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Valuation of Fixed Assets for Accounting Purposes

1. Introduction

Fixed assets are elements of company's material assets. They have a determined useful life which is longer than one year, they are complete and usable at the moment of bringing them into operation, destined for the entity's own needs or transferred to other entities on the basis of rental, lease or other agreements of similar kind.

Fixed assets comprise real property, machines and equipment, means of transport and livestock.

The article discusses the methods of fixed asset valuation exemplified by real property, machines and appliances as well as means of transport in use at one of enterprises located near Krakow in January 2008.

2. Fixed Asset Estimation – Theoretical Considerations

Based on the analysis of hitherto methods of fixed asset reassessment and calculating its depreciable value (recorded depreciation) as well as on fixed assets book value and their selling price or liquidation value, as compared between numerous companies, a fixed asset value assessment procedure was developed. The procedure includes an assumption that the assessed fixed asset value should be near its market value.

Following the analysis performed, it was stated that the coefficient (s_k) adjusting a fixed asset book value to its market value ranges from 0.8 to 1.6 of the period that results from maximal depreciation rates, as provided for by the Act on Corporate Income Tax. Therefore, the standard value of this coefficient for a given group

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and kind of fixed assets should arise from weighted average of registered adjusting coefficient values, and hence, it should be determined according to the following formula

$$s_k = \frac{\sum_{i=1}^{n} s_{ki} p_i}{\sum_{i=1}^{n} p_i} \tag{1}$$

where:

$s_{ki} = \frac{C_{ST}}{W_{KST}}$ – ratio of the fixed asset selling price to the book value of a fixed asset indexed by i,

p_i – precision weight related to the number of years of accounting for accumulated depreciation, as results from the Act on Corporate Income Tax, as well as to the number of years of its useful life.

The weight value of objects, which do not display technical damages of their load-carrying structure, should be determined by the following formula

$$p_i = \ln \frac{2n_a + n}{n_a} \tag{2}$$

where:

$n_a = \frac{1}{a}$ – number of years of total accumulated depreciation of a fixed asset, equal to the reverse ratio of depreciation rate, as set out in the Act on Corporate Income Tax,

n – number of years of a fixed asset's useful life, calculated from the year of the last restatement to the year of valuation.

Weights thus determined shall take the following critical values:

$$\text{for } n = 0 \Rightarrow p_{n=0} = \ln 2 = 0.69 \tag{3}$$

$$\text{for } n = 3n_a \Rightarrow p_{n=3n_a} = \ln 5 = 1.61 \tag{4}$$

For objects displaying a technical damage of the load-carrying structures, the coefficient of adjustment should be estimated by construction experts based on their review.

In order to determine the market rate (A_s) of the fixed asset value decrease, a formula has been adopted such that, as the useful life accrues, the downward

tendency of the decrease of the fixed asset value (wear and tear) continues. At the same time, the value of the consumption coefficient in the zero year of useful life must equal 0, while in the end year of useful life (n_k) it should equal 1, that is:

$$\text{for } n = 0;\ A_s = 0, \tag{5}$$

$$\text{for } n = n_k;\ \mathrm{A}_s = 1. \tag{6}$$

Conditions thus determined are fulfilled by the logarithmic function, where the logarithm base is defined by the adjustment coefficient in the form of $(1+s_k)$.

In connection with assumptions (5) and (6), the function derived from the logarithm with the base of $(1+s_k)$ should be as follows

$$A_n = \lg_{1+s_k} \frac{n_a + n}{n_a} \tag{7}$$

because:

$$\text{for } n = 0;\ A_s = \lg_{1+s_k} \frac{n_a}{n_a} = \lg_{a+s_k} 1 = 0, \tag{8}$$

$$\text{for } n = n_k = s_k \cdot n_a;\ A_s = \lg_{1+s_k} \frac{n_a + s_k n_a}{n_a} = \lg_{1+s_k} (1+s_k) = 1 \tag{9}$$

Therefore, the market ratio of the fixed asset consumption after n years of use will always be defined by the following equation

$$A_n = \lg_{1+s_k} \left(\frac{n_a + n}{n_a} \right), \quad (0 \le n \le n_k) \tag{10}$$

The estimated value of the fixed asset ($W_{ST(n)}$), after n years of use, may be determined on the basis of its initial value (W_{ST0}), according to the following formula

$$W_{ST(n)} = W_{ST0} \cdot \left(1 - \lg_{1+s_k} \cdot \frac{n_a + n}{n_a} \right) \cdot (1+r_k)^n \tag{11}$$

where:

W_{ST0} – fixed asset initial value, as the original value accounted for,

n_a – number of years of calculation of the total accumulated depreciation of the fixed asset,

n – number of years of the fixed asset's useful life calculated from the moment of assembly or modernization until the year of valuation,

r_k – capitalization rate of expenditure related to the acquisition of fixed assets which should be in the range from 8% to 12%.

For the practical application of the above equation, the definition of the natural logarithm (ln) has been used, that is

$$\lg_{1+s_k}\left(\frac{n_a+n}{n_a}\right)=\frac{\ln\frac{n_a+n}{n_a}}{\ln(1+s_k)} \tag{12}$$

thus

$$W_{ST(n)}=W_{ST0}\cdot\left(1-\frac{\ln\frac{n_a+n}{n_a}}{\ln(1+s_k)}\right)\cdot(1+r_k)^n \tag{13}$$

The above formula shows that the estimation of fixed assets comes down to the determination of the value of the following parameters:

W_{ST0} – initial (gross) value of a fixed asset, which should include the monetary expenditure on the fixed asset manufacture, its acquisition, assembly and installation costs as well as costs of repairs and modernization,

n_a – number of years of the accounting for the accumulated depreciation, resulting from the upper depreciation rates as set out by the Act on Corporate Income Tax,

s_k – value of the coefficient adjusting the book value to the market value of a fixed asset,

n – number of years of a fixed asset's useful life, calculated from the moment of acquisition, assembly or modernization until the determined year of valuation,

r_k – capitalization rate of expenditure related to the acquisition of fixed assets which should be in the range from 8% to 12%.

If the (gross) initial value (W_{ST0}) of a fixed asset is restated as the book value W_{STK}, the accounted value of W_{STK} and a modified formula (13) need to be used in valuation of fixed assets, that is

$$W_{ST(n)}=s_k W_{STK}\cdot\left(1-\frac{\ln\frac{n_a+n}{n_a}}{\ln(1+s_k)}\right)\cdot(1+r_k)^n \tag{14}$$

where:

s_k – coefficient adjusting the reassessed book value of a fixed asset, which is determined by an expert according to equation (1),

n_p n – number of years of a fixed asset's useful life, calculated from the year of the restatement of the value to the determined year of valuation.

If the acquisition of a fixed asset or restatement of its value or the valuation falls on the appropriate month of a determined year, n or is a non-integer number.

However, this method cannot be used for the estimation of land as it is not subject to depreciation.

3. Practical Example of Fixed Asset Valuation

By means of the equations (13) and (14) example calculations have been performed. They are presented in table 1 (on the interleaf).

4. Determination of Trend in Changes of Land Prices in Time and Estimation of Their Market Value

The market value of land has been adjusted by a coefficient of transaction price changes. This coefficient in a power form has been calculated based on the analysis of similar property.

For the purpose of the analysis of the market situation, a model using the following equation shall be used

$$c = b_0 \cdot b^t \tag{15}$$

where:

c – property unit price,
b_0 – parameter defining the forecast price of property on the first transaction date (in month zero),
b – parameter defining the b_0 monthly price change coefficient,
t – number of months which have passed until the date of the considered transaction in relation to the first transaction in the base.

The estimation of b parameter will be performed using the similarity weights of the property features, according the Gauss–Markov model, which leads to the following system of normal equations:

$$\begin{bmatrix} \sum_{i=1}^{n} p_i & \sum_{i=1}^{n} p_i t_i \\ \sum_{i=1}^{n} p_i t_i & \sum_{i=1}^{n} p_i t_i^2 \end{bmatrix} \cdot \begin{bmatrix} b_0 \\ b \end{bmatrix} = \begin{bmatrix} \sum_{i=1}^{n} p_i \ln c_i \\ \sum_{i=1}^{n} p_i t_i \ln c_i \end{bmatrix} \tag{16}$$

The similarity weights of the property features are calculated using the following equation

$$p_i = \frac{1}{r_t^2 + \sum_{j=2}^{k} r_j^2} \tag{17}$$

where the k index is the number of considered features and r_i is the full correlation for the time of transaction. The weight depends on features which are different for the property being valued and a base property used for comparison.

The b parameter, defining the proportionate change in the one-month price, has been determined by the matrix of normal equations according to the following formula

$$b = \exp\left[\frac{\sum_{i=1}^{n} p_i \sum_{i=1}^{n} p_i t_i \ln c_i - \sum_{i=1}^{n} p_i t_i \sum_{i=1}^{n} p_i \ln c_i}{\sum_{i=1}^{n} p_i \sum_{i=1}^{n} p_i t_i^2 - \left(\sum_{i=1}^{n} p_i t_i\right)_2}\right] \tag{18}$$

The value of b parameter expressed in a binomial form $b = (1+\beta_M)$ means that the increase of one-month price equals β_M. In order to calculate the coefficient of changes in prices (β_K) during one year (12 months), the equation $(1+\beta_K) = (1+\beta_M)^{12}$ will be used.

The adjustment of transaction prices and market values is performed according to the following equation:

$$c_{i(k)} = c_i \cdot b^{t_w - t_i} \quad \text{or} \quad W_{i(k)} = W_i \cdot b^{t_w - t_i} \tag{19}$$

The above equations have been realized for a base of similar properties comprising 23 properties, which were the object of transactions in the period from August 2005 to January 2008.

After realization formulas from (15) to (19) have received the following value of parameter b what is goes to show: b = 1.027186, that price increase for a one month amounts $\beta_M = +0.027186$, that is 2.72%. After recalculating this value for twelve months (per annum) has received

$$(1+\beta_R) = (1+\beta_M)^{12} = 1.027186^{12} = 1.3797 = (1+0.3797).$$

The above expression proves that during one year the unit prices of the considered properties have increased by 37.97%.

Assumption of two periods is suggested for the adjustment of land property prices:

I 2003–2005: annual price increase – 15%,

II 2006–2008: model $W = W_i \cdot 1.027^{24} = W_i \cdot 1.8954$.

References

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[3] *Załącznik nr 1 do Ustawy z dnia 27 lipca 2002 r. o zmianie ustawy o podatku dochodowym od osób prawnych: Wykaz rocznych stawek amortyzacyjnych*. Dz.U. z 2002 r. Nr 141, poz. 1179 [*Appendix 1 to the Act of 27 July 2002 amending the Act on Corporate Income Tax: The list of annual depreciation rates*. Journal of Laws of 2002 No. 141, item 1179)].

[4] *International Valuation Standards 2005* (Polish edition). Polska Federacja Stowarzyszeń Rzeczoznawców Majątkowych, Warsaw 2005.

Table 1. Practical example of fixed asset valuation

Item	Classification of Fixed Assets (KST) symbol [group/subgroup/kind]	Inventory number	Fixed asset name	Month and year of *restatement* or purchase	Month and year of valuation 01.2008	Value of *restatement* or purchase W_{STK} or W_{ST0} [PLN]	Adjusting coefficient s_k	Depreciation rate [%] a	Years of total accumulated depreciation $n_a = \frac{1}{a}$	Years of use after *restatement* or purchase n_P or n	Calculations $\left(1 - \frac{\ln \frac{n_a + n}{n_a}}{\ln(1 + s_k)}\right)$	Capitalization coefficient	Calculations *[8] × [12] × [13]* or [12] × [13]	Fixed asset value for the year of valuation [PLN]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	*5/52/525*	*1/ROE-JENDEREK*	*Plaster staining machine*	*11.2000*	*01.2008*	*42,084.42*	*1.0*	*10.0%*	*10.0*	*7.2*	*0.2201*	*1.981*	*0.4360*	*18,346.94*
2	*1/10/105*	*17*	*Office building*	*02.2003*	*01.2008*	*33,544.70*	*1.2*	*2.5%*	*40.0*	*4.9*	*0.8529*	*1.598*	*1.6355*	*54,863.32*
3	*1/10/101*	*18*	*Production hall*	*02.2003*	*01.2008*	*499,551.56*	*0.9*	*2.5%*	*40.0*	*4.9*	*0.8193*	*1.598*	*1.1783*	*588,640.70*
4	7/76/762	23/ROE-HALA S	Fork-lift truck	04.2003	01.2008	6,557.38	1.0	14.0%	7.1	4.8	0.2637	1.574	0.4150	2,721.20
5	5/58/581	90/ROE-HALA M	Mixer	05.2005	01.2008	2,841.97	1.0	20.0%	5.0	2.6	0.3980	1.280	0.5094	1,447.71
6	3/31/310	57/ROE-SZAT	Heater	05.2003	01.2008	584.11	0.9	14.0%	7.1	4.6	0.2266	1.549	0.3510	205.00
7	8/80/801	94/ROE-LABOR	Laboratory balance	08.2005	01.2008	7,852.51	1.0	25.0%	4.0	2.4	0.3176	1.259	0.4000	3,140.80
8	8/80/808	114/ROE-SPRZ	Desk	02.2006	01.2008	1,800.00	1,0	20.0%	5.0	1.8	0.5477	1.192	0.6528	1,174.96
9	7/74/741	LEASING	Passenger cars	01.2007	01.2008	578,425.81	1.4	20.0%	5.0	1.0	0.7917	1.100	0.8709	503,761.72
10	4/49/491	139/ROE-SPRZ	Computer	06.2007	01.2008	2,574.50	1.2	30.0%	3.3	0.5	0.8205	1.049	0.8611	2,216.86
11	8/80/803	141/ROE-PAL	Xerox printer	07.2007	01.2008	2,450.00	1.2	14.0%	7.1	0.4	0.9272	1.041	0.9653	2,364.88
12	7/74/742	138/ROE-HALA S	Lorry	07.2007	01.2008	42,000.00	1.3	20.0%	5.0	0.5	0.8847	1.049	0.9282	38,985.08