HOW DOES TENANCY AFFECT FARMLAND PRICES? EFFECTS OF LEASE STATUS, LEASE TERM, AND BUYER TYPE

Maximilian Humpesch, Stefan Seifert,
Alfons Balmann, Silke Hüttel

s.seifert@ilr.uni-bonn.de

Institute for Food and Resource Economics, Universität Bonn, Germany

2022

Vortrag anlässlich der 62. Jahrestagung der GEWISOLA
(Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e.V.)
Resilienz von regionalen und globalen Wertschöpfungsketten der Agrar- und Ernährungswirtschaft
07. bis 09. September 2022

How does Tenancy affect Farmland Prices? Effects of Lease Status, Lease Term, and Buyer Type

Maximilian Humpesch [A], Stefan Seifert [1,B], Alfons Balmann [C], Silke Hüttel [B]

Abstract

This paper investigates the conjecture that existing land lease contracts at the time of the sale influence agents' costs of being information deficient and thus their bargaining position, their expectation formation about future returns, and ultimately the price discovery process. To investigate the role of lease status and term in this process, we link different levels of information, search and bargaining cost to different buyer groups with different land use intentions. Relying on a rich data set for the Federal State of Saxony-Anhalt in Eastern Germany covering the years 2014–2019 and a hedonic pricing model, results indicate mark-downs related to lease status and lease term, particularly for tenant buyers.

Keywords: Farmland price dispersion, lease term, hedonic price model, information deficiency

JEL codes: D82, D83, Q12, Q15, Q24

1 Introduction

Farmland markets, as other real estate markets, are thinly traded and the immobility of land makes each transaction unique (Nickerson and Zhang, 2014). Besides such asset heterogeneity, seller and buyer heterogeneity may induce well documented price dispersion (Curtiss *et al.*, 2021; Seifert *et al.*, 2021). In thinly traded markets, asymmetric transaction, search, information gathering and bargaining costs can lead to costs being information deficient. As information deficiency relates to the bargaining positions of agents, it determines the potential for exercising market power (Balmann *et al.*, 2021; King and Sinden, 1994). Linking these costs to agent characteristics, such as being a farmer with specific knowledge about the sector, has offered identifying relative price effects depending on seller-buyer constellations but related to information deficiency. For instance local farmers and tenants can benefit from informational advantages resulting in price mark-downs (Seifert *et al.*, 2021), or price mark-ups paid by non-local buyers with higher information and search cost, for instance about the local market structure, including expected future supply of substitute plots (Beaumais *et al.*, 2021; Curtiss *et al.*, 2013; Curtiss *et al.*, 2021).

An existing lease contract could thereby denote restrictions, but also offer opportunities for cost savings, depending on how a buyer intends to generate future returns. Non-farmer investors consider land as a financial investment for returns, to store wealth, hedge against inflation, or as risk-reducing asset in their portfolio (Desmarais *et al.*, 2017; Balmann *et al.*, 2021). Future returns will thus strongly depend on whether a suitable tenant can be found and a high rental rate can be negotiated at low cost. For the group of investors, an existing lease contract could form an advantage as no additional search cost for finding a tenant occur. At the same time, such a contract limits them benefitting from increasing rental rates for the remaining duration of the lease contract. For Germany, officially reported average land rental rates increased between 2017 and 2020 from 328 to 375 Euros per hectare on average, and from 430 to 481 Euros per hectare for new contracts, respectively (Destatis, 2021, 2017). This suggests that substantial forgone returns from sales with existing lease terms can be anticipated, and the effect can be expected to increase in term.

[1] corresponding author, stefan.seifert@uni-goettingen.de

[A] Thünen Institute of Rural Studies, Johann Heinrich von Thünen Institute, Braunschweig

[B] Agricultural and Food Business Management Group, Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen

[C] Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle

Tenants as farmers typically buy the land they use with the aim to secure their farming structure, to hedge against increases of rental rates, and by increasing collateral they can reduce capital cost. Selling the land to a tenant offers the seller to save search cost, and the buyer to benefit from informational advantages such as true information about land management prior to the sale (e.g. fertilization or crop rotations) relevant for future yield potentials, but hard to assess for non-tenant and non-local buyers. At the same time, however, selling under an existing contract limits chances to sell to other farmer buyers, and thus at reduced outside options, weakening the bargaining position of the seller. Farmers but non-tenants as buyers may see an investment in land as an opportunity to increase their land bank and may evaluate existing contracts as foregone revenues from own farming operation against returns from the lease, potentially as a disadvantage. Thereby, (farmer and non-farmer) investors, tenant and non-tenant farmer buyers with the intention to operate the land may even focus on different types of land regarding the lease status when searching and forming the bid.

While this suggest that lease contracts at the time of sale influence expectations about future returns and thus the price discovery process, its contribution to price dispersion seems relatively unexplored. This paper targets at exploring this relation for the study region of eastern Germany from a microstructural perspective.

Well documented thus far seem that lease status relates to rental rates through social capital in the landlord-farmer relation (Bryan *et al.*, 2015; Taylor and Featherstone, 2018), and lease terms correlate with land rental rates (Choumert and Phélinas, 2017), where even term structures could be identified for Eastern Germany, our study region (Hüttel *et al.*, 2015). Empirical investigations about the influence of least status and lease term on sales price formation seem however rare with mixed results. For instance, Seifert *et al.* (2021) report based on a non-standard hedonic pricing model for the on Eastern German Federal State that tenants buy at lower prices arguing that they might benefit from a landlord-tenant relationship (social capital), lowering overall search cost. Cotteleer *et al.* (2008) find for the Netherlands a notable price mark-down for leased land, however only for semi-urban and urban areas, not for rural areas.

While these studies suggest that farmland price dispersion could be related to tenancy, no in-depth farmland price investigation exits that considers lease status and term explicitly. This appears even more surprising as the regional Committee of Land Valuation Experts in our study region reports a negative correlation between sales prices and lease status and lease term (GA Sachsen-Anhalt, 2021). We argue that not differentiating by buyer type while assessing the interplay between lease status and term with prices, that is, not acknowledging sources of price dispersion, could hamper causal interpretation. This study targets at closing this gap.

We conjecture that lease status and term influence the level of costs being information deficient but also the bargaining position directly and respective expectation formation about future returns from owning the land, and thus ultimately the price discovery process. To explore this overall conjecture, we structure our work around five hypotheses and link different levels of information gathering, search and bargaining cost to different buyer groups, that further offer links to intentions to buy the land (for own operation versus leasing out). We rely on a rich data set for the Eastern German Federal State of Saxony Anhalt, covering the period 2014–2019. We can differentiate between tenant, farmer and non-farmer buyers when analysing the relation between prices, lease status and term. Testing relies on four different hedonic pricing model specifications and functional form specification about the price-lease term relation is supported by LOESS.

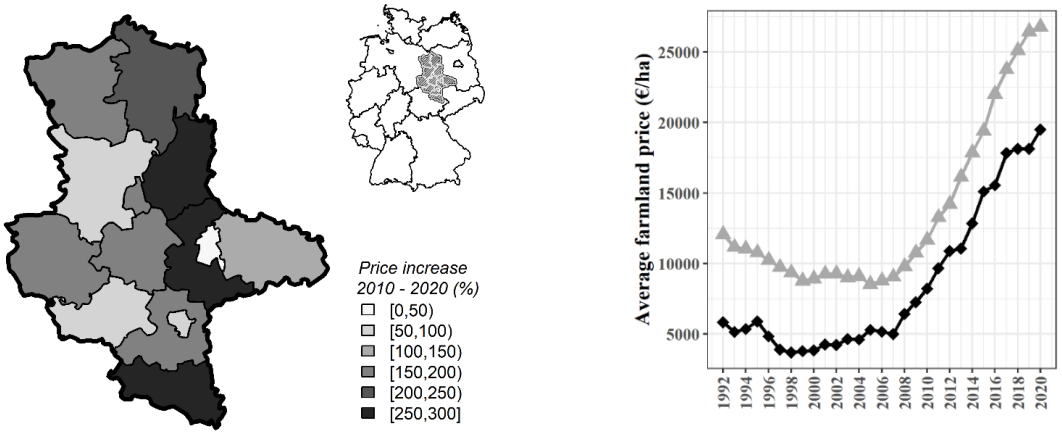
2 Background and hypotheses

2.1 Farmland market in Saxony-Anhalt, eastern Germany

Our study region is the Federal State of Saxony Anhalt located in Eastern Germany. Farmland transactions need a formal approval, where reasons for denial entail too high prices compared

to local levels as documented by the appraisal committees, which is the same source we use in our application, or a non-local buyer, where denial requires a local farmer be willing to pay the price and approved need of land. Other reasons include fragmentation potentially constituting barriers to sustainable farming. Although the privatization of former state-owned agricultural land is still ongoing, the farmland market is thinly traded (ranging between 1 and 2%, where the German average is around 0.5%). Prices in this Federal State have risen as in other post-transition regions considerably during the last decades (see Figure 1), i.e. by 237% from 8,233 €/ha in 2010 to 19,500 €/ha in 2020 (StaLa, 2021a). Price levels are nonetheless still below the German average farmland price of about 26,026 €/ha (Destatis, 2020).

These lower price levels, however, do not reflect that the agricultural sector in Saxony Anhalt is one of the most profitable ones in Germany, where today's farming structure is still shaped by its post-communist transition with rather large, commercially oriented cash crop farms. After the German reunification in 1990, many collective farms were transformed into large cooperative and corporate farms, but also newly founded family farms benefited from large average lot sizes. With an average size of 283 ha, farms are substantially larger than the German average farm of 60 ha (Destatis, 2019).



a) b)

Source: Statistisches Bundesamt (2020), Statistisches Landesamt Sachsen-Anhalt (2021)

Figure 1: a) Price increase per county from 2010 to 2020, b) Average farmland prices in Saxony-Anhalt (black) and Germany (grey) in Euro hectare, 1992 to 2018

In 2020, 73% of the farmland in Saxony-Anhalt were leased and, to our knowledge, no information on lease durations of existing or new land rental contracts is publicly available. Although less pronounced than farmland sales prices, farmland rental rates increased substantially between 2010 and 2020 from 254 €/ha to 417 €/ha (+164%, MULE, 2020). In contrast to farms in western Germany, farmers in Saxony-Anhalt were able to reduce their lease-to-property ratio in the privatization process: between 1993 and 2016, operator-owned farmland increased from 56,400 ha to 327,008 ha, whereas leased farmland decreased from 970,800 ha to 827,700 ha in the same period (Destatis, 2021). Both the federal Bodenverwertungs- und Verwaltungs GmbH (BVVG) and the rural settlement agency of the Federal State of Saxony Anhalt (LGSA) sell at first price sealed bid auctions with public tenders, where LGSA prefers selling to farmers and grants a right of first refusal to their tenants (see Isenhardt *et al.* (2021) for details). These institutional sellers, however, sell only without existing lease contracts.

Based on a non-standard hedonic pricing model for our study region Seifert *et al.* (2021) find these institutional but also other professional sellers selling at higher prices. The choice of the

[1] corresponding author, stefan.seifert@uni-goettingen.de
[A] Thünen Institute of Rural Studies, Johann Heinrich von Thünen Institute, Braunschweig
[B] Agricultural and Food Business Management Group, Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen
[C] Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle

auction mechanism contributes to more cost-efficient search of buyers with a high willingness to pay, where these mark-ups range between 6-38% compared to similar plots under private sellers. Likewise, these authors find mark-downs for tenant buyers, and for farmer buyers but less pronounced compared to non-farmers. These authors suggest that removing price dispersion from asymmetric information gathering and search cost "*would increase market revenue between 124 m and 145 m euros*" (for the period 2014–2017). Given that the total value of the annual farmland sales in Saxony Anhalt amounts to 253 m € in 2020, which is about 20 % of the regional agricultural gross domestic product of the Federal State (Destatis, 2020; LSA, 2020), the number appears substantial, where the contribution of existing lease terms has thus far not been discussed in detail.

2.2 Hypotheses

To derive our hypotheses for buyer-specific price impacts of lease status and lease term, we consider observed farmland prices as a result of search and bargaining processes in a thinly traded market (King and Sinden, 1994). To account for the heterogeneity of farmland, we base our analysis on an hedonic pricing model (Balmann et al., 2021; Curtiss et al., 2021; Seifert et al., 2021) such that specific agent's (dis-)advantages in the search, information gathering, and bargaining process are observed as seller- and buyer-specific price markups or markdowns, respectively. We overall conjecture that lease status (whether a lease contract exists) and term influence the price discovery process and ultimately the distribution of prices related to buyer types' specific preferences. We overall conjecture that lease status (whether a lease contract exists) and term influence the price discovery process and ultimately the distribution of prices related to buyer types' specific preferences.

We start by investigating the relationship between prices, lease status and lease term. An existing lease term means limited flexibility for the seller. Selling to a tenant could imply search cost savings for both sides, and benefits from social capital in the negotiation process (Robinson *et al.*, 2002). Tenant buyers may consider besides rental cost savings future benefits from ownership such as overall capital cost savings and increasing collateral (Clapp and Isakson, 2018). Considering that for other buyers the existing lease term constitutes a barrier as they can use the land only after the contract. This limits outside options of sellers (Muthoo, 2000), weakening their bargaining position compared to a situation without existing contract and makes mark-downs likely. From the non-tenant buyer perspective, getting full ownership and use rights with delay could imply potentially foregone losses. This we also expect to translate into mark-downs, despite the potential search cost savings for a tenant if investors buy the land with the intention to generate returns from leasing the land. The longer the lease terms endure, the lower is the flexibility and the stronger we expect these limitations in flexibility to weaken the bargaining position. Therefore, we expect on average price mark-downs related to existing contracts at the time of the sale. This gives:

H_1 (lease status): An active *lease status* negatively impacts farmland prices.

H_2 (lease term): An ongoing *lease term* negatively impacts farmland prices.

Lease status (i.e., whether a contract exists) and a lease term can offer cost savings in the search and bargaining process but also form substantial restrictions on expected future returns for buyers and thus revenues for sellers. Whether a lease term constitutes a barrier or not, depends on the intention of the buyer how the land will be used and how returns are generated (farming or leasing). Linking the intention to buyer types as our data set offers, we expect tenant buyers to benefit from the weaker bargaining position of the seller and to negotiate lower prices compared to non-tenant and non-farmer buyers. A remaining lease term offers an advantage for tenants and investors, given that the latter group may realize cost savings in presence of a lease contract as no need exists to search for a solvent tenant. As our data set offers a differentiation between farmer and non-farmer buyers, and the most likely the group of investors relates to non-farmer buyers, we expect price increases in lease term for tenants and non-farmers buyers.

H_{3a}(tenant buyer): If the buyer is the current (previous) tenant, on average lower sales prices are observed; these mark-downs increase in remaining *lease term* in comparison to non-agricultural buyers yet not contrasted to non-tenant but farmer buyers.

Non-tenant, but farmer buyers that may particularly be interested in owning the land for farming purposes, may perceive existing contracts as a disadvantage as full ownership rights will be available with delay coming at foregone returns from farming. This delay can be substantial harm and thus expect mark-downs to increase in leas term. As farmer investors may realize forgone returns from not realizing rental rate increases, as non-farmer investors would, this effect holds for farmer and non-farmer buyers. This is expected to impact the willingness to pay of this buyer group in presence of a rental contract but foregone losses from farming are more likely for the farmer buyer group, including most likely a considerable share of farmer buyers with the intention to operate the land; yet, this remains unobserved for us. Compared to tenant farmers, however, this group of buyers may realize higher information gathering cost given their potentially lower level of information in a region compared to a tenant buyer. Compared to non-farmer buyers, this group will still benefit from sector knowledge and farming skills, reducing their search cost (Seifert *et al.*, 2021). This gives:

H_{3b} (non-tenant farmer buyer): If a non-tenant farmer buys, on average higher prices are observed compared to tenant buyers but lower compared to non-farmer buyers; these mark-downs increase in the *lease term* but stronger compared to tenants.

3 Data

We dispose of a dataset of all transactions of arable land in Saxony-Anhalt for 2014–2019 provided by the Committee of Land Valuation Experts of Saxony-Anhalt (*Gutachterausschuss für Grundstückswerte in Sachsen-Anhalt*). The data includes the contract date and the price, main lot characteristics (coordinates, lot size, soil quality index), lease information (binary lease status, remaining length of the contract) and anonymous information of the buyer and seller types. Using the geo-coordinate of the centroid of a transaction, we enrich the dataset with historic rainfall data from a 1km × 1km grid (DWD, 2018), a drought index based on soil moisture from a 4km × 4km grid that counts the number of drought month 36 months prior to the transaction (Zink *et al.*, 2016), the distance to the closest highway access, and the distance to the closest regional metropolis (BBSR, 2019).

After a statistical outlier detection, the final dataset includes 6,786 transactions of in total 25,447 ha with a transaction volume of 536 mio. €. We observe an average lot size of 3.75 ha, and the distribution ranges from 0.25 ha to more than 27.98 ha (compare Table 1). Transaction prices vary substantially between less than 0.37 €/m² and more than 4.5 €/m² with an average of 1.77 €/m² (median 1.60 €/m²).

Table 1: Descriptive statistics, 2014-2019

All farmland transactions (N = 6,786)	Mean	Median	SD	Q1	Q99
Price (EUR/m²)	1.77	1.60	0.95	0.37	4.50
Size (ha)	3.75	1.64	5.67	0.25	27.98
Quality (index)	62.65	64.00	23.12	20.00	100.00
Lease duration (years)	4.25	2.00	5.13	0.00	23.00
Lease status [1,0]	0.68	1.00	0.46	0.00	1.00
Lease price (EUR/m²)	0.02	0.02	0.02	0.00	0.07
Months of drought 3 yrs. past	20.71	20.00	5.94	9.00	34.00
Mean ann. precip. 1981-2010 (cm)	55.93	55.40	4.40	48.51	67.71
Tenant farmer [1,0]	0.53	1.00	0.50	0.00	1.00

[1] corresponding author, stefan.seifert@uni-goettingen.de
[A] Thünen Institute of Rural Studies, Johann Heinrich von Thünen Institute, Braunschweig
[B] Agricultural and Food Business Management Group, Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen
[C] Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle

Non-tenant farmer [1,0]	0.26	0.00	0.44	0.00	1.00
Non-farmer [1,0]	0.20	0.00	0.40	0.00	1.00

Notes: Due to data privacy reasons, minima and maxima are not reported. SD denotes the standard deviation, and Q1 and Q99 refer to the 1% and 99% quantile, respectively.

68.4% of our transacted lots are leased and we observe moderate variation in the share of leased lots over the observation period. For the whole sample, the remaining duration of the lease contracts ranges between 0 and more than 23 years with an average of 4.3 years. For transactions of leased lots, lease contracts continue for another 6.21 years on average. We observe an average lease price of 0.029 €/m² for the leased lots (whole sample: 0.018 €/m²) increasing from 0.026 €/m² in 2014 to 0.033 €/m² in 2019.

In 79.5% (5,394) of the transactions, the buyer is a farmer, and non-farmers account for 20.5%. The buyer is the tenant in 53,2% of the transactions (3,603). As shown by Figure 2, we observe on average lower prices for tenant farmer buyers (1.62 €/m²) compared to non-tenant farmer buyers (1.96 €/m²) and non-farmer buyers (1.87 €/m²).

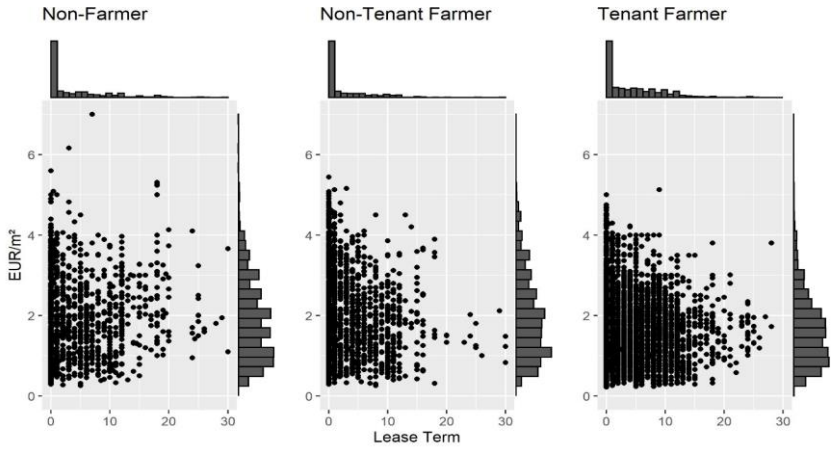


Figure 2: Observation density per buyer group of the remaining lease duration

4 Empirical strategy

We empirically analyse the relationship between farmland prices, lease status and term, and the lease price using a hedonic pricing model (Rosen, 1974). The hedonic model posits that the market value of farmland reflects the implicit prices of the lands' characteristics. These implicit prices are thereby determined at the point where the buyers' willingness to pay (WTP) equals the sellers' willingness to accept (WTA). Thus, farmland prices P are functionally dependent on land characteristics x such that $P = h(x'\beta) + \varepsilon$, where h denotes the hedonic price function and β is a vector of appreciations for the lot characteristics. Observed prices may deviate from this function, ε, due to, for instance, measurement error and noise, but also costs of information deficiency may play a role, observed as price dispersion (Kumbhakar and Parmeter, 2010; Seifert and Hüttel, 2020).

We rely on the standard hedonic model without explicit modelling the price dispersion to investigate our hypothesis H_1 to H_3. We follow Cotteleer *et al.* (2008) and control for lease characteristics as a potential shifter of the hedonic price function. Buyer/seller- characteristics may affect the bargaining process but we presume that appreciations of lot characteristics do not interact with the lease characteristics (Cotteleer *et al.*, 2008). This gives the following base model: $P = h(x'\beta) + \delta L + \varepsilon$ where L denotes the lease characteristics (lease status and term) with the coefficient vector δ capturing effects related to lease characteristics, respectively.

We further rely on a log-linear model specification, i.e. $\log(P)$ as a function of productivity-related lot characteristics such as lot size (x_s), soil quality (x_q), and water availability approximated by a drought index (x_d) and historic average annual precipitation (x_p). We use flexible Box-Cox functional form to limit omitted variable bias (Kuminoff *et al.*, 2010) and lot

size and soil quality enter the model in square roots, and their interaction in linear terms. The drought index enters the model linearly while precipitation in linear and quadratic form (x_p, x_p^2). To account for remaining spatio-temporal heterogeneity potentially causing price variation for identical lot characteristics, we add distance to the closest regional metropolis, m_{dc}, and the distance to the closest highway interchange m_{dh}, both calculated as the shortest air-line distance from a lot's centroid. These shall reflect unobserved but relevant potential future returns of a lot by development options in urban proximity and infrastructure access (see, e.g. Brorsen *et al.*, 2015 for the US). We further add 87 dummy variables m_k (k = 1, …, 87) indicating the standard land value zone (*Bodenrichtwertzone*) of a transaction. These standard land value zones are defined by the Committee of Land Valuation Experts as granular and compact areas with similar land market characteristics (average size: 236 km²). This offers us to account for unobserved but systematic impact of land market characteristics such as supply trends. To account for the substantial price rise during the observation period, we include a quarterly time trend variable in linear and quadratic terms, τ and τ^2, that equal 1 and 1^2 for transactions in the first quarter of 2014, 2 and 2^2 for the second quarter of 2014, and so on. A dummy variable for sales in the third quarter, Q_3, is added to capture seasonality in the farmland market (Seifert *et al.*, 2021). For transaction i, the hedonic part of our model is thus given by

$$h(x) = \alpha_0 + \beta_s\sqrt{x_s} + \beta_q\sqrt{x_q} + \beta_{sq}x_s x_q + \beta_d x_d + \beta_p x_p + \beta_{p2}x_p^2 + \gamma_{dC}m_{dC} + \gamma_{dH}m_{dH} + \sum_k \gamma_k m_k + \gamma_\tau \tau + \gamma_{\tau 2}\tau^2 + \gamma_{Q3}Q_3, \quad (1)$$

where $\beta's$ and γ's are parameters of the hedonic and the spatio-temporal control variables.

To investigate the impact of lease characteristics on farmland transaction prices, we test our hypotheses with four different model specifications. First, to investigate the role of an active *lease status* (H_1), we linearly add a dummy variable for the lease status, L_{LS}, that equals 1 if a lot is leased, and zero otherwise. Model M1 is thus given by

$$\log(P) = h(x) + \delta_{LS}L_{LS}. \quad (2)$$

where we expect $\delta_{LS} < 0$.

We enhance this model to investigate the effect of the *lease term* L_{LT} on prices (H_2). The functional relationship between transaction prices and the lease term is unknown ex-ante and expert interviews with the Committee of Land Valuation Experts of Saxony-Anhalt suggested potential non-linearities. To acknowledge potential non-linearities, we rely on an auxiliary regression of the residuals of Model M1 on L_{LT} using locally weighted scatterplot smoothing (LOESS). The non-parametric LOESS estimator provides a graphical representation of the relationship without requiring any functional form specification (Cleveland and Devlin, 1988). The resulting LOESS estimate (available from the authors upon request) suggests a U-shape and we include the lease duration in a linear-quadratic fashion. Model M2 is thus given by

$$\log(P) = h(x) + \delta_{LS}L_{LS} + \delta_{\mathrm{LT}1}L_{\mathrm{LT}} + \delta_{\mathrm{LT}2}{L_{\mathrm{LT}}}^2. \quad (3)$$

where we expect $\partial \log(P)/\partial L_{LT} < 0$.

To investigate *buyer-type specific price effects of lease status and term* ($H_3's$), we add dummy variables for tenant farmer buyers (z_T) and non-tenant farmer buyers (z_{NT}), and their interactions with the lease term $L_{\square}$. The resulting model M3 is given by

$$\log(P) = h(x) + \delta_{LS}L_{LS} + \delta_{\mathrm{LT}}L_{\mathrm{LT}} + \delta_{\mathrm{LT}2}(L_{\mathrm{LT}})^2 + \delta_T z_T + \delta_{LTT}z_T L_{\mathrm{LT}} + \delta_{NT}z_{NT} + \delta_{LTNT}z_{NT}L_{\mathrm{LT}}, \quad (4)$$

where parameters δ_T and δ_{NT} capture price differentials for tenants and non-tenants relative to non-farmer buyers, respectively; δ_{LTT} captures effects related to lease term and tenant buyers,

[1] corresponding author, stefan.seifert@uni-goettingen.de
[A] Thünen Institute of Rural Studies, Johann Heinrich von Thünen Institute, Braunschweig
[B] Agricultural and Food Business Management Group, Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen
[C] Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle

and δ_{LTNT} respective effects of lease term and non-tenant buyers. Under hypothesis H_{3a}, we expect on average lower prices with a tenant-buyer compared to non-farmer and farmer buyers, and these mark-downs to increase with the remaining lease term but this increase only in contrast to non-farmer buyers such that $\delta_T < 0$; $\delta_{LTT} < 0 \wedge \delta_{LTT} > \delta_{LTNT}$. Following hypothesis H_{3b}, we expect on average higher prices for non-tenant farmers compared to tenant buyers, but lower prices compared to non-farmer buyers. We expect these mark-downs for non-tenant farmer buyers to increase in the lease term; this price-decreasing effect expected to be stronger compared to tenants, such that $\delta_{NT} < 0 \wedge \delta_{NT} > \delta_T \wedge \delta_{LTNT} < 0 \wedge \delta_{LTT} > \delta_{LTNT}$.

All models are estimated by ordinary least squares (OLS) using R. Inference is based on heteroscedasticity-robust standard errors (White, 1980) using the package *sandwich* (Zeileis, 2006); joint non-linear hypothesis testing uses *restrictor* (Leonard Vanbrabant, 2021).

5 Results and discussion

Table 2 reports the parameter estimates for the hedonic variables and the buyer and seller characteristics for the models M1, M2 and M3 All models show a satisfactory goodness of fit as indicated by R^2 between 0.757 (M1) to 0.761 (M3). Across all specifications, regression results reveal effects of hedonic lot characteristics' in line with expectations. Except for very

Table 2: Parameter estimates model M1-M3

N = 6,786	M1		M2		M3	
Intercept	-0.455	(0.582)	-0.495	(0.574)	-0.508	(0.576)
√Size	0.123***	(0.007)	0.125***	(0.007)	0.122***	(0.007)
√Soil quality	0.141***	(0.005)	0.141***	(0.005)	0.141***	(0.005)
Size × soil quality	-0.0001***	(0.00002)	-0.0001***	(0.00002)	-0.0001***	(0.00002)
Lease status [1,0]	-0.017*	(0.009)	0.025**	(0.011)	0.028**	(0.011)
Lease term			-0.012***	(0.002)	-0.005**	(0.003)
Lease term²			0.0004***	(0.0001)	0.0003***	(0.0001)
Drought index	-0.003***	(0.001)	-0.003***	(0.001)	-0.003***	(0.001)
Precipitation	-0.030	(0.020)	-0.028	(0.020)	-0.028	(0.020)
Precipitation ²	0.0002	(0.0002)	0.0002	(0.0002)	0.0002	(0.0002)
Distance highway	0.001	(0.001)	0.001	(0.001)	0.001	(0.001)
Distance city	-0.001*	(0.001)	-0.002**	(0.001)	-0.002**	(0.001)
Quarter trend	0.036***	(0.002)	0.036***	(0.002)	0.036***	(0.002)
Quarter trend²	-0.001***	(0.0001)	-0.001***	(0.0001)	-0.001***	(0.0001)
3rd quarter [1,0]	0.026***	(0.008)	0.026***	(0.008)	0.026***	(0.008)
Tenant [1,0]					-0.004	(0.013)
Tenant [1,0] x lease term					-0.006***	(0.002)
Non-tenant [1,0]					0.053***	(0.014)
Non-tenant [1,0] × lease term					-0.007***	(0.002)
BVVG [1,0]	0.332***	(0.013)	0.319***	(0.013)	0.309***	(0.013)
R^2	0.758		0.759		0.761	
Residual standard error	0.287		0.286		0.285	

Notes: Robust White standard errors in parentheses. Asterisks indicate * p<0.1, ** p<0.05 *** p<0.01.

large values of soil quality and lot size, we find positive price relations, which is in line with previous studies for Saxony-Anhalt (e.g., Ritter *et al.*, 2020). We further note a positive price effect for the third quarter suggesting seasonality in the farmland market (Seifert *et al.*, 2021).

In line with H_1, model M1 shows a statistically significant negative price effect of an active lease status of around 1.6 %. This effect is not robust, but we find statistically significant price-increasing effects of an active lease status of around 2.5%-3% when controlling also for the

lease term in models M2 and M3. Models M2 and M3 further indicate a U-shaped relationship between sales prices and the lease term. Based on the parameter estimates of M2, farmland prices decrease with the remaining lease duration until 14 years and increase afterwards. The aggregate effect is negative and in line with our argumentation of hypothesis H_2.

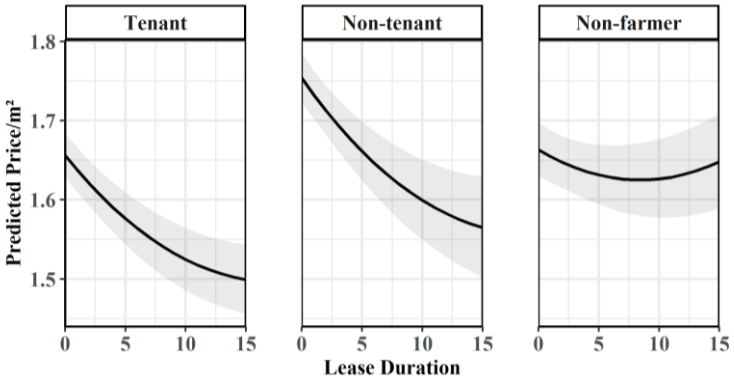


Figure 3: Predicted prices per year remaining lease duration per buyer group

Differentiating by buyer types in model M3, we do not find effects related to tenant farmer buyers compared to non-farmer buyers. Results however indicate decreasing prices for tenant farmer buyers by around 0.6% per additional year of lease term (statistically significant interaction term). Non-tenant but farmer buyers buy at mark-ups compared to non-farmer buyers on average. The statistically significant negative interaction effect with the lease term suggests a compensating effect for this mark-up for lease terms above 7 years (see Figure 3). While the first finding lends in parts support to the argumentation of H_{3a}, results of M3 are not entirely in line with both $H_3's$.

Our results offer insights from a microstructural perspective that can be of general interest. We demonstrate that lease status and term interact with buyer groups in the price discovery process. By linking buyer groups to their relative bargaining position and costs of being information deficient, our results indicate substantial differences in the relative price effects related to lease term by group: first, our results indicate that tenant buyers buy at the lowest prices, in line with other studies considering buyer-type effects (Seifert *et al.*, 2021; Curtiss *et al.*, 2021). The longer the lease term is, the higher is the mark-down tenant buyers can negotiate (see Figure 6), which is in line with our argumentation of H_{3a}. We argue that tenants could benefit from a longer term in several ways. A tenant may be the first addressee of the land owner willing to sell the land during term to avoid long negotiations or in light of social capital from the landlord-farmer relationship, weakening sellers bargaining position. Tenants may even prefer continuing the lease compared to investments in land ownership coming at additional cost and liquidity constraints, strengthening their bargaining position. Depending on the knowledge of the seller, tenants may still offer an attractive price to circumvent that the seller searches for alternative offers. The longer the lease term is, however, the less attractive is the lot for other buyers in light of expected foregone returns from not realizing higher rental rates (non-farmer) or returns from own operation (non-tenant farmer). In turn, tenants may at any time during the lease contract offer a higher rental price to the owner in combination with a request to extend the rental contract or they might offer a buy-out to circumvent competition in the sales market. Though such offers may also be possible for other potential buyers, tenants may benefit from social capital of the landlord relationship, including how well informed the land owner is about the value, and they may have better knowledge about the conditions of the rental contract, local market conditions and the true value of the land.

[1] corresponding author, stefan.seifert@uni-goettingen.de
[A] Thünen Institute of Rural Studies, Johann Heinrich von Thünen Institute, Braunschweig
[B] Agricultural and Food Business Management Group, Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen
[C] Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle

Second, our results suggest that under very short lease terms, non-farmers buy at comparable prices while non-tenant farmers buy at a substantial mark-up. While non-tenant farmers pay the highest overall prices, their willingness to pay for land declines in comparison with other buyer groups relatively strong with increasing lease terms.

Third, for non-farmer buyers, lease status and term seem to be least important according to our results, and we find a rather flat price effect of lease time with some U-shape. This group's specific interest in land can be seen in a high return from their investment characterized by a rather high rental price and other benefits. In presence of a lease contract at the time of the sale, non-farmer buyers evaluate search cost savings for finding solvent tenants against foregone losses from a fixed rental rate in price boom times. Therefore, no clear preferences in favor of non-leased land, or shorter lease terms may prevail.

Our results thus contribute by offering explanations why empirical studies come to mixed or no empirical evidence for lease contracts influencing the price discovery process (e.g., Seifert *et al.*, 2021 for the same study region). The majority of studies still relies on standard hedonic models without explicitly acknowledging price deficiencies related to asymmetric information gathering and search cost in the price discovery process in thinly traded farmland markets systematically attached to buyer groups such as tenants, non-tenant farmers versus non-farmers. And if considered, the interplay between lease status, term and price, these costs and expected future returns from ownership remains unconsidered. Based on the empirical findings, we conclude from academic perspective that understanding of lease term effects on land sales prices requires acknowledging price trends and related future expectations of agents, their costs of being information deficient, and ultimately the market power relation between buyers and sellers. In this regard, the local market microstructure such as number of potential buyers and sellers matters as well.

3.3 Concluding remarks

Central to this paper was the conjecture that lease status and term influence the level of costs being information deficient but also the bargaining position directly and respective expectation formation about future returns from owning the land, and thus ultimately the price discovery process. We investigate this conjecture using a hedonic pricing model and a rich dataset of about 6,500 land transactions in Saxony-Anhalt in the period between 2014 and 2019.

Our results indicate non-linear and buyer-specific effects of lease on farmland prices. In particular, our results indicate no price differences between tenant farmer and non-farmer buyers, whereas nontenant farmers pay a markup for lots without lease. For lots with an active lease status, we find farmland prices to decrease with the remaining lease duration until 14 years and increase afterwards. The current tenant benefits most and achieves the highest mark-downs with prices decreasing by around 0.6% per additional year of lease term. As prices with and without lease contract enter the market reports and standard land values, we recommend to increase market transparency to ensure an efficient allocation of farmland. This includes the publication of detailed information relevant to the price discovery process, such as lease terms and buyer and seller types.

4 References

Balmann, A., Graubner, M., Müller, D., Hüttel, S., Seifert, S., Odening, M., Plogmann, J. and Ritter, M. (2021), "Market Power in Agricultural Land Markets: Concepts and Empirical Challenges", *German Journal of Agricultural Economics*, Vol. 70 No. 4, p. 1.

BBSR (2019), "Laufende Stadtbeobachtung - Raumabgrenzungen. Großstadtregionen"

Beaumais, O., Giannoni, S. and Tafani, C. (2021), "Local buyers' exclusion through price on the farmland market: a potential outcome approach", *Applied Economics*, Vol. 53 No. 19, pp. 2206–2217.

Bigelow, D.P., Ifft, J. and Kuethe, T. (2020), "Following the Market? Hedonic Farmland Valuation Using Sales Prices versus Self-reported Values", *Land Economics*, Vol. 96 No. 3, pp. 418–440.

Brorsen, B.W., Doye, D. and Neal, K.B. (2015), "Agricultural Land and the Small Parcel Size Premium Puzzle", *Land Economics*, Vol. 91 No. 3, pp. 572–585.

Bryan, J., James Deaton, B. and Weersink, A. (2015), "Do Landlord-Tenant Relationships Influence Rental Contracts for Farmland or the Cash Rental Rate?", *Land Economics*, Vol. 91 No. 4, pp. 650–663.

Choumert, J. and Phélinas, P. (2017), "Farmland Rental Prices in GM Soybean Areas of Argentina: Do Contractual Arrangements Matter?", *The Journal of Development Studies*, Vol. 53 No. 8, pp. 1286–1302.

Clapp, J. and Isakson, S.R. (2018), "Risky Returns: The Implications of Financialization in the Food System", *Development and Change*, Vol. 49 No. 2, pp. 437–460.

Clauretie, T.M. and Wolverton, M.L. (2006), "Leave Vacant or Rent. The Optimal Decision for Absentee Home Sellers", *The Journal of Real Estate Research*, Vol. 28 No. 1, pp. 25–38.

Cleveland, W.S. and Devlin, S.J. (1988), "Locally weighted regression: an approach to regression analysis by local fitting", *Journal of the American Statistical Association*, Vol. 1988 No. 83, pp. 596–610.

Cotteleer, G., Gardebroek, C. and Luijt, J. (2008), "Market Power in a GIS-Based Hedonic Price Model of Local Farmland Markets", *Land Economics*, Vol. 84 No. 4, pp. 573–592.

Curtiss, J., Jelínek, L., Medonos, T., Hruška, M. and Hüttel, S. (2021), "Investors' impact on Czech farmland prices: a microstructural analysis", *European Review of Agricultural Economics*, Vol. 48 No. 1, pp. 97–157.

Curtiss, J., Lelínek, L., Hruska, M., Medonos, T. and Vilhelm, V. (2013), "The Effect of Heterogeneous Buyers on Agricultural Land Prices: The Case of the Czech Land Market", *German Journal of Agricultural Economics*, Vol. 62 No. 2, pp. 116–133.

Desmarais, A.A., Qualman, D., Magnan, A. and Wiebe, N. (2017), "Investor Ownership or Social Investment? Changing Farmland Ownership in Saskatchewan, Canada", *Agriculture and Human Values*, Vol. 34 No. 1, pp. 149–166.

Destatis (2017), *Land- und Forstwirtschaft, Fischerei: Eigentums- und Pachtverhältnisse*, Landwirtschaftszählung

Destatis (2019), *Bodennutzung und Anbau: Bodennutzung in landwirtschaftlichen Betrieben*.

Destatis (2020), "Verkäufe landwirtschaftlicher Grundstücke nach Ländern im Jahr 2019".

Destatis (2021), *Land- und Forstwirtschaft, Fischerei: Eigentums- und Pachtverhältnisse*, Landwirtschaftszählung

Deutscher Bundestag (2007), *Gesetz zur Schätzung des landwirtschaftlichen Kulturbodens: Bodenschätzungsgesetz - BodSchätzG*.

DWD (2018), *Multi-annual grids of precipitation height over Germany 1981-2010*, Offenbach

Eder, A., Salhofer, K. and Scheichel, E. (2021), "Land tenure, soil conservation, and farm performance: An eco-efficiency analysis of Austrian crop farms", *Ecological Economics*, Vol. 180, p. 106861.

Feichtinger, P. and Salhofer, K. (2013), "What Do We Know about the Influence of Agricultural Support on Agricultural Land Prices?", *German Journal of Agricultural Economics*, Vol. 62 No. 2, pp. 71–83.

GA Sachsen-Anhalt (2021), *GRUNDSTÜCKSMARKTBERICHT Sachsen-Anhalt*

Garvin, S. and Kagel, J.H. (1994), "Learning in common value auctions: Some initial observations", *Journal of Economic Behavior & Organization*, Vol. 25 No. 3, pp. 351–372.

Graubner, M. (2018), "Lost in space? The effect of direct payments on land rental prices", *European Review of Agricultural Economics*, Vol. 45 No. 2, pp. 143–171.

Haan, P. and Simmler, M. (2018), "Wind electricity subsidies — A windfall for landowners? Evidence from a feed-in tariff in Germany", *Journal of Public Economics*, Vol. 159, pp. 16–32.

Hüttel, S., Ritter, M., Esaulov, V. and Odening, M. (2015), "Is there a Term Structure in Land Lease Rates?", *European Review of Agricultural Economics*, Vol. 43 No. 1, pp. 165–187.

Isenhardt, L., Seifert, S. and Huettel, S. (2021), *On the price effect of a right-of-first-refusal in farmland auctions,* 94th Annual Conference, March 29-30, Warwick, UK (Hybrid), Agricultural Economics Society - AES.

King, D.A. and Sinden, J.A. (1994), "Price Formation in Farm Land Markets", *Land Economics*, Vol. 70 No. 1, pp. 38–52.

Kionka, M., Odening, M., Plogmann, J. and Ritter, M. (2021), "Measuring liquidity in agricultural land markets", *Agricultural Finance Review*, ahead-of-print No. ahead-of-print.

Kropp, J. and Peckham, J.G. (2015), "US agricultural support programs and ethanol policies effects on farmland values and rental rates", *Agricultural Finance Review*, Vol. 75 No. 2, pp. 169–193.

[1] corresponding author, stefan.seifert@uni-goettingen.de

[A] Thünen Institute of Rural Studies, Johann Heinrich von Thünen Institute, Braunschweig

[B] Agricultural and Food Business Management Group, Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen

[C] Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle

Kumbhakar, S.C. and Parmeter, C.F. (2010), "Estimation of hedonic price functions with incomplete information", *Empirical Economics*, Vol. 39 No. 1, pp. 1–25.

Kuminoff, N.V., Parmeter, C.F. and Pope, J.C. (2010), "Which hedonic models can we trust to recover the marginal willingness to pay for environmental amenities?", *Journal of Environmental Economics and Management*, Vol. 60 No. 3, pp. 145–160.

Leonard Vanbrabant (2021), *restriktor: Restricted Statistical Estimation and Inference for Linear Models*.

Leonhardt, H., Braito, M. and Penker, M. (2021), "Why do farmers care about rented land? Investigating the context of farmland tenure", *Journal of Soil and Water Conservation*, Vol. 76 No. 1, pp. 89–102.

LSA (2020), *Volkswirtschaftliche Gesamtrechnungen: Bruttoinlandsprodukt und Bruttowertschöpfung nach Wirtschaftsbereichen 1991-2019 bezogen auf den Stand der Bundesrechnung August2019/Februar2020*

Moss, C.B. and Katchova, A.L. (2005), "Farmland valuation and asset performance", *Agricultural Finance Review*, Vol. 65 No. 2, pp. 119–130.

MULE (2020), *Pachtpreise landwirtschaftlicher Grundstücke 2020*.

Muthoo, A. (2000), "A Non-Technical Introduction to Bargaining Theory", *World Economics*, Vol. 1 No. 2, pp. 145–166.

Nickerson, C.J. and Zhang, W. (2014), "Modeling the Determinants of Farmland Values in the United States", in Duke, J.M. and Wu, J. (Eds.), *The Oxford Handbook of Land Economics*, Oxford University Press, New York, pp. 111–138.

Odening, M. and Hüttel, S. (2020), "Introduction to the special issue 'agricultural land markets – recent developments, efficiency and regulation'", *European Review of Agricultural Economics*.

Patton, M. and Erlean, S.M. (2004), "Spatial Effects within the Agricultural Land Market in Northern Ireland: A Reply", *Journal of Agricultural Economics*, Vol. 55 No. 1, pp. 127–133.

Piet, L., Melot, R. and Diop, S. (2021), "What drives competition on the farmland market? A case study in Brittany (France)", *European Review of Agricultural Economics*, Vol. 48 No. 1, pp. 60–96.

Ritter, M., Hüttel, S., Odening, M. and Seifert, S. (2020), "Revisiting the relationship between land price and parcel size in agriculture", *Land Use Policy*, Vol. 97, p. 104771.

Robinson, L.J., Myers, R.J. and Siles, M.E. (2002), "Social Capital and the Terms of Trade for Farmland", *Review of Agricultural Economics*, Vol. 24 No. 1, pp. 44–58.

Rosen, S. (1974), "Hedonic Prices and Implicit Markets. Product Differentiation in Pure Competition", *Journal of Political Economy*, Vol. 82 No. 1, pp. 34–55.

Rousseeuw, P.J. and van Driessen, K. (1999), "A fast algorithm for the minimum covariance determinant estimator", *Technometrics*, Vol. 41 No. 3, pp. 212–223.

Salhofer, K. and Feichtinger, P. (2020), "Regional differences in the capitalisation of first and second pillar payments of the CAP into land rental prices", *European Review of Agricultural Economics*.

Seifert, S. and Hüttel, S. (2020), *Common values and unobserved heterogeneity in farmland auctions in Germany, FORLand-Working Paper*

Seifert, S., Kahle, C. and Hüttel, S. (2021), "Price Dispersion in Farmland Markets: What Is the Role of Asymmetric Information?", *American Journal of Agricultural Economics*, Vol. 103 No. 4, pp. 1545–1568.

StaLa (2021a), *Kaufwerte landwirtschaftlicher Grundstücke nach Jahren*.

StaLa (2021b), *Tabellen Bodennutzung und Anbau*

Statistisches Bundesamt (Destatis) (2020), *Kaufwerte für landwirtschaftliche Grundstücke 2019, Land und Forstwirtschaft, Fischerei*.

Statistisches Landesamt Sachsen-Anhalt (StaLa) (2021), *Kaufwerte landwirtschaftlicher Grundstücke nach Jahren* (accessed 12 April 2021).

Taylor, M.R. and Featherstone, A.M. (2018), "The value of social capital in farmland leasing relationships", *Agricultural Finance Review*, Vol. 78 No. 4, pp. 489–496.

Turnbull, G.K. and Zahirovic-Herbert, V. (2012), "The Transitory and Legacy Effects of the Rental Externality on House Price and Liquidity", *The Journal of Real Estate Finance and Economics*, Vol. 44 No. 3, pp. 275–297.

Vranken, L., Roebeling, P., Tabeau, E., Ciaian, P. and with contributions from country experts (2021), *Agricultural land market regulations in the EU Member States*, Luxembourg

White, H. (1980), "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity", *Econometrica*, Vol. 48 No. 4, pp. 817–838.

Zeileis, A. (2006), "Object-Oriented Computation of Sandwich Estimators", *Journal of Statistical Software*, Vol. 16 No. 9.

Zink, M., Samaniego, L., Kumar, R., Thober, S., Mai, J., Schäfer, D. and Marx, A. (2016), "The German drought monitor", *Environmental Research Letters*, Vol. 11 No. 7, p. 74002.

[1] corresponding author, stefan.seifert@uni-goettingen.de
[A] Thünen Institute of Rural Studies, Johann Heinrich von Thünen Institute, Braunschweig
[B] Agricultural and Food Business Management Group, Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen
[C] Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle