Land Pricing Model: Price Re-evaluation Due to the Erosion and Climate Change Effects

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Abstract

The aim of this study is to derive and apply the hedonic approach for determining and updating official land prices with respect to e.g. the impact of climate change that has occurred in the conditions of the Czech Republic in recent years. Pricing using the hedonic method is based on capturing individual factors separately. The evaluated soil ecological unit code consists of a 5-digit numerical code, which expresses the affiliation to the climate region (0-9, see table 1), the main soil unit (0-78), the slope of the land and the orientation to the point of the compass (0-9) and also the depth of the soil profile and skeletality (0-9). The derived hedonic pricing model is estimated using heteroscedasticity corrected estimator. The fitted model shows considerably high explanatory power and together with high parameter significance for majority of dummy variables (soil characteristics) as well as with theoretical and logical consistency represent a tool for new official land price settings in the process of land reevaluation due to the erosion and climate change effects.

Keywords

Introduction

Agricultural land is generally classified together with labour and capital as the fundamental factor of production for the functioning of a market economy. In this respect, soil is a very specific production factor, as its properties do not allow reproduction, relocation and at the same time the soil has a limited extent. For the above reasons, it is therefore necessary to protect this production resource in a certain way for future generations, as the landscape is the most important element of multifunctional agriculture (Cahill, 2001).

Setting the right policy for the use of individual production resources is a key factor for the economic and social development of individual countries. Land tenure and protection also play a key role in the sustainable development of the countryside and rural areas (Schwarcz et al., 2013).

An important issue is the correct setting of the land price, as it also serves to determine the tax liability of real estate. Many studies around the world have dealt with pricing and the influence of factors on price.

The value of a land usually reflects the quality of the soil, qualitative characteristics, which, however, relate only to the agricultural use. The results of mathematical models explaining the differences in land prices among countries suggest that almost two-thirds of these are attributed to non-agricultural uses, which can significantly distort the production function (Peterson, 1986). These findings are confirmed by recent studies, where the results lead to a similar conclusion, revealing that the agricultural land prices are only partially explained by agricultural yields (production function), and other non-production factors also enter the land price (Borchers, Ifft, and Kuethe, 2014). For these reasons, Garcia and Grande (2003) suggest the use of statistical techniques and methods based on multidimensional analysis to value agricultural land, which refines and simplifies the identification of variables involved in the valuation of agricultural land.

If we focus on the production factors influencing the price of agricultural land, then e.g., Nickerson et al. (2012) showed a positive correlation between soil quality and soil price. Based on the division

of land into three categories (high, medium and low quality), it can be quantified that medium quality soils were 5% cheaper than high quality soils. Cotteleer et al. (2007) add that agricultural land prices are also affected by land fragmentation.

According to Kocur-Bera (2016), the key variables influencing the price of agricultural land are the location of land in relation to rural settlements, soil quality, soil fragmentation, forest cover and also the location of farms in less-favoured areas (LFA) for agricultural production.

In Poland, the results show the key importance of areas of rural functional types (agritourism areas), which received on average 43% higher prices than in conventional agricultural areas. In addition, the results show that payments within the LFA area and agri-environmental payments decapitalize land value (Czyzewski, Przekota and Poczta-Wajda, 2017). Gelan and Schwarz (2008) point out that in Scotland, single payments have significantly greater negative effects (with respect to land price) on farms in LFA areas than on farms located outside these areas, and local circumstances need to be taken into account when adjusting the common agricultural policy (CAP).

Another factor influencing the price of land is the access to transport infrastructure. In their study, Sheng, Jackson and Lawson (2018) or Eagle et al. (2015) state that a 1% reduction in transport costs between farmers and ports leads to a 0.33% increase in land prices and there is no significant difference between modes of transport. (road, rail, etc.). Similar conclusions are reached by Woch et al. (2011), when the distance of agricultural land from rural settlements reduces farm incomes and thus indirectly reduces the price of agricultural land. Cavailhès and Thomas (2013) in a survey of Belgian municipalities (589 municipalities) conclude that the price of agricultural land is falling by 2.5% for each km of distance from the municipality.

At a time of reducing total emissions, the results of a land use study are also interesting. The results show that agricultural land built up by solar panels increases the prices of the surrounding agricultural land in the range of 3.4% -37% (depending on the distance from the solar panels) compared to the average market price of agricultural land in the area. In developing countries, this fact also has negative consequences, as potential land tenants or buyers cannot afford to rent/buy agricultural land at a higher price (Lai Mei-Chun et al., 2019).

In Sweden, Nilsson and Johansson (2013) analysed

the determinants of agricultural land prices with a focus on area-specific factors. The results show that for areas with low land prices, CAP (single payments for farmers) subsidies have the highest impact. The impact of subsidies under the CAP is also confirmed by Kocur-Bera (2016), where individual subsidies increase the prices of agricultural property, and therefore agricultural land. This conclusion is also reached by Latruffe and Mouel (2009), who state that the aid increases the price of agricultural land (and rent), which favours landowners over agricultural producers.

Agricultural land has been subject to increasing intensification in recent years and it is necessary to prevent deterioration of soil quality. The basic theoretical premise is that landowners have a higher motivation to maintain the quality of land than its tenants. Daedlow, Lemke and Helming (2018) did not demonstrate this premise, and concluded that no clear relationship could be distinguished between the variables used in the model.

Climate change (for example temperature, precipitation), which has occurred in recent decades, can have very serious consequences for agricultural production. For some areas, on the contrary, climate change is an opportunity. Schmitz et al. (2014) point to the fact that 7 out of 10 scenarios in their study assume an increase in fertile soil of 10-25% compared to 2005 (only 1 scenario assumes a decrease). In all models, areas are expanding in South America and sub-Saharan Africa.

In recent years, drought and dryness have become key issues on a global scale (especially in Europe), mainly due to environmental and socio-economic impacts. Drought reduces the biological and economic productivity of ecosystems. Salvati et al. (2012) point to the fact that during the period 2004-2007, more than 50% of the surveyed areas were classified as dry, compared to 0% for the period 2000-2003.

Bozzola et al. (2017) point to the fact that farm incomes are very sensitive to seasonal changes in temperature and precipitation, whereas farms with an irrigation system have the main advantage in this regard. Similar results are obtained by Hossain et al. (2019), when farmers' incomes are influenced mainly by the temperature and the ability of agricultural holdings to use irrigation equipment. The results show that the implementation of global models on climate change can have an impact on income growth in this area, namely by 25-84 USD per hectare.

Chatzopoulos and Lippert (2015) examine the impact of climate change on land prices and assess the impact on individual farm types. Some findings are interesting from the results - with higher temperatures, permanent crops predominate, while in areas with higher precipitation, fodder crops dominates. Land rental prices (lease fees) show concave reactions to the growth of annual precipitation and at the same time increase linearly with increasing temperature. Due to the expected rise in temperatures, climate change is beneficial for most farmers, with the exception of feed producing farmers.

Belyaeva and Bokusheva (2018) analyse the impact of climate change on cereal production in the Russian Federation. For some areas (northern and Siberian), the results show a positive impact of climate change on production. However, due to the high negative impact on the most productive areas in the south of the country, the overall impact of climate change is assessed as negative.

The significant rise in agricultural land prices has led to discussions about the need for more intensive interventions in agricultural land markets. However, changed or new interventions in agricultural land markets should be based on previous analyses of the factors causing the price differences (Lehn and Bahrs, 2018). Ferguson, Furtan and Carlberg (2006) state that one of the ubiquitous forms of agricultural regulation is the restriction of ownership of agricultural land. An example of a restriction on agricultural land ownership is, for example, the Saskatchewan Farmers' Safety Act in Canada. The regulation reduced the prices of Saskatchewan farmland by an average of $ 4 to $ 34 / acre in 1974.

As already mentioned, the price of agricultural land also serves to determine the tax liability. In this case, it is necessary to distinguish two basic types of prices - market and official. Official prices are important in determining the production potential of specific soils in different areas with different natural, ecological or environmental conditions. As stated by Bradáčová (2007), the official price of land enters into property and fiscal relations, but also in soil protection.

In some countries, the official price of land, which is lower than the market price, is used to reduce the tax liability. In the USA, for example, the difference between the tax liability of agricultural entities using the official price and the market price is estimated at USD 60 million. The official price of land is given by the cadastral value - the official price is used, for example, in Austria, Belgium, Denmark, Latvia, Switzerland, the Czech Republic or in the USA. A more detailed comparison of individual EU countries shows that the obligations of individual agricultural entities are very different in terms of calculation methodology, applied rates or what is actually the subject of taxation (OECD, 2019).

Exemptions from land or agricultural property tax is in practise, for example, in the following countries: Australia, Canada (some provinces), Finland, Italy, Japan, Slovenia (excluding farm buildings), Sweden, and the United Kingdom. In some countries, on the other hand, only buildings used for agricultural production are exempt from tax or the tax is significantly reduced - for example, France, Hungary, Latvia, Lithuania, Norway, Poland, etc. Alternatively, reduced tax rates may be applied to farmers for calculation of tax liability from land or agricultural buildings - these are, for example, countries: Belgium, the Czech Republic, Denmark, Estonia, France, etc. A more detailed comparison of the Czech Republic and selected neighbouring countries shows a significant difference in the calculation of tax liability for agricultural entities. In the Czech Republic, the tax base for agricultural land is determined by the product of the acreage of land and the price determined by Decree No. 288/2018 Coll., which sets the list of cadastral areas with assigned average land prices. If we multiply the tax base by a percentage rate of 0.25% - 0.75% (depending on the type of agricultural land), we get the resulting tax liability.

In Poland, real estate tax is calculated as part of the so-called agricultural tax. The rate depends on the average purchase prices of rye, which will be announced by the President of the Statistical Office within 20 days after the end of the 3rd quarter. The municipal council may, by decree, reduce the purchase price of rye for the area where it is locally competent to determine the agricultural tax. According to the law, the tax base is a land size that exceeds 1 hectare and is either real or recalculated depending on whether the land is included in the agricultural holding or not. The recalculated area depends on the so-called conversion coefficients, which are determined depending on the type of land, the classification of the land into a class and the location of the land in one of the 4 districts. The amount of rye depends on whether it is land of agricultural or not. For agricultural land, the rate of rye is 2.5 q (quintal) and for non-agricultural land, the rate is higher and is 5 q of rye.

In Germany, property tax is governed by the Grundsteuergesetz (GrStG). According to § 2 of the GrStG, agricultural and forestry land, buildings and units in Germany are subject to real estate tax. German tax legislation distinguishes between real estate tax A (agrarian), which is levied on agricultural land, and real estate tax B (construction), which applies to built-up or buildable land and buildings. As in the Czech Republic, the law does not distinguish between property owned by a natural or legal person. The tax base is determined on the basis of property valuation and is determined by the local authority. The valuation of assets is determined in accordance with different valuation regulations for different types of assets. A tax rate of 6% applies to agricultural and forestry enterprises.

Materials and methods

The aim of this study is to apply the hedonic approach for determining and updating official land prices with respect to e.g. the impact of climate change that has occurred in the conditions of the Czech Republic in recent years. Another need for the robust tool for setting the official land price is the introduction of new land codes and more detailed land price stratification.

The supporting data are based on a comprehensive soil survey (1960-1970), which is a combination of soil survey and agronomic survey to determine nutrient levels, soil reactions, etc. The comprehensive soil survey is then based on the evaluation of soils, where the goal is the economic valuation of individual factors of the area (climate, relief, soil unit). The valuation is based on different production and cost assumptions of individual types of agricultural land, which are expressed by evaluated soil ecological unit (ESEU) - which is the basic unit of agricultural land valuation. The basis of the ESEU valuation is the creation of valuation type structures (VTS), which express the shares of the appropriate representation of the most important crops on arable land, on the basis of which the individual ESEU codes are valued using the scoring method. The economic valuation itself is calculated on the basis of the gross annual rent effect (GARE), which represents the difference between revenues and costs in the parameterized crop production in a given VTS. There are currently 2318 defined ESEU codes for the Czech Republic. From the above, the obsolescence of the data on which the entire calculation is based is evident - despite minor updates. The determination of climate regions does not currently meet the criteria - usually it refers to a higher average temperature than that assigned by the methodology to the climate region and a lower total annual precipitation than defined in the climate regions.

Pricing using the hedonic method consists in separating the individual factors entering into the final pricing. The ESEU code consists of a 5-digit numerical code, which expresses the affiliation to the climate region (0-9, see table 1), the main soil unit (0-78), the slope of the land and the orientation to the point of the compass (0-9) and also the depth of the soil profile and skeletality (0-9). In the second phase, a hedonic econometric model was specified using these variables. A total of 2,172 ESEU codes were used in accordance with applicable legislation (Decree No. 441/2013 Coll.), the rest of the codes have not yet been valued within the conditions of the Czech Republic. The data for the calculation and application of the hedonic method are based on Act no. 441/2013 Coll. (annex no. 1) – there are the prices of individual ESEU valid for the given period. The hedonic model will be used for valuation of other ESEU, that have not yet been valued (there is no valuation for 146 code).

Model specification:

$$Y_i = f(K, SDR, SDRH, D) \qquad (1)$$

where Y_i is a price of ESEU (CZK/m^2), K stands for a vector of dummy variables on climate region, SDR is a vector of dummies on the combine characteristics of the land slope and exposition, SDRH represents a vector of dummies for the combine effect of the depth of soil profile and skeletality and D is a vector of dummy variables representing the main soil unit. The detail variable specification is provided in Table 1.

We apply a heteroscedastic corrected linear regression model to estimate parameters of model (1).

Dummy variable	Specification
K1	Climate region 1 – warm, dry
K2	Climate region 2 – warm, slightly dry
K3	Climate region 3 – warm, slightly moist
K4	Climate region 4 – slightly warm, dry
K5	Climate region 5 – slightly warm, slightly humid
K6	Climate region 6 – slightly warm, warm, very humid
K7	Climate region 7 – slightly warm, humid
K8	Climate region 8 – slightly cold, humid
K9	Climate region 9 – cold, moist
SDR1	Land slope: 3-7 degrees, exposition: without exposition
SDR2	Land slope: 3-7 degrees, exposition: south
SDR3	Land slope: 3-7 degrees, exposition: north
SDR4	Land slope: 7-12 degrees, exposition: south
SDR5	Land slope: 7-12 degrees, exposition: north
SDR6	Land slope: 12-17 degrees, exposition: south
SDR7	Land slope: 12-17 degrees, exposition: north
SDR8	Land slope: 17-25 degrees, exposition: south
SDR9	Land slope: 17-25 degrees, exposition: north
SDRH1	Depth of soil profile: 30/60 cm and more, skeletality: skeletaless to weakly skeletal
SDRH2	Depth of soil profile: 60 cm and more, skeletality: weakly skeletal
SDRH3	Depth of soil profile: 60 cm and more, skeletality: moderately skeletal
SDRH4	Depth of soil profile: 30 cm and more, skeletality: moderately skeletal
SDRH5	Depth of soil profile: less than 30 cm, skeletality: weakly skeletal
SDRH6	Depth of soil profile: less than 30 cm, skeletality: moderately skeletal
SDRH7	Depth of soil profile: 30 cm and more, skeletality: weakly skeletal*
SDRH8	Depth of soil profile: 30 - 60 cm, skeletality: strongly skeletal
SDRH9	Depth of soil profile: 30 - 60 cm, skeletality: moderately skeletal
D_2 till D_76	Dummies for each main soil unit

Note: * applies to soil units with land slope above 12 degrees (soil unit 40, 41)
Source: Author's own processing

Table 1: Model variable specification

Results and discussion

Table 2 provides parameter estimates of hedonic pricing model (1). The majority of fitted parameters are highly significant, even at 1 % significance level. The only exceptions are 9 out of 75 parameters on the main soil unit.

We employed the heteroscedasticity corrected estimator since the original estimate of linear regression model contained the heteroscedastic error structure. The R^2, as a measure of goodness fit, with other model statistical characteristic (Table 3) indicate good statistical properties. In particularly, $R^2 = 0.945$, shows that 94.5 % of the variability of official land prices is explained by employed dummy variables. The high explanatory power of the hedonic model with high parameter significance for majority of dummies (soil characteristics) are important factors determining the robustness of the official land price model as a tool for new price settings. However, another important model characteristic that must be met by the estimate is the logical consistence of fitted parameters.

The parameters of dummy variables for climate regions show the following patterns. The parameters represent the change in the official land price (CZK/m^2) with respect to the based region, in this case K0 – very warm and dry region. That is, the parameter of K1 – warm and dry region – indicate that the price for this region is lower by 0.62 CZK/m^2 as compared to the K0 region.

Variable	Coefficient	Std.error	p-value		Variable	Coefficient	Std.error	p-value	
const	14.999	0.374	0.000	***	D_25	-5.139	0.391	0.000	***
K1	-0.620	0.081	0.000	***	D_26	-6.143	0.385	0.000	***
K2	0.343	0.084	0.000	***	D_27	-6.344	0.391	0.000	***
K3	1.398	0.089	0.000	***	D_28	-5.131	0.390	0.000	***
K4	-0.885	0.082	0.000	***	D_29	-5.992	0.390	0.000	***
K5	-0.202	0.078	0.000	***	D_30	-5.672	0.394	0.000	***
K6	-0.300	0.076	0.000	***	D_31	-6.407	0.389	0.000	***
K7	-1.327	0.087	0.000	***	D_32	-6.904	0.393	0.000	***
K8	-1.751	0.126	0.000	***	D_33	-5.430	0.399	0.000	***
K9	-1.305	0.165	0.000	***	D_34	-6.612	0.470	0.000	***
SDR1	-1.055	0.042	0.000	***	D_35	-6.544	0.485	0.000	***
SDR2	-1.360	0.104	0.000	***	D_36	-7.734	0.554	0.000	***
SDR3	-1.331	0.111	0.000	***	D_37	-0.104	0.126	0.407	
SDR4	-2.061	0.044	0.000	***	D_39	0.241	0.409	0.556	
SDR5	-1.996	0.044	0.000	***	D_40	0.044	0.265	0.869	
SDR6	-1.085	0.379	0.004	***	D_41	0.064	0.262	0.806	
SDR7	-1.084	0.404	0.007	***	D_42	-3.921	0.486	0.000	***
SDR8	-1.088	0.450	0.016	**	D_43	-4.878	0.415	0.000	***
SDR9	-1.085	0.496	0.029	**	D_44	-5.486	0.496	0.000	***
SDRH1	-1.090	0.121	0.000	***	D_45	-5.023	0.421	0.000	***
SDRH2	-1.329	0.074	0.000	***	D_46	-6.672	0.406	0.000	***
SDRH3	-1.871	0.077	0.000	***	D_47	-7.513	0.370	0.000	***
SDRH4	-3.425	0.127	0.000	***	D_48	-7.033	0.392	0.000	***
SDRH5	-11.226	0.383	0.000	***	D_49	-7.914	0.390	0.000	***
SDRH6	-11.516	0.386	0.000	***	D_50	-6.836	0.389	0.000	***
SDRH7	-12.365	0.600	0.000	***	D_51	-7.971	0.383	0.000	***
SDRH8	-12.378	0.599	0.000	***	D_52	-7.501	0.389	0.000	***
SDRH9	-12.398	0.568	0.000	***	D_53	-7.491	0.393	0.000	***
D_2	0.174	0.690	0.800		D_54	-8.337	0.386	0.000	***
D_3	1.545	0.940	0.100		D_55	-7.139	0.486	0.000	***
D_4	-6.712	0.418	0.000	***	D_56	-3.549	0.820	0.000	***
D_5	-4.982	0.506	0.000	***	D_57	-5.388	0.961	0.000	***
D_6	-2.942	0.428	0.000	***	D_58	-6.179	0.759	0.000	***
D_7	-3.685	0.555	0.000	***	D_59	-7.418	0.536	0.000	***
D_8	-4.104	0.397	0.000	***	D_60	-1.209	1.053	0.251	
D_9	-0.056	0.750	0.941		D_61	-2.923	1.076	0.007	***
D_10	-0.203	0.465	0.662		D_62	-4.988	0.548	0.000	***
D_11	-1.906	0.426	0.000	***	D_63	-9.568	0.470	0.000	***
D_12	-2.597	0.425	0.000	***	D_64	-7.729	0.405	0.000	***
D_13	-3.939	0.388	0.000	***	D_65	-9.895	0.431	0.000	***
D_14	-2.719	0.396	0.000	***	D_66	-11.918	0.499	0.000	***
D_15	-3.848	0.403	0.000	***	D_67	-12.139	0.450	0.000	***
D_16	-6.051	0.413	0.000	***	D_68	-10.612	0.424	0.000	***
D_17	-7.826	0.382	0.000	***	D_69	-11.943	0.430	0.000	***
D_18	-5.712	0.396	0.000	***	D_70	-10.077	0.422	0.000	***
D_19	-4.970	0.400	0.000	***	D_71	-10.699	0.418	0.000	***
D_20	-6.287	0.386	0.000	***	D_72	-11.887	0.446	0.000	***
D_21	-8.713	0.372	0.000	***	D_73	-10.349	0.400	0.000	***
D_22	-7.679	0.372	0.000	***	D_74	-10.344	0.400	0.000	***
D_23	-7.560	0.381	0.000	***	D_75	-9.847	0.399	0.000	***
D_24	-5.435	0.394	0.000	***	D_76	-9.842	0.400	0.000	***

Note: ***, **, * indicate the level of significance 1%, 5 % or 10%, respectively
Source: Author's estimate

Table 2: Parameter estimate of hedonic pricing model.

Then, the marginal effects of regions K2 – warm and modestly dry - and K3 – warm and modestly moist - are positive, i.e. the marginal prices for these regions are higher by 0.343 and 1.398 CZK/m², respectively. The marginal effects for regions K4 till K9 are negative with increasing values from K5 till K8. This estimated marginal prices and the difference among the prices are consistent with our expectations.

Sum squared residuals	6614.4	S.E. of regression	1.788
R-squared	0.945	Adjusted R-squared	0.942
F(102, 2069)	345.2	P-value(F)	0.000

Source: Author's own processing

Table 3: Statistical characteristics of fitted model.

The combine characteristics of the land slope and exposition show negative marginal prices with respect to the SDR0 – flatland without exposition. SDR1 – modest slope (3 – 7 degrees) without exposition – has the price by 1.055 CZK/m2 lower as compared to SDR0. Analogically, SDR2 – slope 3-7 degrees, south exposition - has lower price by 1.360 CZK/m², SDR3 – slope 3-7 degrees, north exposition - by 1.331 CZK/m², SDR4 – slope 7-12 degrees, south exposition by 2.061 CZK/m², SDR5 – slope 7-12 degrees, north exposition - by 1.996 CZK/m², SDR6 – slope 12-17 degrees, south exposition - by 1.085 CZK/m², SDR7 – slope 12-17 degrees, north exposition - by 1.084 CZK/m², SDR8 – slope 17-25 degrees, south exposition - by 1.088 CZK/m² and finally SDR9 slope 17-25 degrees, north exposition - by 1.085 CZK/m². That is, we can observe similar prices for the soils with the same slope and slopes higher than 12 degrees (this is the case of SDR6 till SDR9 with the slope 12 till 25 degrees).

The combine characteristics of the depth of soil profile and skeletality show similar patterns. That is, the estimates indicate negative effects of the soil types as compared to the SDRH0 – depth of soil profile more than 60 cm and skeletaless. In particular, SDRH1 – with depth of soil profile 30 cm and more and skeletaless or weakly skeletal – has the price lower by 1.09 CZK/m2, SDRH2 – with depth of soil more than 60 cm and weakly skeletal - by 1.329 CZK/m², SDRH3 – with depth of soil more than 60 cm and moderately skeletal - by 1.871 CZK/m², SDRH4 – with depth of soil more than 30 cm and moderately skeletal - by 3.425 CZK/m², SDRH5 – with depth of soil less than 30 cm and weakly skeletal - by 11.226 CZK/m², SDRH6 – with depth of soil less than 30 cm and moderately skeletal - by 11.516 CZK/m², SDRH7 – with depth of soil more than 30 cm and weakly skeletal - by 12.365 CZK/m² (applies for soil units with land slope above 12 degree), SDRH8 – with depth of soil more than 30 cm till 60 cm and strongly skeletal - by 12.378 CZK/m², and SDRH9 – with depth of soil more than 30 cm till 60 cm and moderately skeletal - by 12.398 CZK/m². That is, the soil with SDRH5 till SDRH9 belongs to the group of less quality soils and have considerable lower price. Similar results are achieved by a study that evaluates the impact of certain factors on the agricultural land market (one of the factors is agronomic factors). From the results we can confirm the basic assumption that with the quality of the soil goes up the price (O´Donoghue et al., 2015).

Finally, the parameters of dummy variables for each main soil unit indicate different prices. However, the values are consistent with the assumption about the positive relation between the price and soil quality. The decomposition of the main soil unit value is the subject of the next research activities.

Figure 1 demonstrates ESEU characterization and structure of the selected area, in this case the part of cadastral community in Šardice before actualization in 1973 serves as an example. Figure 2 presents the same area but with ESEU characterization after the actualization in 2000. The figures indicate the different soil characteristics when mapping the area more in detail. This helps to better evaluate the different soil quality with subsequent economic consequences. For this reason and for updating the soil quality in dynamic perspective the robust, solid and unbiased method for price setting is needed. This study is the first and considerably promising attempt to provide such a tool.
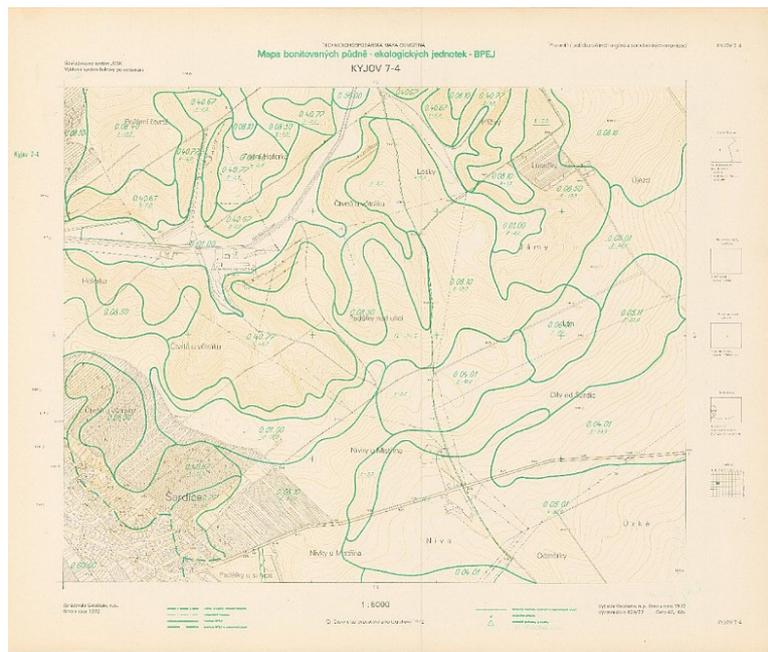
Source: VÚMOP

Figure 1: ESEU in cadastral community Šardice – before actualisation in 1973.
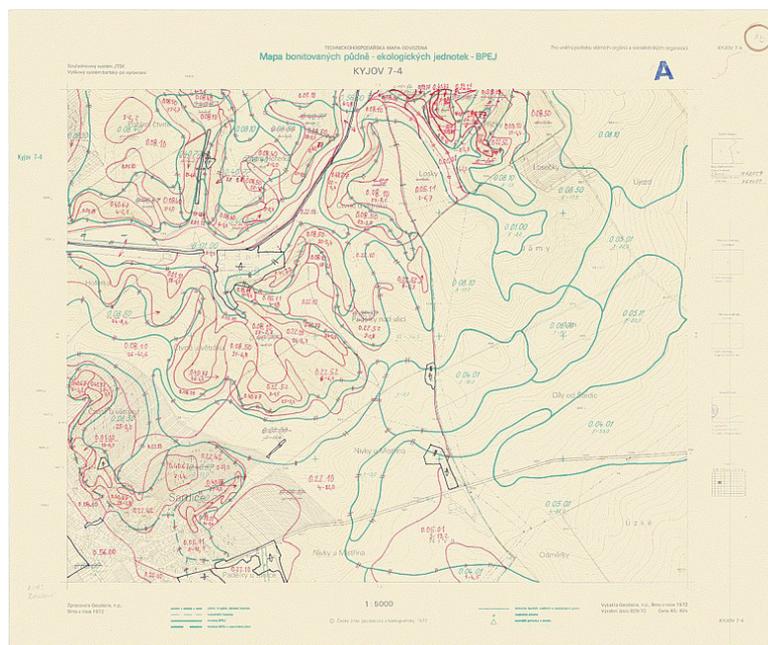
Source: VÚMOP

Figure 2: ESEU in cadastral community Šardice – after actualisation in 2000.

Conclusion

The overall good statistical, econometric properties with high explanatory power and especially the economic and logical consistency of fitted parameters suggest that the fitted hedonic pricing model might be a good candidate for the calculation of new official land prices or recalculation of the current prices due to the changes in soil code specification.

Currently, according to the valid legislation in the Czech Republic, there are 2172 ESEU codes. At the same time, in the coming years it is planned to expand the main soil units with other types and to adjust the classification of individual

ESEU into climate regions. In the context of these changes, the presented model is easy to apply due to the very good overall statistics. The advantage of the hedonic approach in determining the price of individual ESEU codes is primarily the speed with which the resulting model can respond to changes in individual influencing parameters. The resulting model serves as a tool for possible recalculation of ESEU prices in the case of a change in the first input parameter, which is defined as a climate region (the climate region is characterized by average temperatures, precipitation, etc.). The use of the resulting econometric model consists in the possible application by the state administration, which is in charge of this issue. At the same time, the valuation problem of individual

ESEUs is marginally reflected in the calculation of the official price of land, from which the tax liability (real estate tax) for individual business entities managing agricultural land is subsequently calculated. Due to the nature of these circumstances, it is necessary to verify and sensitively assess the possible impacts on tax collection and the impact on individual private entities.

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