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Depreciation of Fixed Assets in The Context of Company Evaluation

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Abstract: This article explores how depreciation in financial accounting impacts a corporation's intrinsic worth and market value. To study this influence, the statistical development and simulation of the activities of various fictitious companies were conducted. The companies are identical, except for the depreciation strategy in financial accounting. It is demonstrated that the choice of depreciation technique influences the market value added when periodic depreciation exceeds investments in operating assets and the surplus amount is temporarily invested in highly liquid financial assets. In this situation, the company's value should be adjusted by the present value of lost profits caused by investing temporarily free funds in highly liquid financial assets instead of operation activity, on the one hand, and the present value of savings on capital transfer costs to the owners, on the other. If a positive net financial result is anticipated over the planning horizon, the first adjustment should be considered when selecting the depreciation method. It is calculated by the rate of return on temporary free capital invested in financial assets. Therefore, if the discount rate exceeds the rate of return on short-term financial support, the approach that provides the slowest amortization of non-current operational assets should be used in financial accounting.

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1. Introduction

Depreciation as a practice and efforts to conceptualize it have a long history. The current definition of depreciation and its separation from the revaluation of an asset date back to the 14th century (Kuter et al., 2018). In the first half of the 20th century, Schmalenbach (1959) introduced the notion of dynamic balancing, where depreciation was declared as a method for allocating starting expenses to align them with the income of specific reporting periods. In the second part of the 20th century, accountants developed a profound understanding of depreciation (Lamden et al., 1975). Despite the simplicity and beneficial estimation features of such computations in terms of statistics (Lane et al., 1997; Hillier et al., 2006; Ahmad et al., 2019), the distribution of beginning expenses across accounting periods is a delicate process. Accounting experts have repeatedly questioned attempts to interpret depreciation as diminishing the production potential of fixed assets (i.e., deterioration and obsolescence) within a reporting period (Wells, 1968; Get'man, 2020; Ullah et al., 2022).

If depreciation were solely related to the deterioration of assets caused by their productive use, it would be acceptable to charge it according to the extent of the activity. Nonetheless, damage can also be caused by other variables (aging, corrosion, etc.). Second, many fixed assets are structurally complicated things with various components that fail at different times and are replaceable during maintenance. In other words, in most circumstances, the useful life of depreciable fixed assets has no direct relationship to their physical existence. It depends on the scheduled maintenance schedule, which is defined by the economic necessity of their usage rather than their physical attributes. Thirdly, predicting the obsolescence rate and, as a result, the estimated replacement time for an asset is typically challenging.

Moreover, the shift in asset value is typically not gradual but rather abrupt, and market fluctuations may cause an asset's value to rise rather than fall. Formal methods of depreciation are incapable of predicting these events. In some instances, a frequent revaluation of assets is sufficient for their accurate reporting (Aboody et al., 1999; Lisdiono et al., 2022).

It is not more persuasive to understand depreciation as a reserve for the future replacement of fixed assets (Sokolov, 2015; Tomshinskaya et al., 2019; Ssaharti, 2022). In the case of an inflationary tendency, when the accumulated depreciation may be significantly less than the asset's worth on the following day's market, the erroneousness of such a conception becomes readily apparent (Lawrence et al., 2013).

Under constant innovation, when assets cannot typically be replaced with their exact counterparts since this is either impossible or unreasonable (Khan et al., 2020), this concept of depreciation becomes even more from reality. The sections of a research paper are the introduction, the literature review of the study, the methodology, the results and analysis, and finally, the conclusion and suggestions.

2. Literature Review

Following the central tenet of pragmatism (Peirce, 1960), depreciation as a method for cost allocation must be defined by the circumstances surrounding its calculation. Changing the depreciation technique in a corporation's accounting system can have practical ramifications for various tasks for the business and its shareholders. In a deterministic simulation of an economic system, the impact of depreciation on the profit tax is evident, and this is the focus of practicing accountants (Zaitsev et al., 2019). Thus, investigating the tax impacts induced by depreciation in equipment replacement decision-making under uncertainty necessitates extensive stochastic simulation approaches, but the conclusions are unclear (Adkins et al., 2013; 2017). Researchers actively discuss the use of depreciation indicators in management accounts, particularly regarding pricing and cost management problems (Salinger, 1998; Gunn, 2003; Rogerson, 2011; Nechitaylo et al., 2020), budgeting, and evaluating the performance of responsibility centers (Grinyer, 1987; Dutta et al., 2002; Bell, 2018; Victorova et al., 2019; Zaitsev et al., 2019).

The impact of depreciation on public financial statements and judgments taken on its basis is the subject of numerous studies. Analyzing how depreciation affects the selling price of fixed assets, Jackson, Rodgers, and Tuttle (Jackson et al., 2010) conclude that in decision-making, managers are inclined to consider the residual value of fixed assets in financial reporting rather than their market prices, even if the information about them is available. The authors of Fattinnanzi et al. (2020) examine depreciation from the perspective of public property valuation and demonstrate that the Depreciated Replacement Cost Method overestimates the actual prices of assets. Kang et al. (2010) examine the function of depreciation in real estate investment trusts (REIT) and conclude that fixed assets are consistently understated in the company's public financial statements. Bu (2006) examines the macroeconomic impacts of higher depreciation and, consequently, higher rates of devaluation of fixed assets in developing nations relative to more developed countries.

According to this research, depreciation's primary pragmatic purpose in financial accounting is to control the size of a company's net profit and dividends. Modern scholars analyze this topic primarily in terms of the impact that financial statement indicators have on the behavior of stock market participants and, consequently, on stock prices (i.e., the market value of companies) and the investment decisions made by the managers of these organizations. According to several review articles, including Roychowdhury et al. (2019) and Shakespeare (2020), this influence is paradoxical and must be investigated further. Even more importantly, the issue is less pressing for companies that are not publicly traded, and these companies succeed.

In the meantime, another factor not directly tied to the behavior of financial market participants and firm executives typically remains hidden. Depreciation in financial statements establishes an institutional limitation for the withdrawal of cash from the firm in the form of dividends, which can affect the company's underlying value. Therefore, the first question concerns the conditions under which the depreciation method employed in financial statements involves the company's intrinsic worth and its market value added. If such terms are disclosed, a second question arises: what factors can enhance or decrease the difference in market value added when different depreciation techniques are utilized in financial statements? This research aims to provide answers to these problems.

3. Methodology and Data

To solve the problems stated above, the following model of company value is applied:

$$P_{k-1} = PB_{k-1} + M_{k-1} = E_{k-1} + L_{k-1} + MVA_{k-1}\,, \tag{1}$$

$$PB_{k-1} = \sum_{t=k}^{n} \frac{CF_t - IFA_t}{(1+r)^{t-k+1}} + \frac{CF_{n+1}}{(r-g)\cdot(1+r)^{n-k+1}} - \frac{PV_{IFAn}}{(1+r)^{n-k+1}} = FA_{k-1} + S_{k-1} + MVA_{k-1}, \tag{2}$$

where P_{k-1} is the company value at the beginning of period k, $k \in 1:n$;

PB_{k-1} is the present value of the operating assets at the beginning of period k;

M_{k-1} is the temporarily free funds invested in highly liquid and low-risk financial assets at the beginning of period k;

E_{k-1} is the equity according to the public financial statements at the beginning of period k;

L_{k-1} is the debt of the company (except accounts payable) at the beginning of period k;

MVA_{k-1} is the market value added of the company at the beginning of period k;

CF_t is the net cash flow from operations in period t, $t \in 1:n$

IFA_t is the investment in the fixed assets in period t;

r is the cost of capital;

g is the growth rate of cash flow from operations after the terminal date;

PV_{IFAn} is the terminal value of future investments in fixed assets starting from period $n+1$, calculated using the Infinite Chain Method for each fixed asset item that should be replaced.

FA_{k-1} is the residual value of the non-current operating assets at the beginning of period k (for our discussion, let us take it equal to the residual value of the fixed assets putting aside that the company may have intangible assets and constructions in progress);

S_{k-1} is the net current operating assets (the sum of inventories, accounts receivable, and the required cash balance, which can be calculated differently (Matveeva et al., 2016), minus accounts payable) at the beginning of the period k.

Based on equations (1) and (2), it can be shown that the interrelation between depreciation and other indicators of the public financial statements in period k has the following form:

$$\Delta M_k + \Delta S_k + IFA_k + D_k = NP_k + DP_k + \Delta DTL_k + IE_k + \Delta L_k, \quad (3)$$

where ΔM_k is the change of temporarily free funds invested in highly liquid financial assets in period k, $\Delta M_k = M_k - M_{k-1}$;

ΔS_k is the change of net current operating assets in period k, $\Delta S_k = S_k - S_{k-1}$;

D_k is the dividends paid in period k;

NP_k is the net profit according to the public financial statements in period k;

DP_k is the depreciation in the financial statements in period k;

ΔDTL_k is the difference between the changes of deferred tax liabilities and deferred tax assets in the financial statements in period k (given the subject of the research, in further calculations, is taken into account only as caused by the difference in the methods used for depreciation in tax accounting and financial statements);

IE_k is the equity received from the owners in period k;

ΔL_k is the change in the debt (except accounts payable) in period k, $\Delta L_k = L_k - L_{k-1}$.

Furthermore, the change in temporarily free funds in equation (3) can be divided into three constituents by types of activity:

$$\Delta M_k = CF_k - IFA_k + [IE_k + \Delta L_k + M_{k-1} \cdot w - L_{k-1} \cdot r_L - D_k], \quad (4)$$

$$CF_k = NOPAT_k + DP_k + \Delta DTL_k - \Delta S_k = EDITDA_k \cdot (1-T) + DPT_k \cdot T - \Delta S_k \quad . \quad (5)$$

where w is the rate of return after tax on liquid financial assets M;

r_L is the cost of debt L.

$NOPAT_k$ is the net operating profit after tax in period k;

$EBITDA_k$ is the earnings before interest, taxes, depreciation, and amortization in period k;

T is the profit tax rate;

DPT_k is the depreciation in tax accounting in period k.

Suppose in equation (3) the investments in the operating non-current and current assets exceed or equal to the depreciation. At the same time, the remaining net profit is paid out in dividends, and no other funding is used. In that case, most of the funds are concentrated in operating assets, and the intrinsic value can be estimated using formulas (1) and (2) without any adjustment. Such a position is usual for rapidly growing companies and steadily operating firms, in which the replacement of multiple fixed assets is gradual so that the amount of depreciation is approximately equal to the costs of fixed assets replacement within many reporting periods. Thus, if inequality $IFA_t + \Delta S_t \geq DP_t$ takes place for all $t \in 1:n$, evaluation of the impact of depreciation on the company value is not a special problem.

However, in some cases (predominantly when the business is mature), the company can accumulate depreciation in the form of highly liquid financial assets. As a rule, the rate of return on this investment w is lower than the required rate of return on investment in operating assets r, i. e. typically $r>w$. In terms of company evaluation, highly liquid financial assets are usually estimated at the market value M_{k-1}, which, in the case of the efficient financial market, is closer to the value obtained through discounting at the rate w of future earnings from this investment. This value in the total with the present value of the operating assets PB_{k-1} according to (1) should be equal to the company's intrinsic value at the moment k-1. Such a practice would be reasonable in cases where the change of short-term financial assets has nothing to do with the company's future operating activity and should be evaluated separately.

Meanwhile, the changes in the temporarily free funds invested in financial assets directly follow from the operational activity are subject to risk. Thus, at $r>w$, the present value of short-term financial assets will be less than M_{k-1} at the value X_{k-1}, which is determined by the difference between r and w:

$$M_{k-1} = X_{k-1} + \frac{M_{k-1} \cdot (1+w) - M_k}{1+r} + \frac{M_k \cdot (1+w) - M_{k+1}}{(1+r)^2} + \ldots + \frac{M_{n-1} \cdot (1+w) - M_n}{(1+r)^{n-k+1}} + \frac{M_n}{(1+r)^{n-k+1}} \quad . \quad (6)$$

After the elementary transformation of (6), we obtain the following:

$$X_{k-1} = \frac{M_{k-1} \cdot (r-w)}{1+r} + \frac{M_k \cdot (r-w)}{(1+r)^2} + \ldots + \frac{M_{n-1} \cdot (r-w)}{(1+r)^{n-k+1}} \quad . \quad (7)$$

According to the going concern postulate, i.e., assuming that $n \to \infty$ (7) can be written as follows:

$$X_{k-1} = \sum_{t=k}^{\infty} \frac{M_{t-1} \cdot (r-w)}{(1+r)^{t-k+1}}. \quad (8)$$

Since planning calculations have quite a definite perspective *n*, (8) should be modified in the following way:

$$X_{k-1} = \sum_{t=k}^{n} \frac{M_{t-1} \cdot (r-w)}{(1+r)^{t-k+1}} + \frac{X_n}{(1+r)^{n-k+1}}. \quad (9)$$

When (9) is used, choosing a planning horizon comparable with the long-term useful life of the company's fixed asset is desirable. Otherwise, estimating the value Xn using the Infinite Chain Method is difficult.

For better clarification of the content of the value X_{k-1}, let us look at the problem from another standpoint. The matter is that when the operating assets are evaluated using formula (2), it is assumed that the incoming funds, including depreciation, should be reinvested in the assets with the required return *r*. When such an evaluation is made, the alternatives for future reinvestment are not usually known. Some of the funds can be paid out to the owners in the form of dividends and invested in the stocks of other companies with a similar level of risk and rate of return *r*. Meanwhile, a production or a trading company has fewer alternatives for investing funds. If there is no need to invest in operating assets and these funds cannot be paid out to the owners, highly liquid and low-risk financial assets (bank deposits, state bonds, etc.) are the only way for temporary investing of free funds because the main objective of a company is to maintain its operational activity and temporarily free funds can't be immobilized for a long time. Due to this fact, when planning financial investments, it may be found that the available yield on these investments w is significantly lower than the required return on the operating assets *r*. According to the public financial statements, suppose all the net profit is withdrawn as a dividend from (3). In that case, it can be easily seen that most of the increment of free funds is related to the depreciation of the non-current operating assets.

In this case, X_{k-1} can be considered as an adjustment of the company value for the present value of lost profits when temporarily free funds are deposited in highly liquid financial assets, while the part of this amount related to the impact of depreciation can be estimated using the formula below:

$$XDP_{k-1} = \sum_{t=k}^{n} \frac{(M_{t-1} - \hat{M}_{t-1}) \cdot (r-w)}{(1+r)^{t-k+1}} + \frac{XDP_n}{(1+r)^{n-k+1}}, \quad (10)$$

Where $\hat{M}_{t-1}$ are the free funds at the beginning of period *t*, estimated with an assumption that depreciation is not charged in the financial accounting and DP_t in (3) is defined as the initial value of the retired fixed assets, while the loss which is regularly incurred because of it, is covered by the owners. Consequently, $M_{t-1} - \hat{M}_{t-1}$ is the estimated value of the depreciation fund at the moment *t*-1. An alternative and less conservative variant for calculating this value can result not from a formal requirement to maintain the capital invested by the owners but from the need for financial solvency allowing the company to operate even when an uncovered loss persists for some time.

In addition, by preventing the transfer of momentarily available cash to the owners and collecting them in highly liquid financial assets for future investment in operating assets, the company saves on future capital-raising from the owners. To determine the core of these cost savings, let us imagine a hypothetical future for the company in which the owners may fully withdraw the net profit and the depreciation after each reporting period. Then, as the costly fixed assets had to be replaced following (3), the company would regularly suffer a shortage of funds, i.e., a negative cash balance, and to continue operations, it would have to obtain new funds from its owners to restore the sums previously paid to them. These operations should not result in substantial costs for tiny non-profit organizations. However, the cost of a stock offering is not likely negligible for major public corporations. Consequently, according to the accounting entity postulate, depreciation in the public financial statements and the barrier it generates for capital outflow may be viewed to reduce issue costs in the typical scenario. Considering the need to preserve the capital invested by the owners, these savings can be presented formally as follows:

$$y_t = \begin{cases} 0, & \tilde{\tilde{NP}}_t \geq 0, NP_t \geq 0 \\ -\tilde{\tilde{NP}}_t \cdot \frac{v}{1-v}, & \tilde{\tilde{NP}}_t < 0, NP_t \geq 0 \\ -(\tilde{\tilde{NP}}_t - NP_t) \cdot \frac{v}{1-v}, & \tilde{\tilde{NP}}_t < 0, NP_t < 0 \\ NP_t \cdot \frac{v}{1-v}, & \tilde{\tilde{NP}}_t \geq 0, NP_t < 0 \end{cases} \quad (11)$$

where $\tilde{\tilde{NP}}_t$ is the estimated value of net profit (loss) in period *t* before the capital deficiency coverage, in the case when depreciation is not charged in the public financial statements, and the initial value of fixed assets is expensed at the time of their disposal.

v is the issue costs of the raised equity.

At the same time, if the company follows the requirement of financial solvency rather than the formal requirement to maintain the capital invested by the owners, it would become possible to use the model instead of (11), where the need for raising equity is assessed assuming that the raised funds are used to cover the scarcity of cash balance rather than to recoup the retained loss.

After saving on the issue for several future periods is assessed, its impact on the value of the company now k-1 is calculated in the following way:

$$Y_{k-1} = \sum_{t=k}^{n} \frac{y_t}{(1+r)^{t-k+1}} + \frac{Y_n}{(1+r)^{n-k+1}} \quad (12)$$

It may be seen from above that if all $t \in k:n$ the net profit is paid out to the owners in full, to reflect the impact of depreciation, the value P_{k-1} and MVA_{k-1} should be adjusted by:

$$U_{k-1} = Y_{k-1} - XDP_{k-1}, \quad (13)$$

Guided by the recommended methodology, let us examine the influence of depreciation on the MVA of four hypothetical organizations that are similar in all respects except for the accounting depreciation method they employ. Company A uses the double-declining balance method; Company B uses the linear method; Company C currently uses the linear method but plans to apply the double-declining balance method to all newly acquired fixed assets; and company D acts in the exact opposite manner, using the double-declining balance method and planning to switch to the linear method.

Table 1 offers analytical accounting data for fixed assets that these companies intend to employ within the next five years. The depreciation and residual values of these companies' fixed

assets over the next five years are depicted in Tables 2 and 3, respectively. In addition, for the same horizon, Tables 2 and 3 display the projections for the other financial indicators required to determine the intrinsic worth of these companies. When the market value added, and other economic indicators of the companies are calculated following the models discussed previously, the following assumptions are made: The companies have four fixed assets in permanent operation and are periodically replaced with similar items. For the sake of simplicity, it is assumed that the items are returned immediately at the end of the year and that their use begins at the start of the next year.

- The projected life cycle and useful life are equivalent for depreciation purposes in financial and tax accounting.
- The double-declining balance approach calculates depreciation in tax accounting, per accounting regulation.
- The financial accounting concept of depreciation has no bearing on the calculation of the property tax base. If the tax legislation of the country in which the company operates requires the tax base to be computed using the residual value of fixed assets in financial accounting (as is the case in Russia), the depreciation method has a direct impact on future cash flows, making it more difficult to estimate the effect of the factors under consideration on the market value added.
- The owners withdraw the entire net profit as dividends in the year it is earned.
- For all firms, the owners' equity is paid in 50,500 thousand rubles and remains constant over the planning horizon.
- No borrowed money is required to finance the operation, and the opportunity costs of raising stock determine a discount rate of 10%.
- To simplify the computations, it is assumed that all changes in cash accounts occur at the end of each planning year, although interest is charged annually.
- Beginning in the sixth year, operating cash flow stabilizes at the level of the fifth year.

The tax rate on profits is 20%.

Table 1. Fixed assets that company A, B, C, and D plan to use in 5 years horizons (Author's Data)

Fixed asset	Useful life, years	Remaining useful life at the time of planning, years	Initial value at the time of planning, thousand rubles	Costs of replacement in future, thousand rubles
FA1	5	2	21,000	21,000
FA2	5	2	6,500	5,200
FA3	5	4	19,000	19,800
FA4	5	4	7,500	6,800

Table 2. The indicators of the operating financial result and cash flow of companies A, B, C, and D within the planning horizon, thousand rubles (Author's Data)

Indicator		Planning year					
		1	2	3	4	5	6 - ∞
Earnings before interest, depreciation, and amortization *EBITDA*(1-T)*		11,686	11,460	11,168	14,024	14,024	14,024
Depreciation tax shield *DPT*T*		1,866	1,357	2,668	1,830	2,883	2,064
Net cash flow from operations *CF*		13,507	12,728	13,193	15,854	16,907	16,088
Net cash flow from investment IFA		0	-26,200	0	-26,600	0	0
Depreciation in the financial accounting of the company *DP*	A	9,330	6,786	13,342	9,150	14,413	-
	B	10,800	10,800	10,540	10,540	10,560	-
	C	10,800	10,800	15,780	11,588	14,413	-
	D	9,330	6,786	8,102	8,102	10,560	-

Table 3. The indicators calculated for companies A, B, C, and D at the end of each year (0-5), thousand rubles (Source: Author's data)

Indicator	Company	End of the year					
		0	1	2	3	4	5
Net current operating assets *S*	A B, C, D	4,936	4,980	5,069	5,712	5,712	5,712
The residual value of fixed assets *FA*	A	21,840	12,510	31,924	18,582	36,032	21,619
	B	32,200	21,400	36,800	26,260	42,320	31,760
	C	32,200	21,400	36,800	21,020	36,032	21,619
	D	21,840	12,510	31,924	23,822	42,320	31,760
Temporary free funds in short-term financial assets *M*	A	23,724	33,010	13,507	26,206	8,756	23,168
	B	15,436	25,898	9,606	20,063	3,725	15,056
	C	15,436	25,898	9,606	24,255	8,756	23,169
	D	23,724	33,010	13,507	22,014	3,725	15,056
Deferred tax *DTL*	A	0	0	0	0	0	0
	B	2,072	1,778	975	1,536	1,258	2,028
	C	2,072	1,778	975	488	0	0
	D	0	0	0	1,048	1,258	2,028

To answer the posed questions, we compare the MVA of companies A, B, C, and D using the layout in Figure 1. First, we calculate this indicator for companies A, B, C, and D according to (1) and (2) with adjustments (9) and (12) for the rate of return on financial investment before tax $w^*=w/(1-T)$ =0.04 and the rate of issue cost v=0.04 at each reporting date within the planning horizon.

In addition, following (13), we estimate adjustment *U* for the value of the companies and calculate its weight in the general adjustment *Y-X*. The comparison of the pars A-B allows measuring the impact of the differences in the depreciation methods used by the companies consistent in their accounting policy since the time they were set up. At the same time, the pairs D-A and C-B are compared to see the effect of the change

in the depreciation method in identical circumstances at the beginning of the first planning period.

Additionally, to study the possibility of improving the MVA in case of the consistent accounting policy pursued by companies A and B, we measure the maximum allowable level of reduction of equity *E* and temporary free funds in short-term financial assets *M* at the planning horizon as a result of shares buyout. After estimating the new level of the MVA0 and adjustment for companies A and B after the change in the equity invested by the owners (let us designate them A' and B'), we compare the value pairs A'-A and B'-B.

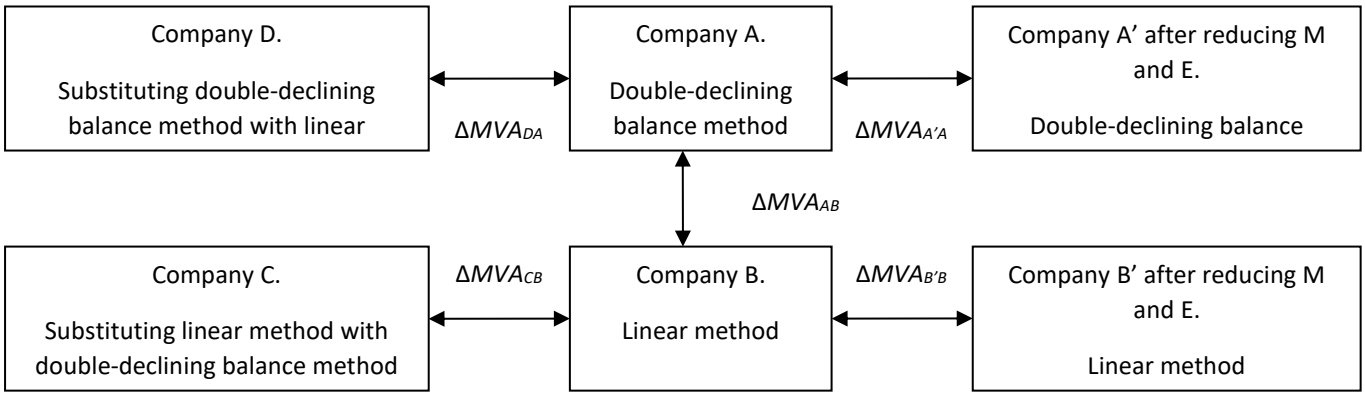

Figure 1. The layout of the companies A, B, C, and D MVA comparison

($\Delta MVA_{AB}=MVA_A-MVA_B$, $\Delta MVA_{DA}=MVA_D-MVA_A$, $\Delta MVA_{CB}=MVA_C-MVA_B$, $\Delta MVA_{A'A}=MVA_{A'}-MVA_A$, $\Delta MVA_{B'B}=MVA_{B'}-MVA_B$).

To answer the question about the factors determining the difference between the MVA_0 of companies A, B, C, and D, according to (9) and (12), we calculate several adjustments to the value of companies $Y_0 - X_0$ for different rates of return on financial assets *w* and for different rates of issue costs *v*. Since variation *w* and *v* affects the future profits and alternative costs and does not impact on M_0 and DTP_0, to analyze the impact of variation *w* and *v* on the MVA it is enough to examine only its effect on $Y_0 - X_0$. We consider the variation in the rate of return on short-term financial assets within the interval from 0 to the discount rate in increments of 1% and the variation in the rate of issue costs from 0 to 6% in increments of 2%. As a result, we get the adjusted MVA_0 of companies A, B, C, and D for each pair of *w* and *v*. Further, we calculate the differences in the MVA_0 for pairs A-B, D-A, and C-B and analyze their dependence on *w* and *v*.

4. Results and Discussion

The results of calculating the financial indicators of companies A, B, C, and D at the beginning of the first planning year are presented in Table 4. The companies have an identical potential for generating free cash flows *PB*, so the differences in free funds M0 determine the difference in their MVA, deferred taxes DTL_0, and adjustment $Y_0 - X_0$ due to variance in depreciation in financial accounting. The main part $Y_0 - X_0$ (from 95.3% for B' to 97.9% for A) is caused by the devaluation and deferred taxes. For this reason, in our case, it is possible to use $Y_0 - X_0$ instead of values U_0 to measure the effect of depreciation on the MVA.

The comparison of the MVA_0 of companies A and B, which have been consistent in their accounting policy since the time they were set up, shows that despite a big negative adjustment for company A, it also has a bigger MVA. To a large extent, it can be explained by greater temporarily free funds M_0 by company A due to the faster depreciation in the past. What is more, the last difference is more essential than the difference in the adjustment $Y_0 - X_0$. This fully explains the fact that when the MVA is analyzed for several future reporting dates, the difference in the MVA between A and B reaches the minimum at the end of the second and fourth year, i.e., at the moments when retired fixed assets are replaced with new ones and when the difference in the balance of free funds is also minimal which can be seen in Figure 2.

Table 4. The indicators of the actuarial balance sheet (1) of companies A, B, C, and D with adjustments (9) and (12) at the beginning of the first planning year at w*=0.04 and v=0.04, thousand rubles.

Indicator	Company					
	A	B	C	D	A'	B'
Present value of the aggregate operating assets PB_0	48,882	48,882	48,882	48,882	48,882	48,882
Temporarily free funds in financial investments M_0	23,724	15,436	15,436	23,724	14,968	11,711
The adjustment for the difference in the saving on issue costs and lost profits from investing temporarily free funds in financial assets Y_0-X_0, including due to:	-10,899	-7,154	-8,102	-9,952	-5,646	-4,919
depreciation and deferred taxes U_0	-10,669	-6,924	-7,871	-9,721	-5,415	-4,689
Total company value P_0	**61,707**	**57,164**	**56,216**	**62,654**	**58,204**	**55,674**
Share capital	50,500	50,500	50,500	50,500	41,744	46,775
Retained earnings	0	0	0	0	0	0
Deferred taxes DTL_0	0	2,072	2,072	0	0	2,072
Market value added MVA_0 adjusted for Y_0-X_0	11,207	4,592	3,644	12,154	16,460	6,827
Total company value P_0	**61,707**	**57,164**	**56,216**	**62,654**	**58,204**	**55,674**

The difference between A and B's MVA does not indicate a preference for the double-declining balance technique, as it represents the result of prior judgments regarding the depreciation method. The circumstances are not comparable and do not need a change in the depreciation method. Under these conditions, a question may arise regarding removing funds not required for operations on the horizon of planning. This cash may be withdrawn by purchasing shares. Table 3 demonstrates that 3,725 thousand rubles can decrease firm B's share capital without affecting operations. In this manner, the

present value of future lost profits X0 can be reduced, and 2,235 thousand rubles can increase firm B's MVA0. The latter number is determined by comparing the MVA0 of B and B' according to Table 4's data. Thus, business A can cut its share capital by 8,756,000 rubles, thereby increasing its MVA0 by 5,253,000 rubles.

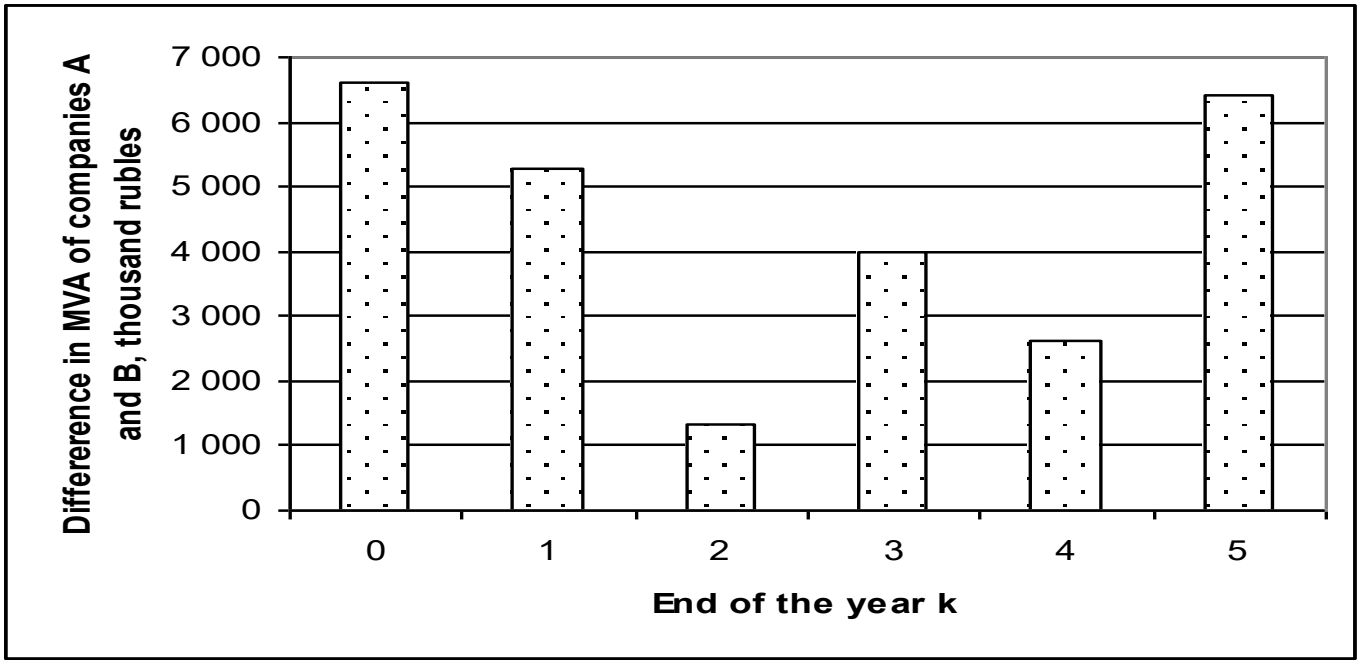

Figure 2. Dynamics of the difference in the MVA of companies B and A, $\Delta MVA_{AB}=MVA_A-MVA_B$

To determine the most advantageous method of depreciation in financial accounting, let us examine the effects of various methods under comparable initial conditions, i.e., when the value of free funds and deferred taxes is the same at the start of the first year, which is only possible if two companies use the same depreciation method. Comparing the MVA0 of firms D and A based on the data in Table 4 reveals that when company D switches from the decreasing balance approach to the linear method, the present value of future lost profits X0 decreases, and the MVA0 rises by 947 thousand rubles.

Comparing the MVA0 of firms C and B reveal that company C's switch from the linear technique to the double-declining balance method for all newly acquired fixed assets results in a proportional increase in X0 and a drop in MVA0. Figures 3 and 4 demonstrate the expected dynamics of the differences between MVADA and MVACB on the planning horizon mirror symmetrically. The disparity between the compared MVA pairs reverses sign beginning in the third year when new fixed assets are placed into operation.

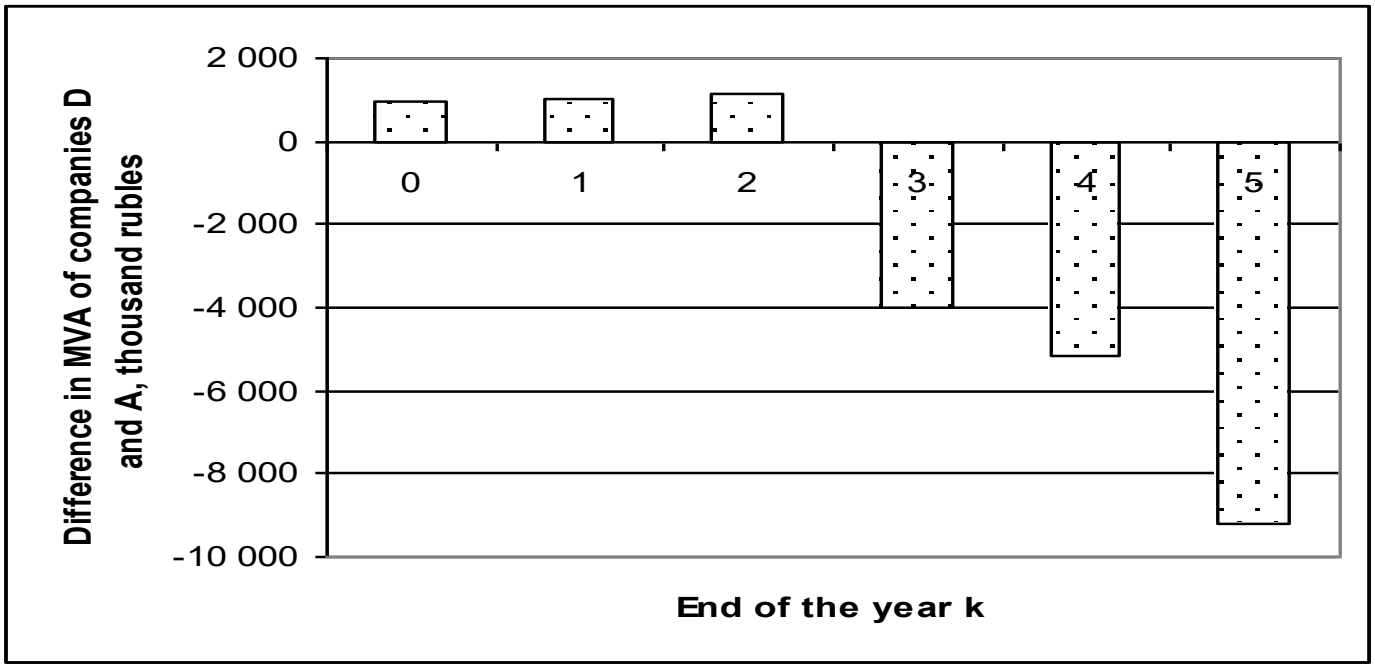

Figure 3. Dynamics of the difference in the MVA of companies D and A, $\Delta MVA_{DA}=MVA_D-MVA_A$

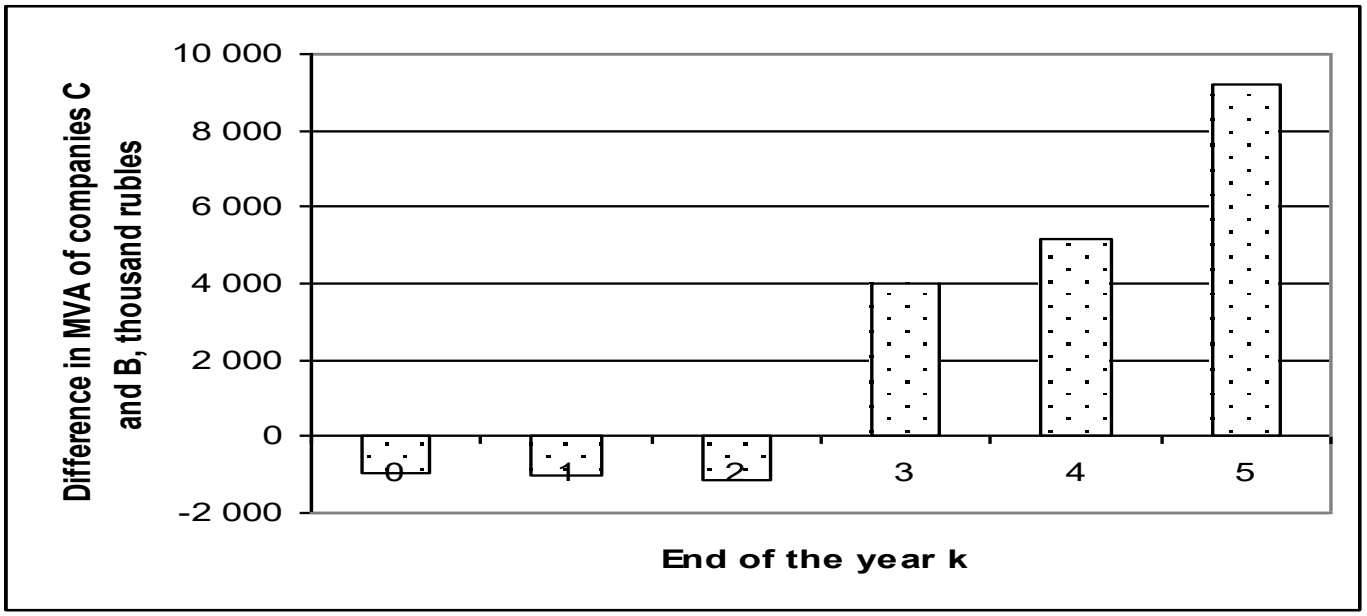

Figure 4. Dynamics of the difference in the MVA of companies C and B, $\Delta MVA_{CB}=MVA_C-MVA_B$

The results of calculating the adjustment $Y_0 - X_0$ at different *w* and *v* of companies A and B are presented in Tables 5 and 6, respectively. If the discount rate is constant and *w* and *v* increase, $Y_0 - X_0$ grows, and at w^*=0.09, this indicator becomes positive. The pairwise comparison of the indicators in the tables shows that the variation of w fully explains the difference in companies A and B adjustments. It is caused by the fact that when the net financial results *NP* are positive on the planning horizon, the difference in depreciation method does not affect the adjustment Y_0, which follows from (11). For the other companies, the calculations are similar, so they are not discussed here in detail.

Table 5. Adjustment at different w and v for company A, thousand rubles

	Issue costs *v*			
Rate of return on financial assets *w**	0	0.02	0.04	0.06
0	-21,719	-20,674	-19,586	-18,451
0.01	-19,547	-18,502	-17,414	-16,280
0.02	-17,375	-16,331	-15,243	-14,109
0.03	-15,203	-14,159	-13,071	-11,937
0.04	-13,031	-11,987	-10,899	-9,766
0.05	-10,859	-9,816	-8,728	-7,595
0.06	-8,688	-7,644	-6,557	-5,423
0.07	-6,516	-5,472	-4,385	-3,252
0.08	-4,344	-3,300	-2,214	-1,080
0.09	-2,172	-1,129	-42	1,091
0.1	0	1,043	2,130	3,262

Table 6. Adjustment $Y_0 - X_0$ at different *w* and *v* for company B, thousand rubles

	Issue costs *v*			
Rate of return on financial assets *w**	0	0,02	0,04	0,06
0	-15,477	-14,432	-13,344	-12,209
0.01	-13,929	-12,885	-11,797	-10,662
0.02	-12,382	-11,337	-10,249	-9,115
0.03	-10,834	-9,790	-8,702	-7,568
0.04	-9,286	-8,242	-7,154	-6,021
0.05	-7,738	-6,695	-5,607	-4,474
0.06	-6,191	-5,147	-4,060	-2,926
0.07	-4,643	-3,600	-2,513	-1,379
0.08	-3,095	-2,052	-965	168
0.09	-1,548	-504	582	1,715
0.1	0	1,043	2,130	3,262

Correspondingly, in the case of the paired comparison of the MVA_0 of companies A-B, D-A, and C-B, the difference in the MVA_0 at the chosen parameters of operating and investment activities and constant discount rate are fully explained by the variation of *w*, which can be seen in Table 7. In addition to the above, for pairs D-A and C-B, when $w^*=r$=0.1, the depreciation method does not affect MVA_0. The differences in MVA_0 depend linearly on w^*:

$$\Delta MVA_{AB} = 62419 \cdot w^* + 4118$$

$$\Delta MVA_{DA} = -15793 \cdot w^* + 1579$$

$$\Delta MVA_{CB} = 15793 \cdot w^* - 1579$$

Table 7. The difference in the MVA0 of companies A, B, C, and D at different w, thousand rubles

*w**	A-B	D-A	C-B
0	4,118	1,579	-1,579
0.01	4,742	1,421	-1,421
0.02	5,366	1,263	-1,263
0.03	5,991	1,105	-1,105
0.04	6,615	948	-948
0.05	7,239	790	-790
0.06	7,863	632	-632
0.07	8,487	474	-474
0.08	9,112	316	-316
0.09	9,736	158	-158
0.1	10,360	0	0

5. Discussion

It should be noted that at a given point in the future if the linear approach is utilized, the market value added will be less than the level attained by this indication if accelerated depreciation methods were employed. This is because the depreciation technique adopted in financial accounting cannot affect the generation of future free cash flow (and, consequently, the present value of the operational assets) but might affect the company's momentarily available cash. These funds grow if accelerated depreciation procedures are utilized at a given point in the future. This may result in a greater MVA. Moreover, while selecting the technique of depreciation, the primary criterion is the current MVA, not the future MVA, which is greater under comparable conditions if the linear method is utilized. As for future MVA, they can also be enhanced. This can be accomplished by partially withdrawing temporarily available cash in the form of a share buyback, as opposed to a change in accounting policy.

The results of calculating the adjustment $Y_0 - X_0$ at different *w* and *v* of companies A and B are presented in Tables 5 and 6, respectively. It can be seen that if the discount rate is constant and *w* and *v* increase, $Y_0 - X_0$ grows, and at w^*=0.09, this indicator becomes positive. The pairwise comparison of the indicators in the tables shows that the variation of w fully explains the difference in adjustments of companies A and B. Ruan (2020) states the dependence of investment decisions of some companies on the expected future value of fixed assets resale, which is determined by the depreciation method used. Fattinnanzi et al. (2020) consider depreciation from the standpoint of public property evaluation and show that the Depreciated Replacement Cost Method leads to overestimation compared with the actual prices of assets. Kang et al. (2010) look at the role of depreciation in real estate investment trusts (REIT) and conclude that a consistent underestimation of the fixed assets in the public financial statements in this business

6. Conclusions and Recommendations

The conclusion is that the method of depreciation utilized in financial accounting may impact a company's intrinsic value and MVA. This impact illustrates depreciation as a mechanism that ensures the company's independence and occurs when its value periodically surpasses investments in working assets. The surplus is temporarily stored in highly liquid financial assets. In this case, the value of the company should be adjusted, on the one hand, for the present value of the lost profit from the deposition of temporarily free funds in highly liquid assets and, on the other hand, for the current value of the cost savings associated with the capital transfer between the company and its owners. Suppose a positive net financial result is anticipated at the planning horizon. In that case, the depreciation technique should only consider the first adjustment, defined by the rate of return on the temporarily available financial assets w. This is because the method of depreciation may impact the balance of temporarily free funds at future reporting dates and, consequently, the investment income lost. Likewise, the second adjustment, determined by the issue costs v, is irrelevant under these conditions.

Consequently, when the rate of return on short-term financial assets w is equal to the discount rate r, the depreciation method has no impact on a company's current MVA. If true, the approach that provides the slowest depreciation of non-current operational assets should be selected. In this study, the linear approach is such a technique. Using the linear and accelerated depreciation techniques, the difference in MVA is precisely proportional to w at a constant r.

These clauses only make sense if the owners can invest the company-obtained funds in assets with an average return of r. In the absence of these, there are no assets with relative risk on the financial market, which calls into doubt the accuracy of the initial model of the company's intrinsic value (1), as its judgments under such conditions are very conditional. Nonetheless, despite the conceptual limitations of the study, the results provide some insights into the relationship between public financial statements and the company's intrinsic value, which may be useful for financial analysts and accountants who shape the accounting policy of large corporations.

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References

Aboody, D., Barth, M. E. and Kasznik, R. (1999) 'Revaluations of fixed assets and future firm performance: Evidence from the UK,' *Journal of Accounting and Economics*, 26(1–3), pp. 149–178. doi: https://doi.org/10.1016/S0165-4101(98)00040-8

Adkins, R. and Paxson, D. (2013) 'The effect of tax depreciation on the stochastic replacement policy', *European Journal of Operational Research*, 229(1), 155–164. doi: https://doi.org/10.1016/j.ejor.2013.01.050

Adkins, R. and Paxson, D. (2017) 'Replacement decisions with multiple stochastic values and depreciation', *European Journal of Operational Research*, 257(1), 174–184. doi: https://doi.org/10.1016/j.ejor.2016.07.006

Ahmad, M., Beddu, S., binti Itam, Z., & Alanimi, F. B. I. (2019). State of the art compendium of macro and micro energies. *Advances in Science and Technology Research Journal*.13(1), 88–109 https://doi.org/10.12913/22998624/103425.

Ali, M., Ullah, S., Ahmad, M. S., Cheok, M. Y., & Alenezi, H. (2022). Assessing the impact of green consumption behavior and green purchase intension among millennials toward sustainable environment. *Environmental Science and Pollution Research*, 1-13. doi: https://doi.org/10.1007/s11356-022-23811-1

Bell, P. W. (2018) 'Depreciation accounting and evaluation of decisions and performance', in *Toward Greater Logic and Utility in Accounting: The Collected Writings of Philip W. Bell*. Hernando, FL: Rice University, 103–141. doi: https://doi.org/10.4324/9781315052663-4

Bu, Y. (2006) 'Fixed capital stock depreciation in developing countries: Some evidence from firm level data', *The Journal of Development Studies*, 42(5), 881–901. doi: https://doi.org/10.1080/00220380600742183

Dutta, S. and Reichelstein, S. (2002) 'Controlling investment decisions: Depreciation- and capital charges', *Review of Accounting Studies*, 7(2–3), 253–281. doi: https://doi.org/10.1023/a:1020238405769

Fattinnanzi, E. *et al.* (2020) 'Applying the depreciated replacement cost method when assessing the market value of public property lacking comparables and income data', *Sustainability (Switzerland)*, 12(21), 1–22. doi: https://doi.org/10.3390/su12218993

Get'man, V. G. (2020) 'Rules of Fixed Assets Accounting Should Be Changed', *Accounting. Analysis. Auditing.*, 7(1), 42–48. doi: https://doi.org/10.26794/2408-9303-2020-7-1-42-48

Grinyer, J. R. (1987) 'A New Approach to Depreciation', *Abacus*, 23(1), 43–51. doi: https://doi.org/10.1111/j.1467-6281.1987.tb00138.x

Gunn, C. (2003) 'On Intertemporal Subsidy-Free Prices and Economic Depreciation: Constrained Market Pricing Revisited', *Journal of Regulatory Economics*, 24(2), 135–159. doi: https://doi.org/10.1023/A:1024734027206

Hillier, J. R. and Willett, R. J. (2006) 'The impact of depreciation-type adjustments on the distribution of accounting earnings', *Accounting and Business Research*, 36(4), 309–335. doi: https://doi.org/10.1080/00014788.2006.9730030

Jackson, S. B., Rodgers, T. C. and Tuttle, B. (2010) 'The effect of depreciation method choice on asset selling prices', *Accounting, Organizations and Society*, 35(8), 757–774. doi: https://doi.org/10.1016/j.aos.2010.09.004

Kang, S.-H. and Zhao, Y. (2010) 'Information content and value relevance of depreciation: A cross-industry analysis', *Accounting Review*, 85(1), 227–260. doi: https://doi.org/10.2308/accr.2010.85.1.227

Khan, M. A., West, S. and Wuest, T. (2020) 'Midlife upgrade of capital equipment: A servitization-enabled, value-adding alternative to traditional equipment replacement strategies', *CIRP Journal of Manufacturing Science and Technology*, 29(Part B), 232–244. doi: https://doi.org/10.1016/j.cirpj.2019.09.001

Kuter, M. *et al.* (2018) 'Asset impairment and depreciation before the 15th century', *Accounting Historians Journal*, 45(1), 29–44. doi: https://doi.org/10.1016/j.cirpj.2019.09.00110.2308/aahj-10575

Lamden, C. W., Gerboth, D. L. and McRae, T. W. (1975) *Accounting for depreciable assets; Accounting research monograph 1*. New York: American Institute of Certified Public Accountants, 181. Retrieved from https://egrove.olemiss.edu/cgi/viewcontent.cgi?article=1002&context=aicpa_guides

Lane, J. and Willett, R. (1997) 'Depreciation need not be arbitrary', *Accounting and Business Research*, 27(3), 179–194. doi: https://doi.org/10.1080/00014788.1997.9729543

Lawrence, O. A. and Okechukwu, U. A. (2013) 'Review of accounting gimmicks called depreciation', *Open Journal of Accounting*, 2(2), 6. doi: http://dx.doi.org/10.4236/ojacct.2013.22007

Lisdiono, P., Said, J., Yusoff, H., Hermawan, A. A., & Manan, D. B. A. (2022). Risk Management Practices and Enterprise Resilience-The Mediating Role of Alliance Management Capabilities. *Journal of Advances in Humanities Research*, *1*(2), 77-91. doi: https://doi.org/10.56868/jadhur.v1i2.21

Matveeva, A. V., Kalmykova, D. V. and Chernenko, A. F. (2016) 'Optimization method of cash balance', *Journal of Applied Economic Sciences*, 11(4), pp. 773–781. Retrieved from https://www.ceeol.com/search/article-detail?id=534509

Nechitaylo, I. and Guzikova, L. (2020) 'Depreciation in the context of pricing in digital economy', in *SPBPU IDE '20: Proceedings of the 2nd International Scientific Conference on Innovations in Digital Economy: SPBPU IDE-2020, October 2020, Article No. 20*. ACM. doi: https://doi.org/10.1145/3444465.3444500

Peirce, C. S. (1960) *Collected papers of Charles Sanders Peirce/Vol. 5 Pragmatism and pragmaticism, Collected papers of Charles Sanders Peirce*. Edited by C. Hartshorne and P. Weiss. Cambridge, Massachusetts: Harvard University Press. Retrieved from https://books.google.co.in/books?hl

Rogerson, W. P. (2011) 'On the relationship between historic cost, forward looking cost and long run marginal cost', *Review of Network Economics*, 10(2). doi: https://doi.org/10.2202/1446-9022.1242

Roychowdhury, S., Shroff, N. and Verdi, R. S. (2019) 'The effects of financial reporting and disclosure on corporate investment: A review', *Journal of Accounting and Economics*, 68, 2–3. doi: https://doi.org/10.1016/j.jacceco.2019.101246

Ruan, L. (2020) 'Accounting for fixed assets and investment efficiency: a real options framework', *Accounting and Business Research*, 50(3), 238–268. doi: https://doi.org/10.1080/00014788.2019.1675492

Salinger, M. A. (1998) 'Regulating Prices to Equal Forward-Looking Costs: Cost-Based Prices or Price-Based Costs?', *Journal of Regulatory Economics*, 14(2), 149–164. doi: https://doi.org/10.1023/a:1008057218273

Schmalenbach, E. (1959) Dynamic Accounting, trans. Murphy, GW, Most, Kenneth S (based on Schmalenbach E (1925) Fundamentals of dynamic balance sheet theory, 3rd edn. Leipzig: Gloeckner). London: Gee and Company. Retrieved from https://books.google.co.in/books/about/Grundlagen_dynamischer_Bilanzlehre.html?id=rnpgnAEACAAJ&redir_esc=y

Shakespeare, C. (2020) 'Reporting matters: the real effects of financial reporting on investing and financing decisions', *Accounting and Business Research*, 50(5), 425–442. doi: https://doi.org/10.1080/00014788.2020.1770928

Sokolov, V.Y. (2015) 'Depreciation history in Russia before revolution', *The Bulletin of the Adyghe State University. Series "Economics*, (3), 118–123. Available at: http://vestnik.adygnet.ru/files/2015.3/4039/118-123.pdf

Ssaharti, M. (2022). The Impact of Crypto Currencies on the Economy and The Financial Industry. *Journal of Advances in Humanities Research*, *1*(1), 60-69. https://doi.org/10.56868/jadhur.v1i1.11.

Tomshinskaya, I. N. and Syrovatskiy, Y. Y. (2019)' Depreciation policy and depreciation fund as indicators of improving equipment efficiency', in *IOP Conference Series: Materials Science and Engineering, Volume 666, Quality Management and Reliability of Technical Systems, Article No.012053*. doi: https://doi.org/10.1088/1757-899X/666/1/012053

Victorova, N. G., Valebnikova, N. V. and Valebnikova, O. A. (2019) 'Improvement of methods of budgeting for the industrial enterprises of the Russian Federation for the purpose of maintaining essential competitive advantages in Hi-tech sectors of economy', in *Proceedings of the 33rd International Business Information Management Association Conference, IBIMA 2019: Education Excellence and Innovation Management through Vision 2020*, 1689–1700. Retrieved from https://www.elibrary.ru/item.asp?id=41701057

Wells, M. C. (1968) 'A note on the amortization of fixed assets', *The Accounting Review*, 43(2), 373–376. Retrieved from https://www.jstor.org/stable/243774

Zaitsev, A., Kichigin, O. and Korotkova, A. (2019) 'Standard dynamic financial analysis and control tools of an enterprise in the time of digital economy', in *SPBPU IDE '19: Proceedings of the 2019 International SPBPU Scientific Conference on Innovations in Digital Economy, October 2019, Article No. 17*. ACM. doi: https://doi.org/10.1145/3372177.3373305