nlcom command in STATA.

[9] For an assessment of different test of the significance of mediated effects see MacKinnon *et al*. (2002).

status quo and thereby rises the will to stabilise farms via necessary growth in land. Thereby, ENTREPRENEUR has additional indirect effects upon LANDMARKET that depend on its potential contribution to HABITUAL and ESTEEM.

The model further assesses how these observed behavioural categories relate to the farm development dynamics, whose factors stem from a different construct (Table 1). STABILITY simply describes the current stability of dynamic as well as stagnating farms. It also depends upon the potential delay of structural change in past years (RUPTURE). Whether variables from the behaviour construct impact upon farm development dynamics depends on exogenous conditions that determine the extent of potential rents of the status quo and farmers' outside opportunities. If an impact exists, an indirect relationship between BEHAVIOUR and LANDMARKET is expected, thereby justifying the hypothesis of a mediated relationship in this case.

Figure 6 indicates all of the possible relationships that were tested in the mediation model, with dotted lines indicating those relationships that connect variables which are not from the same construct. The results of the different regression models that form the basis of the mediation approach are presented in Table 4. The first model explains HABITUAL, which is closely negatively related to the exogenous variable ENTREPRENEUR as expected. The coefficients on

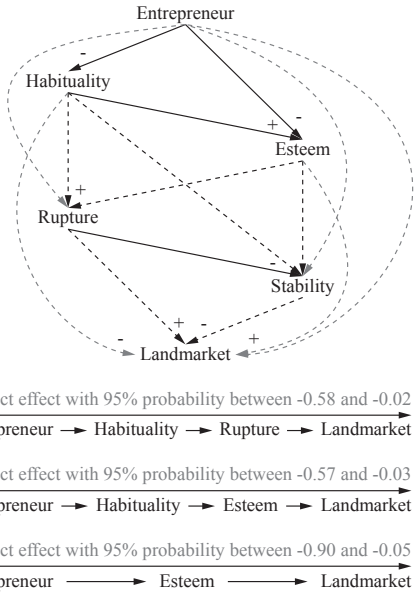

Figure 6: Causal relationships between economic environment, structural situation, farmers' attitude and strategic decisions in NUTS 3 districts of western Germany in 2007.

Note: Solid lines indicate relations between factors that relate to constructs and are therefore correlated by construction. Dotted lines indicate relations between technically unrelated variables.
Source: own figure

Table 4: Results of the separate regression models in the mediation approach.

Outcome:	**HABITUAL**	**ESTEEM**	**RUPTURE**	**STABILITY**	**LANDMARKET**
Constant	4.175 *** (0.415)	0.164 (0.425)	3.405 *** (0.648)	4.211 *** (0.778)	4.599 ** (1.778)
Exogeneous variable					
ENTREPRENEUR	-0.815 *** (0.120)	-0.546 *** (0.099)	0.146 (0.187)	0.043 (0.185)	0.042 (0.340)
Mediators					
HABITUAL		0.380 *** (0.081)	0.486 ** (0.146)	0.025 (0.157)	-0.542 ° (0.288)
ESTEEM			-0.293 (0.203)	0.138 (0.203)	0.706 ° (0.375)
RUPTURE				-0.236 ° (0.132)	0.493 * (0.250)
STABILITY					-0.430 ° (0.250)
Controls					
Factors					
NOPROFIT	-0.019 (0.068)	0.002 (0.042)	0.091 (0.064)	-0.074 (0.064)	-0.299 ** (0.119)
INVESTOPTION	0.273 ** (0.109)	0.022 (0.070)	0.052 (0.107)	-0.045 (0.105)	0.297 (0.194)
ADINCOME	0.033 (0.111)	-0.033 (0.068)	0.310 ** (0.104)	-0.177 (0.110)	-0.132 (0.206)
Variables from secondary statistics					
GINI79	-0.037 * (0.018)	0.021 ° (0.011)	0.013 (0.018)	0.013 (0.017)	-0.016 (0.032)
LANDQUALITY	0.007 (0.010)	0.003 (0.006)	0.017 ° (0.009)	0.024 ** (0.009)	-0.029 (0.018)
VALUEADDED	-0.038 * (0.018)	0.031 ** (0.012)	-0.050 ** (0.019)	-0.014 (0.020)	0.028 (0.036)
MEANSIZE	0.006 (0.009)	0.015 ** (0.005)	-0.019 * (0.009)	0.004 (0.009)	-0.010 (0.017)
COWS	-0.005 (0.006)	0.003 (0.004)	-0.010 ° (0.006)	0.006 (0.006)	0.014 (0.011)
R-square	0.61	0.80	0.51	0.29	0.29
p-value of whole model	0.000	0.000	0.000	0.071	0.090

Note: N = 67. Standard errors in parentheses below coefficients. ***, **, * and ° denote significance at the 0.1%, 1%, 5% and 10% level.
Source: own calculation

the covariates show that passive behaviour is stronger, where farmers seem to invest in non-farm assets (INVESTOPTION, see Table 1) and where the initial inequality in farm size distribution (GINI79) and the value added of agriculture (VALUEADDED) are rather low.

The second model explains the second mediator, ESTEEM. ESTEEM is positively related to HABITUAL and negatively to ENTREPRENEUR. Moreover, it is higher, where the value added of agriculture per hectare is higher and where the mean size of farms is larger. One could interpret this result as such: in regions with few alternatives, farmers are rather passive and stabilise their farms. If at the same time they are lucky enough to have relatively large farms and good conditions for intensive production, their esteem is high as compared to other professions. If, on the other hand, farmers are outside-oriented, i.e. they use local alternatives and develop their farms entrepreneurially, or if the economic potential of existing farms is low, farming does not have a lower or higher esteem than any other occupation. The third model explains the second mediating variable, RUPTURE. This situation of delayed structural change and a structural divide between small and large farms is positively related to a passive behaviour of farmers (HABITUAL) but not so to the other two factors of the behaviour construct. Quite plausibly, delayed structural change is also more relevant where additional income sources exist (ADINCOME) and where VALUEADDED and the farms' MEANSIZE are smaller. The current STABILITY of farms (fourth model) is, as expected, negatively related to a delayed structural change (RUPTURE). It is additionally positively related to a better LANDQUALITY. Finally, the LANDMARKET (fifth model) is more relaxed where the passive behaviour of farmers dominates (HABITUAL) and where ESTEEM is low, probably because a lower esteem contributes to higher exit mobility. In regions that are characterised by a delayed structural change (RUPTURE) the land market is rather tight, while in contrast in regions with stable farms, the land market is rather relaxed. According to the covariates, in regions where profitability of farming is low (NOPROFIT), the land market is more relaxed as well.

Figure 6 summarises the significant causal relationships between ENTREPRENEUR, the mediators and LANDMARKET from the estimation results in Table 4. Pluses indicate significant positive coefficients, minuses significant negative coefficients.

The causal chains below the graphic present the significant indirect effects of ENTREPRENEUR upon LANDMARKET according to the bootstrapping approach. While the direct effect of ENTREPRENEUR is insignificantly positive, all significant indirect effects are negative. This denoted difference between the direct and the indirect effect hints at the ambiguity inherent in the relationship between ENTREPRENEUR and LANDMARKET. On the one hand, more entrepreneurial or growth oriented farmers demand more land. On the other hand, they might also be characterised by a higher mobility or rather crowd smaller farms out of production (Margarian, 2010a, b). The results of the mediation model tell us that in regions where an entrepreneurial strategic orientation is accompanied by low HABITUALITY and/or low ESTEEM, the negative impact prevails: contrary to first intuition, the dominant growth orientation contributes to a more relaxed land market. This implies that a more conservative strategic orientation goes along with a tighter land market if it is accompanied by high HABITUALITY and/or high ESTEEM. The partial relevance of RUPTURE indicates that this result is also due to the fact that structural change is less delayed in regions with more 'entrepreneurial' farms.

Discussion

The results of the two types of empirical models presented in the paper are in accordance with the idea of a reflexive relationship between the land market and farmers' strategies. According to the first model that explains observed behaviour by indicators of local agricultural structure, farmers act more conservatively in the observers' eyes in land markets with reduced competition. As the results show, this might be due for example to the dominance of few large farms on the land market or to a high share of rented land, which limits the ability to realise new rents of the *status quo* by additional growth. In this perspective and according to the first model, farmers minimise risks by continual but restricted growth in order to secure sustainable realisation of rents of the *status quo*. This general 'attitude' (or growth orientation) of farmers can therefore be explained endogenously.

The results of the second model based on mediated regression tell us that in regions where an entrepreneurial strategic orientation is accompanied by low HABITUALITY and/or low ESTEEM, the negative impact prevails: contrary to first intuition, the dominant growth orientation contributes to a more relaxed land market. This implies that a more conservative strategic orientation goes along with a tighter land market if it is accompanied by high HABITUALITY and/or high ESTEEM. The partial relevance of RUPTURE indicates that this result is also due to the fact that structural change is less delayed in regions with more 'entrepreneurial' farms. Accordingly, not only is observed behaviour explained by the local farm structure (model one) but farmers' strategic orientation also affects the current land market situation.

This reflexivity implies that the specific conditions in local land markets have the potential to contribute to a regional differentiation of farm development strategies. If strategies are thereby recognised as endogenous to the process of structural development, the possibilities of path dependence and of different equilibria need to be taken into account as well. The situation is even more complicated by the recognition that (weaker) competition on quantities implies a less severe selection process and thereby allows for a larger variety in fundamental attitudes towards development among the remaining farms. These attitudes might be conditional upon other factors such as local culture or local opportunities. They potentially further contribute to the variety in observed farm development strategies, thereby necessitating a careful analysis of local conditions in the explanation of land markets and of structural change in agriculture[10]. The results also imply that the observed differences in land markets and in

[10] Taking into account the possibility of different equilibria leads to more differentiated models and the need to estimate far more coefficients in the explanation of structural change as can be seen from Margarian, 2010c.

structural change are a reflection of rational considerations under given circumstances and not, as sometimes assumed, a reflection of irrational behaviour. The results thereby, on the one hand, potentially increase the difficulty of analyses of agricultural economists but, on the other, raise hope that the observed phenomena are principally open to economic explanations.

Finally, in a methodological respect a word of caution seems appropriate: usually it is not possible to empirically determine the direction of causal relationships. Therefore, the value of the presented approach is in the combination of a proposed endogenous explanation for the observed heterogeneity in strategies and dynamics and the supplementary statistical analysis of primary data from a survey that was designed in order to test the derived hypotheses. If the theoretical fundament is principally contested, the empirical analysis will not be able to prove the reflexive relationship between market and strategies; but if the theoretical argument is not refused in principle, the empirical results may serve as enhancing evidence (Pearl, 2008).

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