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# Buyer-specific land valuation and prices: An empirical analysis of the farmland market in the Czech Republic

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# Buyer-specific Land Valuation and Prices

## An Empirical Analysis of the Farmland Market in the Czech Republic

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## Motivation & Objectives

Analyzing differences in land prices among various types of buyers can shed light on the functioning of land markets and future land ownership structures. This could reveal possible threats to land use efficiency, environment and rural development.

**Objectives**: • To analyze systematic differences in land prices and their distribution between non-agricultural and agricultural buyers (individual farms, limited liability companies, joint stock companies and cooperatives); • To explore buyer-type specific behavioral differences and market asymmetries; • To formulate expectations on future land market development.

## Land Market and Farm Structure in the Czech Republic

• Total of 3.5 million hectares of agricultural land; 45% of the total geographic area. • Highly fragmented ownership structure with ca. 1.1 million plot holders, result of private ownership restoration during the country's transition to a market economy. • In 1999, beginning of privatization of 600,000 hectares of state land; 87.5 % sold by 2010. • At the beginning of the 1990s, less than 0.5% of agricultural land was traded annually. Today, agricultural land trade amounts to more than 2.5 % of agricultural land. • Farmland price increased by 77% between 2005 and 2011. The Czech ag. land prices of 2,000-4000/ha are still significantly below the EU-15 average (in 2005, 13,362 €/ha (Eurostat, 2013)).

• The present farm structure still reveals a dual character specific to countries with a forced collectivization past (cf. Table 1). • There are four main legal forms of farm entities: individual private farms (IPFs), limited liability companies (Ltds), joint stock companies (JSCs), and cooperatives (coops) (cf. Table 1). • More than 70% of agricultural land is leased (in 2000 more than 90% of land was leased); share of land owned by agricultural businesses has thus increased.

**Table 1: Farm structure and agricultural land distribution in the Czech Republic (2000/2010)**

| Farm type | Number of farms | | Average (per farm) size of utilized ag. land (ha) | | Share of total ag. land (%) | | Share of own land in utilized ag. land (%) | |
|---|---|---|---|---|---|---|---|---|
| | 2000[1)] | 2010[2)] | 2000[1)] | 2010[2)] | 2000[1)] | 2010[2)] | 2000[1)] | 2010[2)] |
| Individual private farms | 20,115 | 15,321 | 42 | 62 | 23.5 | 27.3 | 26.6 | 47.0 |
| Limited liability companies | 1 171 | 1 751 | 669 | 458 | 21.7 | 23.0 | 1.7 | 20 |
| Joint stock companies | 519 | 649 | 1,502 | 1,374 | 21.6 | 25.6 | 0.8 | 10.9 |
| Cooperatives | 723 | 527 | 1,465 | 1,392 | 29.3 | 21.1 | 0.6 | 7.1 |
| Total | 26,640 | 22,746 | 136 | 152 | 100 | 100 | 8.4 | 23.5 |

*Notes:* [1) 2)] Data includes only farms using more than 3 hectares and 5 hectares of agricultural land, respectively.
*Sources*: MA (1994); CZSO (1996, 2001, 2012).

## Theoretical Considerations & Hypotheses

In a perfect land market, land is acquired by buyers with the highest bidding potential. Buyers of lower bidding potential acquire land only if they display non-uniform land-characteristic valuation and land is spatially heterogeneous. Observing asymmetric price deviations from the maximum bidding prices at given land characteristics are attributable to land market imperfections.

**H1**: Non-agricultural buyers are expected to have greater utility from and show higher price valuation of non-productive land characteristics (e.g., proximity to town/municipalities).

**H2**: Non-agricultural buyers are expected to display greater variability in land valuation than agricultural buyers (buyer-specific heteroscedasticity) due to more heterogeneous intentions and utilities.

**H3**: Agricultural buyers are expected to have higher utility from productive potential of land and thus to value (pay for) land quality more.

**H4**: Land prices are expected to be distributed asymmetrically due to market imperfections. Market asymmetries are expected to affect competition mainly among agricultural buyers.

## Methodology

**Stochastic frontier hedonic pricing model**

***Model 1***: Pooled bidding price frontier

$$log(p_i) = \propto_0 + \sum_{j=1}^{k} \propto_j x_{ji} + v_i - u_i$$

***Model 2***: Buyer-type-specific bidding price frontier

$$log(p_i) = \propto_0 + \sum_{j=1}^{k} \propto_j x_{ji} + \beta_0 AGbuyer_i + \sum_{j=1}^{k}\sum_{m\geq j}^{n} \beta_{jm} x_{ji}\, AGbuyer_i + v_i - u_i$$

For both models:

$$v_i \sim iid\ N(0, \sigma_{vi}^2);\ \sigma_{vi}^2 = \exp(w_i\delta) \qquad u_i \sim iid\ N^{+}(0, \sigma_{ui}^2);\ \sigma_{ui}^2 = \exp(z_i\vartheta)$$

$v_i$ - symmetric distribution component capturing "noise" and possible heteroscedasticity due to unobserved buyer-specific utility functions and information asymmetries.

$u_i$ - nonnegative distribution component representing land market imperfections with a discounting effect (relationship trading, bargaining position).

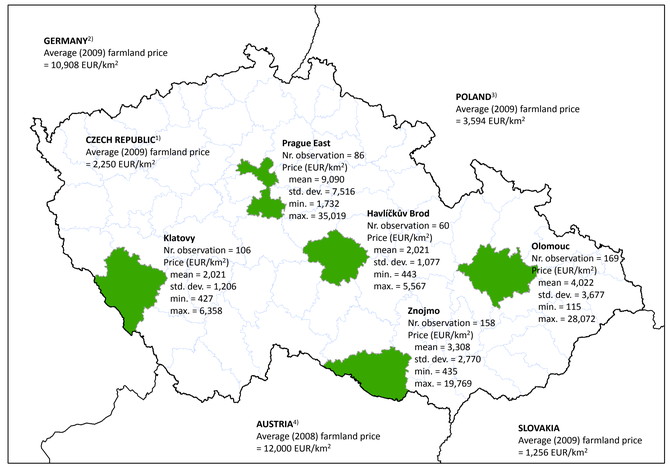


**Figure 1: Sample regions in the Czech Republic and main regional land price statistics**

*Sources*: [1)] Eurostat - Land Prices and Rents (2012); [2)] Statistiches Bundesamt (2011); [3)] Agricultural Statistical Yearbook (2011); [4)] Martos (2009).

## Data

- Data are extracted from individual contracts on farmland sale transactions registered with the Czech Cadastral and Mapping Office from 2008- 2010.
- 579 observations (contracts) from five districts of the Czech Rep. (cf. Figure 1).
- Extended by data from Czech Statistical Office on the location characteristics, e.g. plot distance to district city or cadastre municipality.

## Results

**Table 2: Moran's I statistics – test of spatial autocorrelation**

| | Moran's I statistic [a)] | Z-score (Normality) | Z-score (Randomisation) | P-value (Normality) | P-value (Randomisation) |
|---|---|---|---|---|---|
| Farmland unit price | 0.280 | 0.946 | 0.959 | 0.344 | 0.338 |

*Note*: [a)] $H_0$: prices or model residuals are spatially independent; $H_1$: prices or model residuals are not spatially independent.

**Table 3: Stochastic frontier hedonic pricing models** (base dummy = non-agricultural buyer)

| Dependent variable log unit price | Model 1 | | Model 2 | | | |
|---|---|---|---|---|---|---|
| | | | | | *AGbuyer * $x_j$* | |
| Variables $x_j$ | ∝ coefficients | *p*-values | ∝ coefficients | *p*-values | $\beta$ coefficients | *p*-values |
| Constant | 4.069*** | 0.000 | 5.844*** | 0.000 | -0.745*** | 0.000 |
| Log land quality (administrative price) | 0.165*** | 0.000 | 0.013 | 0.847 | 0.222** | 0.007 |
| Grassland (dummy) | -0.100 | 0.172 | -0.221* | 0.056 | 0.183 | 0.221 |
| Log number of purchased parcels | -0.004 | 0.909 | -0.051 | 0.204 | 0.011* | 0.071 |
| Log purchased area (km²) | -0.131*** | 0.000 | -0.237*** | 0.000 | 0.180*** | 0.000 |
| Log number of farms/km² in the cadastre | -0.095** | 0.040 | -0.085 | 0.233 | 0.012 | 0.899 |
| Log plots' (weighted) distance to district town | -0.317*** | 0.000 | -0.307*** | 0.000 | 0.036 | 0.722 |
| Sale of municipal land (dummy) | 0.332** | 0.015 | 0.034 | 0.897 | 0.329 | 0.276 |
| Number of sale contracts/buyer | -0.038*** | 0.000 | -0.054*** | 0.000 | 0.046*** | 0.003 |
| $\ln(\sigma_v^2)$ | | | | | | |
| Constant | -1.102*** | 0.000 | -1.758*** | 0.000 | | |
| Agricultural buyer (dummy) | -0.941*** | 0.000 | -0.178 | 0.529 | | |
| $\ln(\sigma_u^2)$ | | | | | | |
| Constant | 3.336*** | 0.009 | 3.925*** | 0.001 | | |
| Individual farm (dummy) | 0.504* | 0.061 | -1.036** | 0.025 | | |
| Limited liability company (dummy) | 0.007 | 0.985 | -1.758*** | 0.006 | | |
| Joint stock company (dummy) | 0.927** | 0.015 | -0.614 | 0.249 | | |
| Cooperative (dummy) | 0.781* | 0.060 | -0.900 | 0.126 | | |
| Number of sale contracts/buyer | -0.213*** | 0.001 | -0.183*** | 0.000 | | |
| Log purchased area (km²) | -0.497*** | 0.000 | -0.449*** | 0.000 | | |
| Wald $\chi^2$ (df) | 496.19 (14) | 0.000 | 620.60 (29) | 0.000 | | |
| Log likelihood | -485.946 | | -458.220 | | | |

*Note*: Estimations were carried out with STATA 12; time and regional dummies are not displayed.

## Conclusions

The results provide strong evidence of buyer-specific valuation of land's productive and site characteristics, as well as systematic differences in land market conditions among groups of buyers, both of which affect the land price.

Non-agricultural buyers significantly overbid agricultural buyers, particularly on land location. As opposed to non-agricultural buyers, prices paid by agricultural buyers are significantly determined by land quality. With increasing size of traded land, non-agricultural buyers bid lower prices (they are mainly smaller investors investing accumulated savings). Non-agricultural buyers who trade more frequently achieve lower prices (information advantage).

The frontier approach to land market analysis reveals significant price asymmetries. Among agricultural buyers, joint stock companies and cooperatives enjoy major land price discounts, while individual private farms and limited liability companies face land market access constraints that are surmountable only through paying significantly higher prices. These results suggest constrained growth possibilities for individual farms and limited liability companies, and have negative implications for the development of land use efficiency and rural areas.

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