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The taxation of agricultural land with the use of multi-criteria analysis

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Abstract: The issue of land taxation is currently often neglected in scientific articles despite the existence of the land taxation and property taxes in most countries of the European Union. This paper deals with a specific property tax in the Czech Republic – the tax on the acquisition of immovable property. The aim of the paper is, on the one hand, to characterise the tax on the acquisition of immovable property, its general principles and the classification in land taxation, and on the other hand, to analyse the possibilities of a tax entity for the tax base determination and the tax liability calculation. For this purpose, a model example of taxation of the transfer of immovable property for consideration is used, to which the method of the multi-criteria decision-making is applied as an opportunity to use the mathematical methods for the transactional property tax. Based on the method of the multi-criteria analysis of alternatives, it was found that in the model example, it was more advantageous for the tax entity to use the indicative value.

Keywords: agricultural land, multi-criteria analysis, land taxation, tax entity, tax on acquisition of immovable property, transfer for consideration

The standard economic theory understands the land as one of three primary sources (apart from labour and capital), which is rare, limited and used for the production and business activities, infrastructure, dwellings and living space for the population.

During the feudalism and at the beginning of capitalism, the theory of land economics takes an important role in the research of economists at that time (the issue of land in economic theories also Honová 2009). It were probably the physiocrats, who attached the greatest importance to the agricultural land; their most famous representative is François Quesnay (the core work from 1758). Physiocrats hold the view that the origin of all wealth comes from agriculture and land cultivation; they profess the so-called tax monism, which suggests the existence of only one tax – a tax on land rents (closer Evans 2004). Adam Smith extends the theory of land reform with the classification based on its yield, defines the monopoly rent and in the terms of quality puts the activities in agriculture on a higher level than the manufacturing activity (Smith 1982). A short list of economists who assign an important role to land and its taxation may be concluded with Thomas Malthus (1815), who, true to his theory of accelerated population growth, describes the declining

agricultural yields, land scarcity and the differential rent (Malthus 1815).

The current economic research tends to underestimate the importance of land, agriculture and even the property taxes, for example, 4 pages are devoted to this issue in the prestigious book *The Economics of Taxation* (James and Nobes 2013).

Apart from the classification of the land taxes into the tax system and their characteristics, this paper aims to analyse the tax on the acquisition of immovable property in the Czech Republic, to specify the basic principles and to analyse the options of the tax entity during the determination of the tax base and the calculation of the tax on the transfer of agricultural land for consideration. Using the method of the multi-criteria decision-making, the variant of determining the comparative tax value using the indicative value is compared to the variant of determining the indicative value using the determined price. Results of this research may be the guideline for a further research in the area of property taxes.

MATERIAL AND METHODS

According to the international methodology (OECD 2015), property taxes are classified to the group 4000,

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as illustrated by Table 1. Apart from the road tax that has no relation to the soil, there are other property taxes in the Czech Republic, which are based on the soil (land or buildings located on them) – the tax on immovable property and the tax on acquisition of immovable property (the inheritance and gift tax were cancelled). These taxes are not harmonized within the European Union (Zodrow 2006), and this is why their presence in the tax system of the member states, the actual tax construction and its rates are left in the powers of the national governments (see Schellekens 2014). In practice, it is then possible to see both unit property taxes and ad valorem taxes (the difference between the impact of unit tax and ad valorem tax in more detail in Akai et al. 2011 or Šíroký and Strílková 2015), as well as their place in the system of the public budgets, which receive revenues from these taxes (OECD 2014).

Last but not least, it is important to realize that the land as the primary factor of production is not only taxed as such, but its products may be subject

to the tax as well (as stated by David 2012), and in the modern economies, the whole area is a centre of the state intervention (in more detail Severová et al. 2012).

Here, the subject of interest is the tax on the acquisition of immovable property. Since 1st January 2014, the transfer of immovable property for consideration in the Czech Republic is subject to the tax on the acquisition of immovable property, which applies to transfers of the immovable property for consideration. This tax replaced the real estate transfer tax. It is an entirely new tax, which cannot be confused with the real estate transfer tax, although some principles have been maintained. The tax on the acquisition of immovable property has been enacted in the form of a statutory measure of the Senate No. 340/2013 Sb. (Coll. of Laws of the Czech Republic 2014).

The legislative regulation in question is briefly described in the introductory part of the text to provide a basic understanding of the subject as of 31st May 2015. In addition to the initial description of the problem and the legislation study, the paper also uses the general theoretical methods of the classification analysis, deduction and induction with the subsequent synthesis of the lessons learned from the results obtained. From the special scientific methods, the method of mathematical-econometric approach was used by the means of the multi-criteria evaluation of the research problem.

The task of the multi-criteria decision-making addresses problems when the optimal decision must comply with more than one criterion. The criteria may be both of a quantitative and qualitative nature, or they may be maximizing and minimizing. They may even be in conflict with each other. If the set of alternatives consists of a finite number of alternatives, it is a case of the multiple-criteria evaluation of alternatives. If the set of the possible alternatives is specified with conditions, and those must be met during the selection of the optimal alternative, it is a case of the multiple-criteria programming problem (in more detail Bierman et al. 1986).

In the following part of the paper, the problem of determining the comparative tax value for the tax on the acquisition of immovable property will be mathematically formulated and solved, either with the indicative value or determined price. When determining the weights (importance factors), the team of authors draw on the experience of its female member from the practice in the tax office and also the narrative interviews.

Table 1. The OECD classification of taxes

1000	Taxes on income, profits and capital gains
1100	Taxes on income, profits and capital gains of individuals
1200	Corporate taxes on income, profits and capital gains
1300	Unallocable as between 1100 and 1200
2000	Social security contributions
2100	Employees
2200	Employers
2300	Self-employed or non-employed
2400	Unallocable as between 2100, 2200 and 2300
3000	Taxes on payroll and workforce
4000	Taxes on property
4100	Recurrent taxes on immovable property
4200	Recurrent taxes on net wealth
4300	Estate, inheritance and gift taxes
4400	Taxes on financial and capital transactions
4500	Other non-recurrent taxes on property
4600	Other recurrent taxes on property
5000	Taxes on goods and services
5100	Taxes on production, sale, transfer, leasing and delivery of goods and rendering of services
5200	Taxes on use of goods, or on permission to use goods or perform activities
5300	Unallocable as between 5100 and 5200
6000	Other taxes

Source: OECD (2015)

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The transfer of ownership rights to the immovable property for consideration is a subject to the tax on the acquisition of immovable property; the property can be land, building, a part of underground services or a unit located in the Czech Republic. As for the acquisition of the ownership right by purchase or exchange, the transferor (seller) of the ownership right to the immovable property is the taxpayer. This does not apply if the transferor and transferee agreed in the purchase or exchange contract that the tax will be paid by the transferee. In all other cases, the taxpayer is the transferee (the buyer). The tax base is the acquisition value minus the deductible expenses. A deductible expense is a reward and any other costs demonstrably paid by the taxpayer to an expert for providing the expert opinion that specifies the determined price. The deductible expense may be applied only if the expert's opinion is a mandatory annex of the tax return. The current rate of the tax on the acquisition of immovable property is 4%.

RESULTS AND DISCUSSIONS

Definition of acquisition value

The acquisition value is the contracted price, the comparative tax value, the determined price, or the special price. The acquisition value is the contracted price if it is greater than or equal to the comparative tax value. If the comparative tax value is greater than the contracted price, then it is the acquisition value. The determined price is the payment for the acquisition of the ownership right to the immovable property. The comparative tax value is 75% of the indicative value or the determined price. The taxpayer may choose in the tax return whether the indicative price or the determined price (price determined by an expert) will be used for the determination of the comparative tax value. The taxpayer cannot change the decision later, even when submitting the additional tax return. If the taxpayer decides for the indicative value, it is necessary to provide data about the immovable property in the tax return, which are necessary for the determination of the indicative value. If such data are not provided, the determined price is used.

The calculation of the indicative value is stipulated by the relevant regulation and it is based on the prices of the immovable property at the site where the immovable property is located in the comparable period

of time. The indicative value takes into consideration the type, location, purpose, condition, age, equipment and construction-technical parameters of the immovable property.

If the acquisition value is not the contracted price or the comparative tax value, then it is the determined price (e.g. in case of a financial leasing, security transfer of right, assigning of claim for consideration secured by the security transfer of right or the acquisition of ownership right to an enterprise). The determined price is a price determined by an expert under the Act on the Property Valuation, which regulates the property valuation.

In exceptional cases, the acquisition value corresponds with the special price. The special price is used in the case of auction and supplementary bid (e.g. enforcement sale of immovable property in accordance with civil procedure code, distraint by selling the immovable property under the enforcement regulations, tax distraint by selling the immovable property in accordance with the tax regulations, or the sale of immovable property in public auction). In addition to that, the special price becomes the acquisition value in the case of depositing the immovable property in the commercial or capital company, cooperative or in the context of insolvency.

Accounting view of tax on acquisition of immovable property

According to the legislative regulation in question, the taxpayer of the tax on acquisition of the immovable property is: (i) the transferor of the ownership right to the immovable property in case of the acquisition of the ownership right by purchase or exchange, and the transferor and the transferee did not agree in the purchase or the exchange contract that it is the transferee, and (ii) the transferee of the ownership right to immovable property in other cases.

From the accounting view (in more detail Bohušová and Svoboda 2011) – if the taxpayer is the transferee, there are two ways how the tax may be entered into the accounts: (a) the tax on the acquisition of immovable property will be included in the acquisition price of the intangible fixed assets, or (b) the tax on acquisition of the immovable property will be posted directly to cost.

In the case of the option (a), the tax on the acquisition of immovable property will be included in the costs associated with the acquisition of the

immovable property, and it is therefore a part of the acquisition price of the intangible fixed assets and will be debited to the accounting group 04. (Intangible fixed assets under construction and acquisition of long-term financial assets) and credited to the accounting group 32. (Short-term liabilities), or alternatively others according to Annex No. 4 of the Decree No. 500/2002 Sb. (Coll. of Laws of the Czech Republic 2015). The moment of posting the entry of the acquisition of the property constitutes the title for payment of the tax, and the taxpayer will recognize the component of the acquisition price against estimated payables. The assessed tax and the advanced payment are seen equally. It is immaterial for the accounting method if the tax is paid by the taxpayer in a standard way or by the prepayment. If a higher tax is assessed based on the assessment of payment from the tax administrator, the difference will be then evaluated according to the standard accounting procedures, which means that the acquisition price of the purchased immovable property will increase. In the terms of taxes, this change will reflect in the input price, and the tax amortization will still be based on the so-called increased input price.

The option (b) can be used both for the transferor and transferee when the tax assessment of the tax on acquisition of the immovable property is debited to the costs of the accounting group 53 and credited to the accounting group 34. The tax on the acquisition of immovable property is tax deductible if paid in accordance with the Section 24 (2) (ch) of the Act No. 586/1992 Sb. on income taxes (Coll. of Laws of the Czech Republic 2015).

Model example of taxation of transfer of agricultural land for consideration

The model example consists of the calculation of the tax on the acquisition of immovable property that is associated with the transfer of agricultural land for consideration. It is the case of the acquisition of the ownership right to the immovable property by purchase. The land area of 100 000 m² is located in Karviná. According to the zoning plan, the land is not intended to be built on, and there is no permanent vegetation.

In the tax return for the tax on the acquisition of immovable property by transfer for consideration, the taxpayer must choose whether the comparative tax

value will be the indicative value or the determined price. In the model example, the indicative value will be calculated, and afterwards the price will be determined based on the expert opinion; for the purpose of simplification, the price will equal to the indicative value. Reward and costs demonstrably paid by the taxpayer to the expert for the expert opinion are at the amount of 8000 CZK.

For determining the indicative value, the land will be valued in accordance with the Decree No. 419/2013 of 9th December 2013 to implement the statutory measure of the Senate on tax on the acquisition of immovable property. The price per m² of land in the Karviná municipality is 8.20 CZK. The price must be increased by the additional tax of 200%, which relates to the Karviná municipality. The general procedure for the calculation of the indicative value is described in Appendix 1. The indicative value of the land is 2 460 000 CZK (Appendix 2). For the model example, the price was determined by an expert at the same amount as the indicative value. The comparative tax value is therefore in both variants 1 845 000 CZK. The tax liability for the variant of determining the comparative tax value using the indicative value is 80 000 CZK (see Appendix 3), and for the variant where the comparative tax value was determined on the basis of the expert opinion, it is 79 680 CZK (Appendix 4).

Model of multi-criteria analysis of alternatives

To solve the problem (the determination of the comparative tax value to specify the tax base of the tax on the acquisition of immovable property), the model of multi-criteria analysis of alternatives was selected, for which there exists a finite number of solution alternatives (Bierman et al. 1986).

The models of multi-criteria analysis (or evaluation) of alternatives consist of the finite set of m alternatives, which are evaluated according to n criteria (more Brožová et al. 2009). The challenge is to find an alternative, which will be according to all criteria evaluated as the best, i.e. the optimal or compromise alternative. In the next step, it is necessary to sort all alternatives, that is from the very best to the worst one, or to eliminate the inefficient alternatives. If the evaluation of the individual alternatives according to the specified criteria is quantified, it is possible to organize the data of the mathematical model into the criteria matrices (see Equation 1).

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$$Y = \begin{matrix} & f_1 & f_2 & \cdots & f_n \\ \begin{matrix} a_1 \\ a_2 \\ \vdots \\ a_m \end{matrix} & \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1n} \\ y_{21} & y_{22} & \cdots & y_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ y_{m1} & y_{m2} & \cdots & y_{mn} \end{bmatrix} \end{matrix} \quad (1)$$

In the criteria matrix $Y = (y_{mn})$, the element y_{mn} represents the evaluation of the m -th alternative according to the n -th criterion. Columns (f_1 to f_n) are identical to the criteria and the rows (a_1 to a_m) to the evaluated alternatives. As follows from the criteria matrix, it includes evaluations of all alternatives according to all specified criteria, although the elements of the matrix need not be only numbers. During the analysis of the multi-criteria evaluation of alternatives, the decision making entity may choose the following goals: (i) the selection of a single alternative identified as a compromise regardless of what alternative will be evaluated as the second best or the next one, (ii) the arrangement of the set of alternatives from “the best” to “the worst”, and (iii) the division of the set of alternatives into “good” and “bad”.

Mathematical problem solving

To solve the problem, it is necessary to specify the alternatives (marked with the letter V), where each alternative represents one of the possible ways to achieve our desired goal. Then the criteria will be established (marked with the letter K), to which the selection of the best alternative will be subordinated. The weights of the individual criteria will be specified in the next step of the calculation. It is often very difficult to gain the weights directly in the numeric form. For that reason, the point method is used to determine the weights.

The prerequisite for the point method is the ability to express the importance of each criterion with a certain number of points from the predetermined point scale, e.g. from 1 to 10, where the more significant criterion is the one with more points assigned. If the point evaluation of the i^{th} criterion is marked with the symbol of p_i , the estimation of the weight of the criterion can be obtained based on the following relation (Equations 2).

$$v_i = \frac{p_i}{\sum_{i=1}^n p_i} \quad (2)$$

Based on these assumptions, the alternatives were chosen to address the problem; they will be assessed by the selected criteria, to which particular weights

Table 2. Criteria definition

K_1 – total financial costs
K_2 – total amount of tax liability
K_3 – accompanying costs
K_4 – knowledge of legislation
K_5 – difficulty of filling out tax return
K_6 – difficulty before filling out tax return
K_7 – the option of using tax portal

Source: Own calculation

will be assigned based on the calculation. With regard to the extent of the problem, only the utility of the individual alternatives is addressed.

Creation of individual solution alternatives, definition of criteria and determination of their weights

The alternative 1 (V_1) is based on the assumption that the payer of the tax on the acquisition of the immovable property decided for the comparative tax value using the indicative value, which means that the payer provided data about the immovable property that are necessary to determine its indicative value; alternative 2 (V_2) is based on the situation, in which the taxpayer decided for the comparative tax value using the determined price.

Based on the initial assumptions, the criteria crucial for solving the selected problem were specified (Table 2).

To determine the individual weights, the point method was used where the importance of each criterion was expressed with a number of points (from 1

Table 3. Criteria evaluation and weights

Criterion	Number of points p_i	Weight v_i
K_1 – total financial costs	5	0.23
K_2 – total amount of tax liability	3	0.14
K_3 – professional publications in the field	1	0.04
K_4 – knowledge of legislation	2	0.09
K_5 – difficulty of filling out tax return	3	0.14
K_6 – difficulty before filling out tax return	4	0.18
K_7 – the option of using tax portal	4	0.18
Total	22	1

Source: Own calculation

to 5). The more important the criterion was, the more points were assigned to it (Table 3), and the resulting weights (v_i) were rounded to two decimal places.

Evaluation of utility of individual solution alternatives

All variants are now evaluated from the utility point of view, so the next step is the specification of alternatives and their arrangement in the relevant matrices. First, the matrix of absolute utilities is created (Table 4), where the criteria of the variants are expressed numerically in the common units of measure.

Then the values listed in the matrix of absolute utilities are transferred using 100-point scale to comparable units, so that it is possible to continue working with them. The best alternative for the individual criterion is assigned the value of 100, and the others are then recalculated with respect to the most advantageous alternative, which will create the matrix of simple utilities in Table 5.

The final step of the evaluation of the utility of the individual alternatives is to create a matrix of the weighted utilities in Table 6, which, apart from the ideal alternative, also captures the final outcome and represents a conversion of values from the matrix of simple utilities using the weights, which have already

been identified as stated above by the means of the point method.

The so-called overall formula of multi-criteria decision-making (Equation 3) was used for the calculations:

$$U_i = \sum v_i \times x_{ij} \quad (3)$$

where U_i = criterion weighted sum by the total utility, v_i = weight of criteria, x_{ij} = representation of the value i of the alternative j of the criterion.

The task of the model of multi-criteria analysis of alternatives is to find the optimal alternative. On the basis of the overall evaluation of alternatives in terms of utility, it can be stated that the alternative V_1 (at the amount of 87.86) was evaluated better than the alternative V_2 (at the amount of 66.93).

Limitation of results

The authors are aware of the limitations of this research, which consist in using the method of the multi-criteria analysis as the only mathematical-econometric method. While the use of standard methods is quite widespread in the field of land taxation (real estate, property) (e.g. Dye and England 1996 or Besley and Rosen 1999), the multi-criteria analysis suggest the possible use of other methods.

Table 4. Matrix of absolute utilities

V \ K	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇
V ₁	80 000	80 000	low	A	high	low	high
V ₂	87 680	79 680	low	A	higher	higher	lower

Source: Own calculation

Table 5. Matrix of simple utilities

V \ K	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇
V ₁	100	99	0	100	75	100	75
V ₂	91	100	0	100	100	25	25

Source: Own calculation

Table 6. Matrix of weighted utilities

V \ K	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	$\Sigma = U$
Weight	0.23	0.14	0.04	0.09	0.14	0.18	0.18	–
V ₁	23.00	13.86	0.00	9.00	10.50	18.00	13.50	87.86
V ₂	20.93	14.00	0.00	9.00	14.00	4.50	4.50	66.93

Source: Own calculation

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CONCLUSIONS

Taxation of land and property stays in the background of the current economic research even though it offers quite a few research opportunities.

The tax on the acquisition of immovable property is a new tax, which replaced the real estate transfer tax. The procedure of taxation on the transfer of immovable property (agricultural land) for consideration is more complex than the taxation in the case of the real estate transfer tax; however, it gives the tax entities more options.

The tax base is the acquisition value reduced by the deductible expense, which is the reward and costs demonstrably paid to the expert for the expert opinion that specifies the determined price. The acquisition value (in the case of the acquisition of property right by purchase) is a comparison of the contracted price with the comparative tax value, and the tax entity can decide if 75% of the indicative value or 75% of the determined price will be used as the comparative tax value.

To address the problem, a specific model example of taxation on the transfer of the immovable property for consideration (agricultural land in Karviná) was used, to which the method of multi-criteria decision making was applied.

Although the result of the model example is illustrative (the results may differ in different municipalities or with different values), the authors' aim was to suggest the use of the multi-criteria analysis in the research of land taxation as one of the primary production factors. This paper may serve as an incentive for a further analysis in this field of study.

Appendix

Appendix 1: General procedure for calculation of the indicative value

The indicative value is calculated according to the following procedure:

$$SHp = v \times (cp \times p)$$

where SHp is the indicative value of the land, v is the land area in m^2 , cp is price of the land, p is additional tax of the municipality.

Appendix 2: Calculation of the indicative value of the model example

Basic cost of the land in Karviná is 8.20 CZK. Furthermore, it is necessary to increase the cost

with the additional tax at the amount of 200% that is associated with Karviná.

$$SHp = 100\,000 \times (8.20 \times 3)$$

The indicative value of the land amounts to 2 460 000 CZK.

Appendix 3: The calculation of tax liability with the indicative value

Contracted price: 2 000 000 CZK

Indicative value: 2 460 000 CZK

75% of the indicative value: 1 845 000 CZK

Acquisition value: 2 000 000 CZK

Tax base: 2 000 000 CZK

Tax rate: 4%

Tax: 80 000 CZK

Appendix 4: Calculation of tax liability with the determined prices

Contracted price: 2 000 000 CZK

Indicative value: 2 460 000 CZK

75% of the indicative value: 1 845 000 CZK

Acquisition value: 2 000 000 CZK

Reward and costs demonstrably paid by the taxpayer for the expert opinion: 8 000 CZK

Tax base: 1 992 000 CZK

Tax rate: 4%

Tax: 79 680 CZK

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