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Foreword

Tradition and Innovation – International Scientific Conference of (Agricultural) Economists
Szent István University, Gödöllő, 3-4 December, 2007

Tradition and Innovation – International Scientific Conference was held on December 3-6, 2007, in the frames of the anniversary programme series organized by the School of Economics and Social Sciences of the Szent István University. The aim of the conference was to celebrate the 50th anniversary of introduction of agricultural economist training in Gödöllő, and the 20th anniversary of the School of Economics and Social Sciences, which was founded in 1987.

The articles published in the special edition of Bulletin 2008 of the Szent István University were selected from the 143 presentations held in 17 sections of the conference and 30 presentations held at the poster section. The presentations give a very good review of questions of national and international agricultural economics, rural development, sustainability and competitiveness, as well as the main fields of sales, innovation, knowledge management and finance. The chairmen of the sections were Hungarian and foreign researchers of high reputation. The conference was a worthy sequel of conference series started at the School of Economics and Social Sciences in the 1990s.

Előszó

Tradíció és Innováció – Nemzetközi Tudományos (Agrár)közgazdász Konferencia
Szent István Egyetem, Gödöllő, 2007. december 3-4.

2007. december 3-6. között a Szent István Egyetem Gazdaság- és Társadalomtudományi Kara (SZIE GTK) által szervezett jubileumi rendezvénysorozat keretében került megrendezésre a Tradíció és Innováció – Nemzetközi Tudományos Konferencia, amelynek célja volt, hogy méltón megünnepelje a gödöllői agrárközgazdász képzés fél évszázada történt elindítását, s ugyanakkor a Gazdaság- és Társadalomtudományi Kar 1987-ben történt megalapításának 20. évfordulóját.

A Szent István Egyetem által kiadott Bulletin 2008 évi különszámában megjelentetett cikkek a konferencián 17 szekcióban elhangzott 143 előadásból, illetve a poszter szekcióban bemutatott 30 előadásból kerültek kiválasztásra. Az előadások jó áttekintést adtak a hazai és nemzetközi agrárközgazdaság, vidékfejlesztés, a fenntarthatóság és versenyképesség kérdései mellett az értékesítés, innováció, tudásmenedzsment, pénzügy fontosabb területeiről is. Az egyes szekciók elnöki tisztjét elismert hazai és külföldi kutatók töltötték be. A konferencia a Gazdaság- és Társadalomtudományi Karon az 1990-es években elkezdett konferencia sorozat méltó folytatása volt.

Dr. László Villányi
Dean / dékán

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A NEW METHODOLOGY FOR THE ESTIMATION OF LAND VALUE

SZŰCS, ISTVÁN – FEKETE-FARKAS, MÁRIA – VINOGRADOV, SERGEY A.

Abstract

In the framework of National Research and Development program No. 4/015/2004 "Land quality, land value and sustainable land use in conditions of European Union" has been developed the methodology of a complex land evaluation using modern technical means. Complex evaluation means an organic systematization of ecological and economical factors. The ecological assessment of land is executed in the D-e-Meter point system. The economical evaluation systematizes the effects of economical factors in conformity with structure of the D-e-Meter system.

Keywords: land evaluation, D-e-Meter system, corrected Gross Margin

Introduction

The current system of the land valuation, the Gold crown system introduced in Hungary in the second half of the XIX century. Since its introduction, this system had served its original purpose more or less well. But during the passed more than 100 years, the system itself and its method became old fashioned. Maybe its survival contributed to the fact that the arrangement of the land ownership conditions, the compensation by land, the reallotment of the land to the coop-members on the basis of the original property value and in general, the privatization - all these procedures need and use the values of the old golden crown valuation system, since it is operating as a link between the past and present. The golden crown system indicating the quality of the agricultural land, promotes highly the arrangement of the property conditions. Consequently, at least till the time when finishing that arrangement, the validation of the gold crown system should be maintained.

The D-e-Meter system is a modern land evaluation system – supported by an on-line space-information modeling possibility – the central element of which is a relative number of land evaluation, i.e. the D-e-Meter point which indicates the production relations of different croplands on the basis of environmental requirements and of production intensity as well as of the production risks in climatic and geological factors [Gaál et al., 2003].

The main point of automated land evaluation is that the developed system reads off the values of factors influencing land values (i.e. the quantified values of influencing factors) from the digital soil maps by site numbers (evaluation units), and then the system computes the complex land return values or rather the complex land prices in Euros per hectare according to a given computation algorithm. The so computed, estimated land value indicates the social values of land estates on the basis of their return-production potential. These values can differ from land-estate prices formed on land market, nevertheless they are decidedly adequate to replace the current Gold-crown system of land valuation and to solve whole series of objectives connected with land evaluation.

Scenarios of development of an automated land evaluation system

Taking into consideration the above mentioned basic tendency, with the development of the new, automated evaluation system we have started from the following scenarios:

The complex (economic) evaluation of agricultural land implies:
- ecological factors (soil quality, climate factors and relief conditions),
- economical factors (transport possibilities, market environment conditions, etc.).

Land evaluation is practically carried out along two threads, namely:
- by return principle, which expresses the potential productivity of the given plot of land, and qualifies the belonging economic environment, thus it contains
  - the land rent and
  - the differential rent
- by means of land prices developed on real land market. This requires building up an information system of land market.

In the course of complex land evaluation, this evaluation has to form a uniform and closed system, although economical and ecological factors can be evaluated separately.

Land evaluation has to serve different objectives simultaneously:
- taxation,
- production regulation (subsidies),
- regulation of inheritance proceedings,
- expropriation and compensation,
- legal actions resulting from property disputes,
- estate re-allocation, land block formulation,
- decision making on company (farm) level, if land evaluation is connected with economic parameters (e. g. soil cultivation costs, angle of slope, transport- and cultivation costs, etc.).

The complex value of agricultural land can be expressed by several dimensions:
- by point scores (e.g. plot scores, D-e-Meter points, cereal units, etc.),
  - by money values (in Forints or in Euros),
  - by standard Forints or Euros,
- by variable exchange-rates,
- by average Forint/Euro parity from the accession year,
- by net land returns, measured in Euros.

There are such land evaluation objectives, in case of which the connected business activities can be solved only by land values expressed in monetary units (e.g. expropriation, compensation and inheritance affairs, etc.). At the same time there are also such ones which can be arranged by point score systems (estate re-allocation, taxation, etc.).
In case of indicators expressed in value, all state-administration, social and economical tasks belonging to this objective can be arranged. Therefore the complex land evaluation has after all to be driven in such a way that the "end-product", i.e. the "evaluation" should appear in value form.

According to our present opinion, the economical (complex) value of agricultural lands is:

EURO-LAND-RETURN

This value is – after the introduction of Euro as national currency – relatively stable, there is a need to intervene with the system only in case of parity change of Euro.

The calculation basis of Euro-return is the Gross Margin (GM).

We have started from the return-based land value. We have assumed that the market land price in long term is fluctuating around the theoretical economic value of land, i.e. around the capitalized value of land rent.

The income share attributable to land is hardly to be separated from other production factors, so we were forced to look for such a methodological solution by means of which the profit-yielding capacity of different land-qualities can be estimated.

According to our findings, the Gross Margin, defined as the difference between the value of output from one hectare and the cost of variable inputs to produce that output.

Estimation of Gross Margin

Our objective has been the statement of different profit-yielding capacity of different land categories.

From territorial units defined in D-e-Meter system, the cadastral unit with topographical lot number forms the smallest independent unit of land turnover. But the data necessary to the calculation of the above mentioned Gross Margin do not belong to cadastral unit, but to each particular parcel. Thus, it seems to be practical to separate the questions under examination in case of two processes, i.e. of sampling needed to the statement of GM-values and of land evaluation itself. The two objectives are geographically connected with land plots, and in such a way, with each other. Based on land plots the D-e-Meter point (relative number for land quality assessment) is available both for cadastral units and for parcels. So, there is a possibility to correlate the GM-values of parcel-level also to cadastral units by means of D-e-Meter point [Vinogradov – Szűcs, 2007].

In conformity with this possibility, we chose the parcel, i.e. the partial unit of agricultural land for observations.

The production value (Revenue) of j-th parcel in case of the i-th crop in the t-th year will be:

$$R_{i,j}^{t} = q_{i,j} \cdot p_i + q_{i,j}^{m} \cdot p_i^{m} + u_{i,j} \qquad (1)$$

where:

$q_{i,j}$ = yield of the i-th crop in case of the j-th parcel (tons/ha)

p_i = market price of the i-th crop (HUF/tons)

$q_{i,j}^{m}$ = yield of the i-th crop's by-product in case of the j-th parcel (tons/ha)

p_i^{m} = value of the i-th crop's by-product (HUF/tons)

$u_{i,j}$ = direct subsidies for the i-th crop in case of the j-th parcel together with the not crop-specific aid falling to j-th parcel (HUF/ha).

The direct variable cost of j-th parcel in case of i-th crop in t-th year is:

$$Cv_{i,j}^{t} = \sum_{l=1}^{9} C_l^{i,j,t} \qquad (2)$$

where:

$C_1^{i,j,t}$ = seed cost of the i-th crop in case of the j-th parcel in t-th year (HUF/ha)

$C_2^{i,j,t}$ = fertilizer cost of the i-th crop in case of the j-th parcel in t-th year (HUF/ha)

$C_3^{i,j,t}$ = cost of plant protecting agents for the i-th crop in case of the j-th parcel in t-th year (HUF/ha)

$C_4^{i,j,t}$ = irrigation cost of the i-th crop in case of the j-th parcel in t-th year (HUF/ha)

$C_5^{i,j,t}$ = diesel oil cost of the i-th crop in case of the j-th parcel in t-th year (HUF/ha)

$C_6^{i,j,t}$ = drying cost of the i-th crop in case of the j-th parcel in t-th year (HUF/ha)

$C_7^{i,j,t}$ = part of direct marketing and processing costs falling to the j-th parcel in t-th year (HUF/ha)

$C_8^{i,j,t}$ = part of direct insurance fee falling to the j-th parcel in t-th year (HUF/ha)

$C_9^{i,j,t}$ = part of other direct costs falling to the j-th parcel in t-th year (HUF/ha)

The Gross Margin of the j-th parcel in case of i-th crop in t-th year:

$$GM_{i,j}^{t} = R_{i,j}^{t} - Cv_{i,j}^{t} \qquad (3)$$

Incorporation of D-e-Meter system and the economic evaluation into a unified system

The basis of the unified system is the establishing equivalence between the D-e-Meter point and Gross Margin. The logic of the system can be interpreted (as it was already mentioned in the first part of the report) as shown on the following figure [Szűcs et al., 2006]:

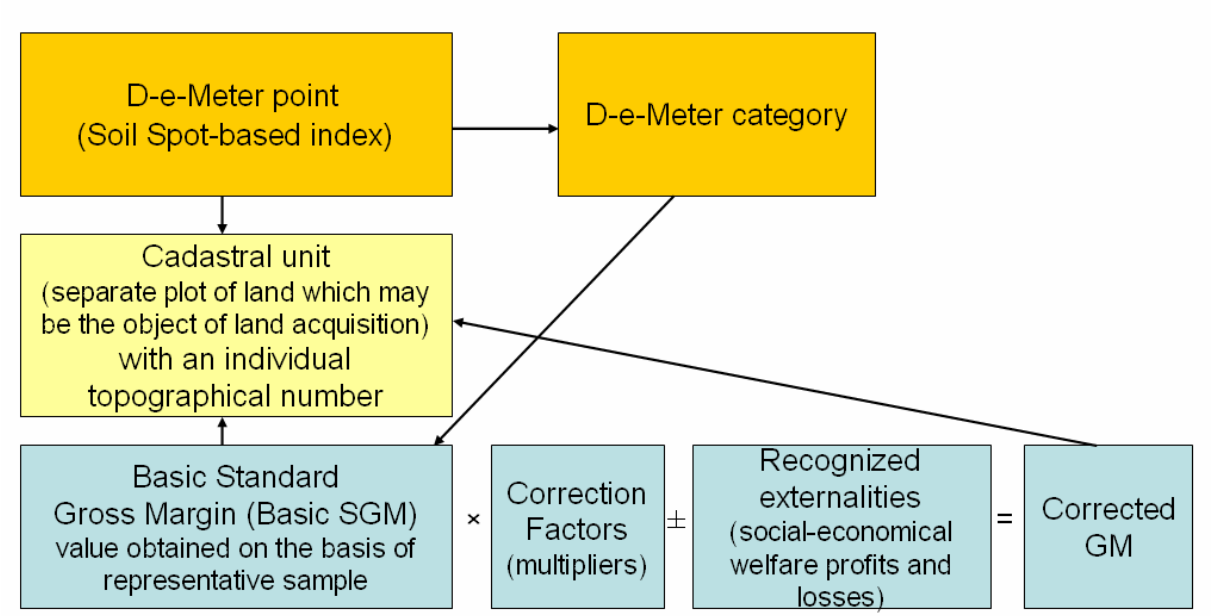

Figure 1. Determination of Corrected GM value of cadastral unit

Automation of evaluation system

The connection and incorporation into a specific system of economy, ecology, as well as of scientific results of mathematics and information technology make possible the development of an automated land valuation mechanism.

The logical process of automation is as follows:

- The D-e-Meter points will be determined in ecologic block of the system on Soil Spot level [Tóth et al., 2006]. The Soil Spot is a unique object, the purpose of using it, to get the soil information of the actual land plot. It is geographically related to the other object (parcel, cadastral unit).
- The basic returns of lands (Basic Gross Margin) will be incorporated into the input data of the system by taking a representative sample, it can subsequently be defined as the endogenous element of the system.

Table 1. The main elements of database

Database				
Cadastral unit with a topographical plot number	D-e-Meter point *exogenous*	Gross Margin *endogenous*	Externalities *endogenous*	Correction factors *exogenous* (reading off from the maps)

- The stratification levels of map (soil spot, parcel, cadastral unit) will be arranged on the level of topographical plot numbers. Thus, it will be the level, where the complex Euro-returns value appears. (It is also in conformity with practical applications, since all the land-estate questions are arranged according to topographical plot numbers or their fractions.)
- The basic land returns will be determined separately by regional levels, since there are big differences in infrastructural environment influencing the economic values, and they have to be taken into consideration during the construction of the system.
- The externalities are treated as corrections of Basic Gross Margin by means of mathematical formulae and incorporated into input data in endogenous way [Farkasné-Szűcs 2005].
- The basic returns value will be corrected by correction factors (after having red off the maps by means of mathematical formulae).

The precondition to practical application of the land evaluation method, we developed, is to assign to each D-e-Meter category a weighted – so called Basic Standard Gross Margin (Basic SGM) value.

The calculation of Gross Margin is based on a representative sample. The responding units are the enterprises dealing with production of arable-land crops in the given region.

It is a basic requirement to the sample that it should be representative, i.e. on its basis conclusions could be drawn on the characteristic values of base set.

According to our a priori statement, a significant stochastic correlation can be assumed between Gross Margin and the region, as well as the organizational form of farming (private or collective farming), therefore to carry out calculations for the whole country, it is practical to apply stratified sampling. The enterprises dealing with production of arable-land crops will first be classified by regions and then by organizational forms. The minimum element number of samples (the number of enterprises in the sample) will be determined by strata. Each parcel of chosen farms will be observed and the necessary information collected.

The Basic Standardized Gross Margin is in case of k-th D-e-Meter category and of r-th region:

$$SGM_{r,k} = \sum_{i=1}^{m} \frac{\sum_{t=1}^{5} \frac{\sum_{j=1}^{n} (GM_{i,j,t}^{r,k} \cdot S_{i,j,t}^{r,k})}{\sum_{j=1}^{n} S_{i,j,t}^{r,k}}}{5} \cdot g_{i,r} \qquad (4)$$

where:

i = the i-th crop, i = 1, 2, ..., m
j = the j-th parcel, j = 1 , 2, ..., n
k = the k-th D-e-Meter category, k = 1, 2, ..., p
r = r-th region, r = 1, 2, ..., 7
t = t-th year of data collection, t = 1, 2, ..., 5
$GM_{i,j,t}^{r,k}$ = the coverage-share value of j-th parcel in case of i-th crop, in r-th region in t-th year in case of k-th D-e-Meter category
$S_{i,j,t}^{r,k}$ = the extent of j-th parcel below the i-th crop belonging to k-th D-e-Meter category in t-th year
$g_{i,r}$ = share of i-th crop in r-th region's crop structure.

Quantifying influence of correction factors

The measuring and building into the evaluation system of the effects of correction factors practically means a way to include of differential land rent into system.

At the calculation of land values we have taken into consideration the following correction factors:

The information can be read off from digital maps, in such a way the automated functioning of the system is warranted [SZŰCS I. et al. 2007].

The joint effect of correction factors to SGM values:

$$SGM^{DM} * (1 + \frac{\sum_{i=1}^{6} k_i}{100}) \qquad (5)$$

where:

k_i = change in SGM caused by i-th correction factor in %

Consideration of external effects

According to classical economic theory, the land value – because of limited supply – is basically determined by the demand side. The demand for agricultural land is a derived demand, thus it is determined by the demand for products producible on it and by means of it. Calculating its Marginal product, we have started from classical production function of land (Ricardo-theorem). According to Thünen it was corrected by the distance to the market.

Table 2. Correction factors

Serial number	*Definition of the factor*	*Evaluation of situation*			*Modification of Gross Margin (%)*
		Bad	*Medium*	*Good*	
1.	*Size and orography of land estate*	<10 ha >200 ha	10-200 ha		-3 % 0
2.	*Irrigation possibility* - land plot equipped with operating underground pressure pipe irrigation network - water-obtaining possi-bility from an open channel - irrigation possibility from a driven well in running condition	*There is/there is not*			+15 +15 +15
3.	*Landmarks impeding the cultivation* overhead electric wire across the plot, taking into consideration 10-40 meter strips on both sides of wire	More than one wire is crossing the plot	A single wire is crossing the plot	There is no wire	-20 -10 0
4.	*Access to the plot* per hectare length of land roads with solid pavement	Under 0,5 km	0,5-1,0 km	over 1,0 km	-15 0 +15
5.	*Infrastructure* distance to the a) closest dispatch stations (railway station, port, processing plant)	Over 5 km	1-5 km	Under 1 km	-10 0 +10
	b) to a settlement with more than 1000 inhabitants	Outside a circle of 5 km radius	1-5 km	Inside a circle of 5 km radius	-15 0 +15
	c) road network, access to highways in minutes	30 <	15-30	15 >	-10 0 +10
6.	*Distance to the closest garbage heap* a) in case of hazardous waste materials	1-2 km	2-5 km	> 5 km	-15 -5 0
	b) in case of non-hazardous waste materials	0,5-2 km	2-5 km	> 5 km	-15 -5 0
	c) in case of neutral waste materials	0,3-1 km	1-2 km	> 5 km	-15 -5 0

In measuring and evaluating land returns a paradigmatic change is needed, what means that in case of interpretation of agricultural output – beside the production measured by basic yields (and by-products) – also the not measured or not measurable output, the so called external effects, or rather the positive (incomes) or negative influences (expenses) of external effects are to be taken into consideration.

The external effects in agriculture can appear in two forms:

- In form of so called connected product, when in course of classical agricultural production (production of agricultural products destined for food or for other purposes, e.g. for forage or energy crop), the external effect arises unintentionally (influence on the soil, on ground and superficial waters, oxygen production, carbon-dioxide absorption);
- As independent product, first of all in form of public goods, when an explicit objective of the activity is to maintain biodiversity and to protect the habitat and the soil.

Thus, in case of determination of land value on the basis of return-principle, the discounted values of expectable present and future services of land are to be modified by negative social effects of land use, i.e. by the so called external costs.

The Hungarian and rather international literature contain – in utility approach –individual preferences to measure external incomes and expenses. In order to solve measurement and evaluation problems, a new evaluation methods has been worked out based on willingness to pay for the quality of environment, as well as on willingness to accept claims for environment damage compensation, and the methods of hedonistic price and of traveling expenses, based on direct and indirect measurements in real or fictitious market conditions, serve the same objective.

The international literature contains efficiency examinations for several countries [Tegtmeier - Duffy 2004, Pillet 2001, Pretty 2000, Pretty 2002]. Those are estimations to express money values of external effects and serve fiscal or support policy, and are connected with land evaluation only rarely, on conceptual level.

In automated system of land evaluation, the external effects are considered in exogenous way, i.e. the value of corrected Gross Margin will be modified by values determined on the basis of preliminary expert estimations.

Afterwards – in research work aiming to modernize the automated system, we make an attempt to work out the possibility of consideration based on digital maps.

The complex land-value calculation algorithm

The complex land-value calculation algorithm, considering also the external effects, can be stated as follows:

$$EURO-LAND-RETURN_{cad.number,\,HUF(EUR)/ha} = SGM^{DM} * (1 + \frac{\sum_{i=1}^{6} k_i}{100}) + E \qquad (6)$$

where:

$EURO-LAND-RETURN_{cad.number,\,HUF(EUR)/ha}$ = the Corrected Standard Land Return of land plot under given cadastre number, HUF(EUR)/ha;

SGM^{DM} = the Basic SGM value belonging to the given D-e-Meter category

k_i = change in SGM caused by i-th correction factor, %

E = quantified joint effect of external factors.

Estimation of land rent and return-based land value

From economic point of view a certain difficulty arises, because the returns of land as of production factor are not separated from Gross Margin, so the capitalization in classical sense (land price = capitalized land rent) cannot be carried out. In economic literature several methods are known for the separation of land rent. From these, the most frequently applied methods are as follows:

- Estimation on remainder principle (deducing the part above the labor- and capital returns from total income);
- Land returns estimated on the basis of Marginal product of production factors;
- Land rent estimated as partial returns of production factors (on the basis of parameters of modified Cobb-Douglas functions);
- Other calculation methods.

In connection with present research work, we have applied such an estimation method what deduces the share (γ-value) of land rent within total income from the conditions of real land market.

In case of necessary number of selling transactions of land estates, the extent of land rent can be determined in knowledge of land prices and real interest rate.

$$\text{Land rent} = \text{Land market price x real interest rate} \tag{7}$$

By means of this formula, the percentage of land rent within the corrected Gross Margin can be calculated by dividing the land rent by Corrected GM as follows.

$$\gamma = \frac{\text{Landrent}}{\text{Corrected GM}} \tag{8}$$

From this:

$$\text{Euro-Land-Return} = \frac{\gamma \times \text{Corrrected GM}}{\text{interest rate}} \tag{9}$$

It is this indicator number appears what appears as the output of automated land valuation system expressed in EURO-returns. This indicator number corresponds to the contents of current Golden crown evaluation, but is more up to date in expressing the differences between economic values of agricultural lands.

The mechanism of the estimation of land value is illustrated on Figure 2.

The system contains the possibilities of the monitoring of the estimated land value: if the difference between the land market value and the estimated land value is significant, we will take the correction of the gammas and GM values.

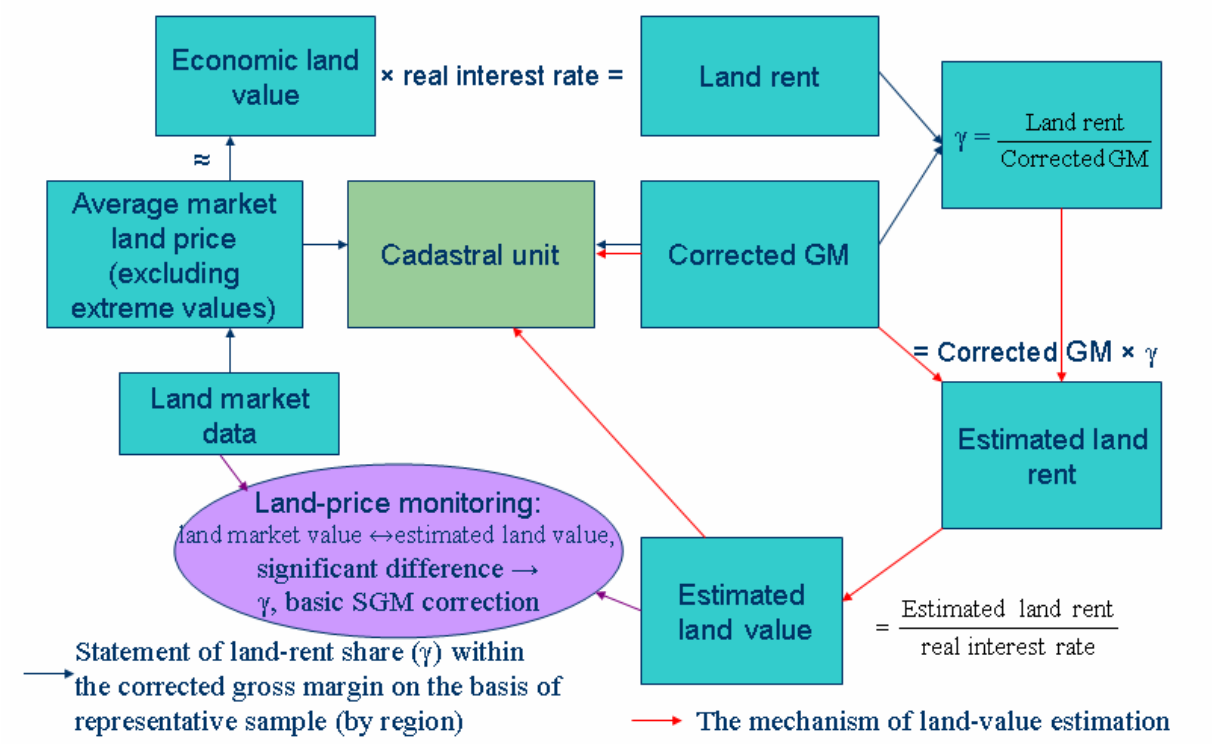

Figure 2. Estimation of land value

Conclusions

The developed methodology of the economic land valuation has practically combined the land prices calculated on return basis with land market prices. It takes into consideration the ecological differences between land estates, but also reflects the demand-supply relations for land.

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