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Excess Value Created as a Performance Metric and its Determination Utilizing the *TEVA* Measure

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ABSTRACT

The paper explores the excess value created (*EVC*) metric, which is an aggregated measure of the financial performance of a company over a multi-period measurement interval. **The relevance** of the study is due to the demand for practical solutions in the field of financial performance monitoring and incentive compensation, which makes it possible to achieve congruence between the interests of shareholders and the decisions of managers. **The aim** of the study is to build and justify a periodic financial measure that takes into account not only the current result but also the long-term consequences of management decisions. **The scientific novelty** of the study lies in the determination of the *EVC* metric via the *TEVA* indicator and providing the rationale for the new design of the performance measure. **The result** of the study is the derivation of formulas for calculating the *EVC* measure on multi-period and one-period intervals, which are free from restrictions on changes in the capital structure and the cost of capital, allow for a time-varying systematic risk of operating activities and possess the advantage of computational simplicity important for practical applications. The study **concludes** that the measurement of value created using the *EVC* indicator determined via *TEVA* makes it possible to achieve close conformity of the metric constructed to the real-world conditions with the unification of calculations in its retrospective and forecast components based on data available from historical and Pro Forma financial statements and information from the capital market.

Keywords: performance measurement; residual operating income; Total *EVA* (*TEVA*); value-based management

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INTRODUCTION

Companies increase their financial value to shareholders when they invest in strategies, projects, technologies, or products with a positive net present value. At the same time, investing in projects that are profitable ex ante does not guarantee that these investments will be profitable ex post. To achieve the goal of creating value, well-functioning mechanisms for measuring, monitoring and rewarding results are needed that stimulate management to realize the economic benefits embedded in the rationale for their decisions.

The difficulty here lies in the fact that the evaluation of the work of management should be based on the past, on actual results. On the other hand, the incentive effect of the indicator for ongoing monitoring of financial performance should be consistent with the overall goal of creating value. A periodic measure that potentially combines these two aspects is residual income — an indicator that characterizes the financial result after covering the income from alternative use of capital forgone by investors [1].

Since the late 1980s, along with the ideas and technologies of value management, the version of residual income, popularized by Stern Stewart & Co [2] under the trademark EVA™ (Economic Value Added), has become firmly established in management practice. The priority purpose of using the indicator is the current assessment of efficiency and the formation of remuneration for managers [3–6]. It should be noted that this, of course, is not the only area of active application of analytical criteria based on the concept of residual income. The issues of using *EVA* in evaluating investment projects [7], building value based management models [8] and controlling

[9] remain relevant. Focusing on the *EVA* indicator, a number of authors conduct a comparative analysis of the activities of Russian corporations from various sectors of the economy [10–12], evaluate the innovative potential of an enterprise [13], as well as the impact of investments in intellectual capital on the company's capitalization [14].

Typical for most publications in Russian periodicals is the interpretation in which the positive value of *EVA* of the period is identified with the creation (increase) of value, and the negative value with its destruction (decrease). And although the equivalence of calculating *NPV* based on expected residual incomes and expected cash flows has long been known [15] and repeatedly reproduced in the literature [16–18], this property does not make residual income maximization over a period equivalent to *NPV* maximization [1, 19–21]. Moreover, academic studies have repeatedly noted that the *EVA* indicator, and in its person the entire family of residual income indicators, has properties that cast doubt on the possibility of its direct use as a single period value creation measure. The most significant shortcomings, in the context of the task of measuring and encouraging performance, include the following.

Firstly, *EVA* is calculated on the basis of accounting data, and this, on the one hand, creates opportunities for manipulation by management [22], and on the other hand, entails the distorting effect of erroneous periodization due to accounting policy for depreciation of long-term assets adopted at the enterprise [7, 23].

Secondly, historical *EVA* does not necessarily reflect future performance, especially if the company is in transition or has made major capital investments. In the latter case, the *EVA* value cannot be an adequate indicator of the quality of managerial decisions due to the effect of deferred productivity: the values of the indicator fall due to the high base of invested capital, while the expected future return on investment is not taken into account in the calculations as a benefit [24].

Thirdly, *EVA* is a single-period metric focused on the current result, which can push management to choose the shortest and most convenient path to personal gain by maximizing the current *EVA* to the detriment of the company's long-term goals and its viability [25–27].

In a broader sense, the use of residual income for the ongoing evaluation of results and the basis for executive compensation leaves the agency problem unresolved. The manager is usually better informed about investment opportunities and their characteristics than his principal, the owner of the company. A prerequisite for a conflict of interest may be a shorter time horizon and/or higher than the principal's risk sensitivity when the agent evaluates his personal benefits at the time of making a decision: the principal seeks to maximize the expected net present value, and the agent seeks to maximize the utility function which depends on residual income through a compensation agreement linking wages to the financial performance of the company [28]. Thus, control and incentives based on the *EVA* indicator itself do not allow achieving a strict correspondence between the goals of the agent and the principal [16, 29, 30], and the decisions made by management may not be optimal with respect to the goal of maximizing financial value.

Bonus schemes based on indicators that are conceptually similar to *EVA* were used by many companies in the first half of the 20th century, but all of them eventually abandoned the idea of incentive payments in the form of a fixed share of *EVA* [31, 32]. The second wave of *EVA* popularity came in the 90s, but by 2008, at least 90% of the companies included in the S&P1500 index had excluded this metric from the arsenal of managerial effectiveness criteria, and out of 66 clients of the consulting company Stern Stewart & Co, who built in 1999 a system of material incentives based on a modified approach, called the "modern bonus plan *EVA*",[1] only six stayed committed by 2008

[1] The earned bonus in this scheme is calculated as the sum of the target bonus and a fixed share of the excess of the actual increase in EVA over the expected increase [35].

[24]. One of the main reasons for this under-the-radar phenomenon of *EVA* abandonment in actual corporate practice is two-fold. Firstly, *EVA* encourages management not to invest in strategically important long-term projects, since it is much easier to achieve *EVA* growth and bonus payments by reducing the amount of assets in the statement of financial position than by working for the future reaching the planned level of profitability in the long term [33]. Secondly, neither the value of *EVA* nor its growth over the reporting period is a reliable indicator of the levels of financial results in the future [34], and hence the value created.

Based on the understanding that the value created by management decisions includes not only the financial result of the period, but also the current value of future economic benefits, then the periodic indicator of the financial result should, by perforce, combine the retrospective and forecast components. This approach is consistent with the findings of contemporary corporate governance research,[2] which shows that companies create the most value when management is focused on achieving high long-term results, while pressure from investors and the board of directors forces managers to focus on values of indicators by the next reporting date. This is also consistent with the methodology of system management, according to which the objective function of assessing the quality of management should include characteristics of the effectiveness and efficiency of the enterprise both in the short and long term [36, 37].

J. O'Hanlon and C. Pisnell [38] introduced a new financial metric Excess Value Created (EVC) into academic circulation, which aggregates the realized value ex post and the creation of new value ex ante through the concept of unrecovered capital.[3] The retrospective and forecast components of *EVC* are calculated through residual income, which forms a single basis for a holistic analysis over a multi-period interval for evaluating performance and allows the development of financial incentive schemes based on a bonus bank, in which management receives remuneration taking into account both the value already realized in historical residual incomes and the value created by residual incomes expected in the future, thereby achieving the necessary alignment between incentive payments and actual value creation [39].

Although the work of J. O'Hanlon and K. Peasnell was recognized by the academic community as a significant advance in the theory of financial performance measurement [40], it did not attract active attention of practitioners. Perhaps this is due to the fact that the *EVC* indicator has not received multimillion-dollar marketing support from consulting companies, and also because the design and calculation of *EVC* in the perception of the manager looks much more complicated than the usual residual net income and *EVA*.

From the point of view of transferring the developments of J. O'Hanlon and K. Peasnell [38] into practice, there are also a number of significant limitations. Initially, *EVC* assumes that the company is financed only from equity, the cost of which remains constant both in the retrospective and in the prospective part of the calculation of the indicator. This assumption narrows the scope of applicability of the basic version of *EVC*. If we take a typical situation in practice, where financing is mixed and the capital structure can change as a result of the mutual imposition of investment, operational and financial decisions, then the problem of cyclic dependencies arises [46, 44] when calculating the weighted average cost of capital WACC in the forecast part of

[2] Sneader K., Williamson S.K., Koller T., Potter V., Babcock A. Corporate long-term behaviors: How CEOs and boards drive sustained value creation. McKinsey&Co and FCLTGlobal, 2021. This is a joint study by FCLTGlobal (a non-profit organization that conducts research and develops tools that encourage long-term investment) and McKinsey. Its full version is available at the URL: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-executives-can-help-sustain-value-creation-for-the-long-term (accessed on 01.04.2022).

[3] This article offers, perhaps, the most complete formalized presentation of consonant ideas discussed in the scientific and professional literature, in particular, in the works [5, 41–43].

EVC, modified for companies with leverage [44], which requires iterative calculations to find the specific weights of WACC for each period and over the entire forecast horizon.. Due to a combination of factors, the correct calculation of the *EVC* indicator really becomes unnecessarily cumbersome.

In the present study, the definition of the indicator of the excess value created *EVC* through the *TEVA* indicator (Total *EVA*) is substantiated and it is shown that the new design of the *EVC* while retaining all the advantages of the original development by J. O'Hanlon and K. Peasnell, removes its inherent limiting assumptions and circumvents the computational complexity of measuring value created for companies with mixed financing.

ASSUMPTIONS AND BASIC RELATIONSHIPS

The following assumptions are accepted as initial for subsequent developments. Cash flows occur discretely at the end of each time period. The Company's assets do not include excess cash and cash equivalents and investments in financial assets. The Company implements a payout policy whereby the total cash flow from its activities (*CCF*, Capital Cash Flow[4]), namely free cash flow[5] (*FCF*) plus tax savings from interest on debt (*TS*), is paid out in full to investors:

$$CCF_t = FCF_t + TS_t, \quad (1)$$

where the index *t* denotes the period.[6]

The interest tax shield is calculated using the formula:

$$TS_t = k_t^D \, \text{int}_t, \quad (2)$$

and with regard to borrowed capital, the standard assumption in the literature is that in each period *t* the debt interest rate coincides with the cost of debt k_t^D, and, accordingly, the financial value of debt V_t^D is equal to the nominal amount of debt D_t, i.e. $V_t^D = D_t$.

Changes in time of flow and final indicators are described by the ratios:

$$int_t = k_t^D D_{t-1}, \quad (3)$$

$$OI_t = NI_t + int_t \cdot (1-T), \quad (4)$$

$$A_t = A_{t-1} + OI_t - FCF_t, \quad (5)$$

where *int* — debt service interest; *OI* — operating income; *NI* — net profit; *T* — income tax rate; *A* — net operating assets.[7] The operating assets growth equation (5) is the basic structural relation linking the statement of financial position (balance sheet) and income statement with the statement of cash flows [48, p. 212].

The TEVA indicator is based on the decomposition of the total financial result into operating and financial components using the cost of unlevered capital k^U, which characterizes the risk of operating assets, as a threshold for calculating the opportunity cost of the capital invested in these assets [49]:

$$TEVA_t \equiv OI_t + TS_t - k_t^U A_{t-1}. \quad (6)$$

Given Equation (4), *TEVA* can be expressed in terms of quantities available directly from historical and projected financial statements[8]:

$$TEVA_t = NI_t + Int_t - k_t^U A_{t-1}. \quad (7)$$

[4] The original English term Capital Cash Flow within the meaning of [46] can be translated as cash flow to invested capital. CCF is also equal to the sum of the cash flow of shareholders (CFE) and the cash flow of creditors (CFD): CCF = CFE + CFD.

[5] A popular book by McKinsey Partners [47] defines free cash flow as the cash flow from operating activities minus new capital investments.

[6] For balance sheet items (statement of financial position) and other totals, the index t — 1 means the end of period t — 1, or, equivalently, the beginning of period t.

[7] The balance sheet amount of total assets minus current non-interest bearing liabilities.

[8] The transition to TEVA as a flow metric of financial performance eliminates the prerequisites for the occurrence of distortions in the assessment and errors in the interpretation of the results, which are potentially possible when using classic indicators of residual operating income, in particular EVA [51].

The financial value at time t of operating assets, V_t^A, which determines the financial value of the company as a whole under blended financing, is equal to the sum of the book value of operating assets and expected future *TEVA*, discounted at rates k_j^U, calculated at time t for each of the future periods j[9] [50]:

$$V_t^A = A_t + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j , \quad (8)$$

where L denotes the expected completion period of the activity,[10] $u_{t,j} = \prod_{s=t+1}^{j} (1+k_s^U)$ and the symbol ∏ denotes the product.[11]

Note that using *TEVA* as a forecasted attribute, it is also possible to estimate the value of the company's equity. Indeed, since the financial value of a company is equal to the sum of the financial value of its equity V_t^E and the financial value of its debt V_t^D:

$$V_t^A = V_t^E + V_t^D , \quad (9)$$

and the book value E_t of equity capital can be expressed from the main balance sheet equation as $E_t = A_t - D_t$, then under the assumptions made regarding debt financing, equation (8) is transformed into the equation

$$V_t^E = E_t + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j , \quad (10)$$

showing that the financial value of equity is equal to equity on the balance sheet plus the sum of current estimated *TEVA*.

MEASURING VALUE CREATED FOR LEVERED COMPANIES

The concept of Unrecovered Capital plays a key role in measuring the value created by a company over a period of time. And if the basic design in [58] assumes the capital of shareholders, then in the case of mixed financing, two new notions must be introduced.

The first is the unrecovered financial value of operating assets at time t. Let us denote it by UV_t^A and define it as the accumulated value of the net investments in operating activities, namely, the total investments from equity and debt capital, minus payments to shareholders and creditors, increased at the alternative return rate k^U:

$$UV_t^A = UV_{t-1}^A (1+k_t^U) - CCF_t , \quad (11)$$

under the initial condition $UV_0^A = V_0^A$.

The equation for UV_t^A over a multi-period interval from the beginning of the measurement at time 0 to the end of the measurement at time t is obtained by induction:

$$UV_t^A = u_{0,t} V_0^A - \sum_{i=1}^{t} u_{i,t} CCF_i , \quad (12)$$

where $u_{i,t} = \prod_{p=i+1}^{t} (1+k_p^U)$, $u_{t,t} = 1$.

In essence, the unrecovered financial value of operating assets is the difference between the financial value imputed at time t of those assets that the company owned at the beginning of the analyzed multi-period interval,[12] and the sum of all accrued payments to investors over time t. Net payouts for a period can be negative if, during that period, the amount received by the company from issuing new shares and/or raising new debt exceeds the total payouts to investors, which consist of cash dividends, share repurchases, and debt servicing and repayment.

The second is the unrecovered book value of operating assets at time t. We denote it as UA_t and define it as follows:

[9] For ease of understanding, the expectation operators in all formulas are omitted.

[10] As a rule, L = Г

[11] If we assume that the company's business portfolio and its systematic risk will not change in the future, then the calculation of the product will be simplified to exponentiation.

[12] For a public company, the natural measure of the financial value of operating assets at the beginning of the performance interval will be the sum of its market capitalization and net debt. If we talk about a closed company or a division of a larger enterprise, then an internal valuation is required, which can be performed, as an option, with the involvement of an external business appraiser.

$$UA_t = u_{0,t} A_0 - \sum_{i=1}^{t} u_{i,t} CCF_i . \qquad (13)$$

Equations (12) and (13) coincide, except for the initial condition. In the latter case $UA_0 = A_0$, where A_0 — is the book value of operating assets at the beginning of the multi-period measurement interval. UA_t can be interpreted as the amount of resources transferred to the company by capital providers in all previous periods cumulated to time *t* at the rate of alternative return.

Using equations (1), (5) and (13) and the definition of *TEVA* (6), the relationship at time *t* between the book value of the assets, the unrecovered book value of the assets and the past realized residual incomes can be established.

Indeed,

$$A_1 - UA_1 = A_1 - A_0(1+k_1^U) + CCF_1 =$$

$$= A_0 + OI_1 - FCF_1 - A_0 - k_1^U A_0 + (FCF_1 + TS_1) =$$

$$= OI_1 + TS_1 - k_1^U A_0 = TEVA_1 .$$

$$A_2 - UA_2 = A_2 - UA_1(1+k_2^U) + CCF_2 =$$

$$= A_1 + OI_2 - FCF_2 +$$

$$+ (-A_1 + TEVA_1)(1+k_2^U) + (FCF_2 + TS_2) =$$

$$= OI_2 - k_2^U A_1 + TEVA_1(1+k_2^U) + TS_2 =$$

$$= TEVA_1(1+k_2^U) + TEVA_2 .$$

Continuing, by induction we obtain:

$$A_t - UA_t = \sum_{i=1}^{t} u_{i,t} TEVA_i . \qquad (14)$$

Equation (14) is a retrospective reflection of equation (8), linking the financial value of assets, their book value and expected future residual operating incomes.

We define the excess value created over a multi-period measurement interval as the excess of the financial value of operating assets over the unrecovered financial value of operating assets at the end of this interval:

$$EVC_t = V_t^A - UV_t^A . \qquad (15)$$

EVC — is a monetary measure at time *t* of the total return on funds invested in the company in excess of the return on alternative investment with the same level of risk, and it represents the total return for all investors, both equity and debt, including both the income already received in the past from the beginning of the measurement interval and income expected in the future.

Since the capital invested in the operating assets of a levered company is a combination of debt and equity, it is possible, according to A. Schueler and S. Krotter [44, p. 273], to divide the unrecovered value of operating assets into the unrecovered value of equity (UV_t^E) and the unrecovered value of debt (UV_t^D), so that $UV_t^A = UV_t^E + UV_t^D$, and calculate UV_t through pre-calculated UV_t^E and UV_t^D. On the one hand, this approach is interesting from a theoretical point of view, as it makes it possible to see that the accumulation of the initial financial value of operating assets and payments to investors cannot be carried out at the standard *WACC* rate, and it is necessary to calculate a modified weighted average rate with weights for each retrospective period, based on the values of UV_t^A, UV_t^E and UV_t^D. On the other hand, it noticeably complicates both the design and calculation of UV_t^A, and this gives a significant advantage to equation (14) in practical applications.

In our assumption about the equality of the financial value of the creditors' investments and the book value of the debt, we have: $V_t^D = D_t = UV_t^D$. Then

$$EVC_t = V_t^A - UV_t^A = V_t^E + V_t^D - \\ - (UV_t^E - UV_t^D) = V_t^E - UV_t^E . \qquad (16)$$

Here we can draw a useful intermediate conclusion. Under the standard assumption in the literature that the net present value of financial decisions is zero, the excess value created by a company with mixed financing can be equivalently calculated either at the level of the company as a whole, i.e. from the standpoint of the entire capital of investors, both equity and debt, or at the level of equity only. When applied consistently and in

concert, both approaches should produce the same result. If we proceed from a more realistic assumption about the possible divergence of the market value and the nominal amount of the debt, and this is a typical situation for bonds, then

$$EVC_t = V_t^A - UV_t^A = V_t^E - UV_t^E + (V_t^D - UV_t^D). \quad (17)$$

The excess value created for shareholders will differ from the excess value created by the company as a whole (for all investors) by the excess value created for the creditor, which is the integral effect of his participation in financing the company over a multi-period time interval.

Further, adding and subtracting $A_t - UA_t$ on the right side of (15) after rearranging the terms, we have:

$$EVC_t = (V_t^A - A_t) + (A_t - UA_t) - (UV_t^A - UA_t).$$

Taking into account (8) for $V_t^A - A_t$, (14) for $A_t - UA_t$, (12) for UV_t^A and (13) for UA_t, we obtain an equation expressing the *EVC* indicator in terms of historical and projected *TEVA*:

$$EVC_t = \sum_{i=1}^{t} u_{i,t} TEVA_i + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j - u_{0,t}(V_0^A - A_0). \quad (18)$$

Thus, the aggregate measure of financial performance — the excess value created over a multi-period time interval from the start of measurement at time 0 to time t — consists of three components. The first is the sum of all TEVAs that have arisen in the past, cumulated to time t. It is equal to the excess at time t of the book value of the company's assets (the total book value of equity and debt) over the amount of investments made in the company during the measurement interval, cumulated to time t at the rate of alternative return. The second is the sum of the future *TEVA* discounted to time t that will occur in periods following period t. It represents the contribution to the *EVC* of financial results expected in the future. The third is the difference between the financial value and the book value of operating assets at time 0, cumulated to time t. This value is included in the *EVC* calculation with a "–" sign, and can be interpreted as an adjustment due to the fact that the return at the level of the alternative should have been provided on investments measured by their financial value and not by the amount on the company's financial statement.

EXPECTATIONS AND ACTUAL RESULTS

If the financial value of the company's assets exceeds their book value, then equation (8) implies that the present value of expected *TEVAs* is positive, or equivalently, expected future *TEVAs* are positive on average. In this case, the fact that *TEVA* is positive for the reporting period does not necessarily mean that the company is successful and is coping with the task of at least maintaining the financial value of operating assets (the value of investors' capital) at the level reached earlier, not to mention its growth. This implies the well-known concept of constructing financial incentive schemes for managers, based on the accrual of bonuses, provided that the residual income value exceeds the target level imputed by already existing expectations regarding future financial results [5, Ch. 8]. Let us show further how this idea can be formalized using the indicators constructed above.

In practice, the value of realized TEVA, as well as TEVA expected in the future, may differ from their values expected (planned) earlier. Let the index s denote the beginning of the control multi-period measurement in the time interval from 0 to t. We denote by $TEVA_{i|s}$ the value of *TEVA* expected in period i ($I = s + 1, s + 2, \ldots, L$) based on the information available at time s. For estimates that are retrospective with respect to the current moment t, financial success is characterized by $TEVA_i^s$ value equal to the excess of the actual $TEVA_i$ period i over $TEVA_{i|s}$, expected in this period at time s:

$$TEVA_i^s \equiv TEVA_i - TEVA_{i|s}. \quad (19)$$

If the expectations were met exactly, then $TEVA_i$, realized in period i, will be equal to

$TEVA_{i|s}$, forecasted for this period based on the information available at time *s*, and $TEVA_i^s = 0$. Deviation from the expected value gives the excess *TEVA*, which can be either positive or negative.

For future periods $j = t + 1, t + 2, \ldots, L$ the measure of success will be the difference between the revised forecast values $TEVA_{j|t}$, based on information at time *t*, and the forecast values $TEVA_{j|s}$, as they were at time *s*:

$$TEVA_j^s \equiv TEVA_{j|t} - TEVA_{j|s}. \qquad (20)$$

Let us represent (8) in the form

$$V_s^A - A_s = \sum_{i=s+1}^{t} u_{s,i}^{-1} TEVA_{i|s} + \sum_{j=t+1}^{L} u_{s,j}^{-1} TEVA_{j|s}$$

and multiply both sides of this equality by $u_{s,t}$:

$$u_{s,t}(V_s^A - A_s) = \sum_{i=s+1}^{t} u_{i,t} TEVA_{i|s} + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_{j|s}. \qquad (21)$$

Then, substituting (21) into equation (18) for the interval from time *s* to time *t*, and taking into account (14) and (15), we obtain:

$$EVC_t^s = \sum_{i=s+1}^{t} u_{i,t} TEVA_i^s + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j^s. \qquad (22)$$

Thus, the excess value created EVC_t^s over the multi-period reference interval from time *s* to time *t* can be defined solely in terms of *TEVA*, excluding the initial difference between the financial value and the book value of the invested capital. It consists of the sum of the excess *TEVA* already realized, accrued up to the date of the control calculation (time *t*), and the sum of the discounted excess *TEVA* arising from the revision of forecasts based on the information that became available at time *t*. If the management of the company achieves positive values of excess *TEVA*, then this means that the required results imputed by the starting position $V_s^A - A_s > 0$ were exceed. Accordingly, *EVC* will be positive, and there is a basis for bonus payouts.

In a situation where financial performance monitoring includes a period-by-period calculation of *EVC*, the duration of the control interval is one period from *t* — 1 to *t*, so that

$$EVC_t^{t-1} = TEVA_t^{t-1} + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j^{t-1}. \qquad (23)$$

Formula (23) has an intuitive interpretation. The excess value created includes the deviation of the actual *TEVA* of completed period *t* from that budgeted at the start of the period, plus the deviation of the present value of future *TEVA* forecast at time *t* from the present value of future *TEVA* as forecast at time *t* — 1. If the result of the period is equal to the planned one and no events have occurred that entail the need to revise the forecasts and budget, then $EVC_t^{t-1} = 0$ and the management receives a reward for achieving the target result. If the value EVC_t^{t-1} is non-zero, then the reasons for the deviation should be analyzed. It may also be necessary to make adjustments to the forecasting assumptions made and to the process of building the financial plan.

Note that $TEVA_t^{t-1}$ on the right side of (23) is equal to the difference between the actual and planned operating profit of period *t*. Indeed, since the book value of operating assets at the beginning of the period does not depend in any way on new information at the end of the period and $A_{t-1|t} = A_{t-1|t-1}$, then

$$TEVA_t^{t-1} = (OI_{t|t} - A_{t-1|t} k_t^U) -$$
$$- (OI_{t|t-1} - A_{t-1|t-1} k_t^U) = OI_{t|t} - OI_{t|t-1}.$$

In addition to the above, there are two more aspects of the meaningful interpretation of the metric EVC_t^{t-1}. Firstly, it can be represented as

$$EVC_t^{t-1} = EVC_{t|t}^s - EVC_{t|t-1}^s, \qquad (24)$$

i.e. as the difference between the amount of excess value created over a multi-period measurement interval from time *s*, calculated based on the information available at time *t*:

$$EVC^{s}_{t|t} = \sum_{i=s+1}^{t} u_{i,t} TEVA_{i|t} + \sum_{j=t+1}^{L} u^{-1}_{t,j} TEVA_{j|t} - \quad (25)$$
$$- u_{s,t}(V^{A}_{s} - A_{s}),$$

and the same value calculated on the basis of the information available at time $t-1$:

$$EVC^{s}_{t|t-1} = \sum_{i=s+1}^{t} u_{i,t} TEVA_{i|t-1} + \sum_{j=t+1}^{L} u^{-1}_{t,j} TEVA_{j|t-1} - \quad (26)$$
$$- u_{s,t}(V^{A}_{s} - A_{s}).$$

From (24) it follows that the increase or decrease in *EVC* relative to its level in the previous period does not necessarily mean the creation or destruction of value, the improvement or deterioration of performance. A quantitative measure of financial success for the reporting period is the excess of the actual excess value created during this period over the value that it was expected at the end of the period at its beginning.

Secondly, EVC^{t-1}_{t} it can be represented as:

$$EVC^{t-1}_{t} = EVC^{s}_{t|t} - (1 + k^{U}_{t}) EVC^{s}_{t-1|t-1}. \quad (27)$$

This is easy to verify: after substituting $EVC^{s}_{t|t}$ из (25), from (25), taking into account the fact that

$$EVC^{s}_{t-1|t-1}(1 + k^{U}_{t}) = \sum_{i=s+1}^{t} u_{i,t} TEVA_{i|t-1} +$$
$$+ \sum_{j=t+1}^{L} u^{-1}_{t,j} TEVA_{j|t-1} - u_{s,t}(V^{A}_{s} - A_{s}),$$

(27) is immediately converted to (23).

Equation (27) says that the net value created for period *t* is equal to the difference between the excess value created at the end of period *t* and the imputed value, which is the amount of excess value created at the beginning of period *t*, cumulated to the end of the period at the rate of alternative return.

ADVANTAGES OF THE PROPOSED APPROACH

The initial design of the *EVC* indicator, presented in [38], is based on the assumption that the company is financed exclusively by the equity capital, the cost of which remains unchanged over the entire multi-period performance measurement interval. The authors intentionally exclude leverage effects from the analysis [38, p. 230], and this makes their constructions refined and the formulas computationally simple, but at the same time significantly limits the scope of their practical application.

In a subsequent publication, A. Schueler and S. Krotter [44] analyze how the EVC indicator and its components should be determined for the company as a whole when financing not only from its own, but also from borrowed funds, and redefine EVC through EVA. The scenario of mixed financing occurs in reality much more often, however, the initial assumptions regarding the capital structure, cost of capital and operational risk in the constructions of A. Schueler and S. Krotter remain quite rigid. In addition to risk-free debt, they assume that the company's financial policy is to constantly adjust the amount of debt used following changes in the value of operating assets in order to maintain financial leverage and the cost of capital at a fixed level,[13] and also that the systematic risk of the company's activities and, accordingly, the rate k^{U} remain unchanged over the entire multi-period performance measurement interval. But even with these highly simplifying assumptions, A. Schueler and S. Krotter conclude that for companies with mixed financing, EVC cannot be based entirely on *EVA* calculated using the standard *WACC*. Historical *EVA* in the retrospective part of *EVC* must be recalculated and then cumulated to the date of calculation of the indicator using a modified weighted average cost of capital, which for each retrospective period is based on weighting factors determined through the values of unrecovered equity and unrecovered debt capital at the beginning of the period

[13] It should be noted that the authors themselves [44, p. 272] explain their choice in favor of focusing on the target capital structure rather by the popularity among practitioners of the assumption of a constant WACC [52, p. 10–12], and not the realism of such a financial policy option.

[44, p. 273]. At the same time, the future *EVA* of the *EVC* forecast portion is still calculated and discounted using the standard *WACC*, in which the weights for the costs of capital components are based on market values of equity and debt. This dichotomy breaks the symmetry and elegance of the results [38] where an identically defined cost of capital rate is used to calculate both unrecovered capital and residual income.

If, while bringing the model closer to reality, we admit the possibility of arbitrary changes in the company's capital structure, then the need to calculate the cost of equity and *WACC* rates[14] are consistent with the forecasts when calculating the *EVC* defined through EVA, as done in [44], leads to multiple cyclic dependencies between the variables of the financial model [53; 54, p. 388–395; 55] and the need to iteratively solve systems of equations for each period over the entire forecast horizon from t to L. Although this problem can be solved using the computational capabilities of modern spreadsheets [56, 57], the modification of the excess value created indicator for levered companies proposed by A. Schueler and S. Krotter, turns out to be excessively cumbersome for periodic calculations and difficult to understand at the level of operational management.

If *TEVA* is used as an *EVC* attribute instead of the traditional *EVA*, then all the noted limitations and difficulties are completely removed. Equations (18), (22) and (23) do not imply any assumptions about the financial policy and capital structure of the company, they do not have cyclical relationships between variables. The definition of the *EVC* indicator proposed in this study, while maintaining the symmetry and computational simplicity of the original construction of J. O'Hanlon and K. Peasnell [38], makes it possible to correctly include the effects of mutual imposition of the consequences of investment, operational and financial decisions into the assessment of operational performance, as well as take into account the change in time of the systematic risk of the company's activities.

Another important advantage of defining *EVC* in terms of *TEVA* is that *TEVA* avoids the design flaw and its consequences inherent in traditional definitions of residual operating income, including *EVA* [50]. The use of *WACC* in the latter as an alternative rate of return for calculating the opportunity cost of funds invested in operating assets creates prerequisites for the occurrence of distortions in measurements and errors in the interpretation of financial indicators. The reason is that *WACC* is a threshold return for a combination of investment and financing decisions, not for return on investment in operating activities, and is also often calculated with simplifying assumptions about the weights and costs of capital components which leads to a discrepancy between the correct *WACC* value and the one actually applied [51].

It should also be noted that the information required for calculations using the presented formulas does not go beyond the perimeter of standard sources that form the basis for management analytics. Net income, interest on debt and book value of operating assets for calculating *EVC* values through *TEVA* are available directly from retrospective and projected financial statements. Rates k^U can be calculated according to a standard scheme using the *CAPM* model [47, 54, 58, 59].

CONCLUSIONS

To achieve a high degree of alignment between the interests of shareholders and the decisions of managers, the financial reward of the latter must be based on the financial value created for shareholders. The use of residual income and *EVA* in particular as performance indicators and the basis for generating incentive payments, does not provide an effective solution to this problem. As a single-period indicator, *EVA* does not

[14] Failure to comply with the consistency conditions leads to the so-called "error of incorrect calculation of the discount rate" [17], which can lead to significant errors in the interpretation of financial results and management recommendations arising from them [51].

take into account the long-term financial consequences, which, as a rule, are the most significant component of financial value, created or destroyed by decisions made by the company's management.

As a metric to overcome the focus of *EVA* on the short term to the detriment of the long-term success of the company, the indicator of excess value created *EVC* is proposed — a financial metric of performance over a multi-period interval, consisting of two components: accumulated residual income realized from the beginning of the measurement to the point in time for which the calculation is made, and the present value of the expected residual income in the future. The combination of retrospective and prospective analysis expands the conventional view of the assessment of financial performance and makes the new metric relevant for management practice focused on creating financial value for shareholders, however, the transfer of this tool from the idealized world of academic research into the field of practical application immediately pulls along the problem of nonconformity of simplifying assumptions with real world conditions.

The construction and use of a consistent financial model with built-in dynamic adjustments to the structure and cost of the company's capital conditional upon the overlapping effects of investment, operating and financial decisions makes the *EVC* indicator computationally cumbersome and, moreover, requires filling in information that is outside the scope of daily monitoring of operations' effectiveness.

The definition of the aggregate financial metric *EVC* for a multi-period and single-period measurement interval, based on the *TEVA* indicator, justified in this study, makes it possible to achieve a constructive unification in the retrospective and prospective components of *EVC*, and also, by simplifying calculations, remove all restrictions on changes in the structure and cost of the company's capital in case of mixed financing. The proposed approach provides a framework for building a holistic system that includes capital budgeting decisions, post-audit of investment projects, evaluation of results and financial incentives, in which management is rewarded taking into account both the value already realized in the historical residual income and the value created by the residual income that is expected in future, thus achieving the required alignment between incentive payments and the actual creation of financial value for shareholders.

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