ТЕОРЕТИЧЕСКИЕ И ЭМПИРИЧЕСКИЕ ИССЛЕДОВАНИЯ

TOWARD BETTER MEASUREMENT OF FINANCIAL PERFORMANCE: A ROBUST OEVA–TEVA ALTERNATIVE TO BIASED EVA

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We demonstrate analytically and illustrate with examples that the conventional measures of the residual operating income such as the Economic Value Added (EVA) are biased by design and so may yield a misleading assessment of financial performance. Fundamentally, the magnitude of the measurement error depends on the amount of realized interest tax shields and the book to value ratio. Other potentially significant sources of distortions induced by the EVA design are identified as well. We propose a robust alternative that is a concurrent evaluation of the firm's operating and total performance by means of two related metrics, the Operating EVA (OEVA) and the Total EVA (TEVA). Coherent implementation of the OEVA–TEVA technique is simpler than the EVA both analytically and computationally. It is also able to provide additional information for the management decision making. The overall consistency of the OEVA–TEVA approach is supported by a formally proved equivalence of the corresponding OEVA–TEVA valuation model to the fundamental valuation by the cash flow discounting.

Keywords: financial performance measurement, operating EVA, total EVA, economic value added, market value added, valuation.

JEL: G32, G39, M21, M41.

In search for a perfect financial performance measure, the concept of residual income had been introduced as an improvement upon accounting income in measuring performance. Started with the pioneering applications by Lewis [Lewis, 1955] and Solomons

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[Solomons, 1965], the notion of residual income came to be the object of extensive debate in the management accounting literature in the 1970s [Amey, 1969; Flower, 1971; Bromwich, 1973; Amey, 1975; Tomkins, 1975; Emmanuel, Otley, 1976]. Some accounting scholars (e.g. [Anthony, 1973]) had long advocated the residual income measures for evaluating business performance and for use in the pay-for performance compensation systems.

While the origins of the concept trace back to the 19th century, it had actually taken increasing interest of academia only in the early 1990th after the publication of analytical work by Ohlson [Ohlson, 1995] and Feltham and Ohlson [Feltham, Ohlson, 1995]. The residual income based valuation relationship stating that the economic value of an entity at a point in time is equal to the sum of the book value of the entity plus the present value of all of the entity's expected future residual incomes has become a common feature of research into the role of accounting numbers in business valuation [Feltham, Ohlson, 1996; Dechow, Hutton, Sloan, 1999; Penman, Sougiannis, 1997; Myers, 1999; Francis, Olsson, Oswald, 2000][1]. About the same time the residual income had been taken up by value-based management practitioners as a means of measuring past performance and rewarding managers [Stewart, 1991; McTaggart et al., 1994], triggering an active debate in the managerial accounting literature. Bromwich and Walker [Bromwich, Walker, 1998] review theoretical papers on the strengths and weaknesses of the value-based management approaches and consider the potential for using residual income as the basis for performance-related reward systems. The work by [Ittner, Larcker, 2001] is a standard reference for extensive survey of the empirical management accounting studies summarized through the lens of the value-based management accounting framework, and [Malmi, Ikäheimo, 2003] examine research-based evidence on how these concepts are actually applied.

Recurrently appearing publications indicate sustainable interest in the dual role of residual income as the performance measure and valuation attribute. [Dekker et al., 2012] review developments in the field and explore the importance of value-based measures for performance evaluation of the middle-level managers responsible for firms' primary operating units. They define the value-based measures as "the financial performance measures that include a capital charge for the use of (debt and equity) capital" [Dekker et al., 2012, p. 1216]. Heinrichs and coauthors [Heinrichs et al., 2013] building on Lundholm and O'Keefe's theoretical framework [Lundholm, O'Keefe, 2001] propose and empirically test an extended residual income valuation model that accounts for non-ideal valuation conditions. [McLaren, Appleyard, Mitchell, 2016] using institutional theory as a framework explore and explain the processes involved in the creation, use and decline of comprehensive residual income based management accounting systems.

Probably the best-known member in the family of residual income approaches is the Economic Value Added (EVA®) trademarked and promoted by the Stern Stewart & Co.[2] In its essence, EVA is the residual income earned from operations, or residual operat-

[1] Most research papers, as noted by [Ohlson, 2002, p. 248], tend to refer residual income valuation relationship as the *accounting based valuation formula*. This is also the case in the financial statement analysis texts [Bernstein, Wild, 1997; Penman, 2001].

[2] Trademarked EVA® is unique in that its calculation involves a potential set of up to 160 adjustments to the conventional accounting data. However, according to [Young, O'Byrne, 2000, p. 257], the typical corporate EVA user makes (in most cases) no more than five adjustments. The explanations Young and O'Byrne give for this reduction are twofold: (a) managers are reluctant to deviate from accounting-based numbers; (b) companies have found that most of the suggested adjustments have little impact on profit and capital. The issue of adjustments to the accounting statements is still the subject of debate.

ing income [Penman, 2001, p. 424][3]. Putting the residual operating income in place as a basic indicator of financial performance makes sense, as it brings a focus to the core business performance, to the profitability of operations that add value. Onwards, we will use EVA as a common abbreviation for the residual operating income methodology, which by its design and purpose falls on the crossroads of accounting, performance measurement and financial management.

Extensive acceptance in the corporate world and diversity of the EVA related literature[4] pushed the metric into the pages of the corporate finance, management accounting and performance management texts.[5] As an evidence of its sustainable popularity, the search query for "economic value added" in the Russian Science Citation Index database returns more than 70 publications for the period from 2015 to 2019, which provide a wide range of examples of applying the EVA metric to measuring performance of Russian enterprises in the real and banking sectors, and for a business valuation based on the economic value added model.

Being in place for decades, the EVA metric and its measuring abilities had been an object of extensive empirical research, criticism from academia and proposals for improvements[6]. The most cited publication are [Biddle, Bowen, Wallace, 1997], who tested assertions that EVA is more highly associated with stock returns and firm values, [Wallace, 1997] with the empirical evidence on how compensation plans based on residual income change managers' behavior, [O'Hanlon, Peasnell, 1998], who reviewed the EVA system in the light of its purpose to promote value-maximizing behavior in corporate managers, [Chen, Dodd, 2001], who examined the value relevance of three profitability measures: operating income, residual income, and EVA. More recent authoritative papers are [Malmi, Ikäheimo, 2003] with the real world evidence on how the Value Based Management, and especially EVA, are actually applied by corporations, and [Baker, Deo, Mukherjee, 2009], who evaluate common concerns about EVA, identify the major concerns (distortions caused by the depreciation method, complex adjustments, short-term focus, low correlation with the stock price), and offer some recommendations for using EVA more effectively.

EVA refinements, intended to improve the quality and informational content of performance measurement, evolved mainly along two ideas. The first, is replacing the accounting depreciation by the economic depreciation [Bodie, 1982; Bierman, 1988] to eliminate discrepancies between the accounting and economic income [Young, O'Byrne, 2000, p. 210–218; Ibragimov, 2007; Brealey, Myers, 2010, p. 303–305]. The second is replacing the book value of the firm's assets in the EVA formula by their market value [Bacidore et al., 1997; Albrecht, 1998]. Yet, there is the third, and, perhaps, more basic issue overlooked by researchers and practitioners. Does EVA actually measure what it is intended for? The paper contributes to existing literature by explicitly addressing this question.

Since the EVA (and the residual operating income in general) is supposed to deal with that part of business activities where managerial actions take place, the metric should not be affected by market movements that affect the share price, or by financing decisions that generally belong to the corporate headquarters. The latter is important in the

[3] Residual operating income is also referred to as the economic profit [Koller, Goedhart, Wessels, 2010, p. 117].

[4] For example, [Sharma, Kumar, 2010] cumulate and categorise 112 papers published from 1994 to 2008 covering various EVA related issues.

[5] See, for example, [Grinblatt, Titman, 2001, p. 341–343; Brealey, Myers, 2010, p. 299–301, 709; Arnold, 2005, p. 181–190; Merchant, Van der Stede, 2007, p. 451–452; Bhimani et al., 2008, p. 650–651; Atrill, McLaney, 2009, p. 350–355; Garrison, Noreen, Brewer, 2010, p. 526–527; Horngren, Datar, Rajan, 2012, p. 812–813].

[6] The number of the EVA related research papers posed to the SSRN´s eLibrary (https://www.ssrn.com/) approaches thee hundred, with more than 34 000 downloads of the highest ranking among them.

performance measurement context, since, for example, changing the leverage by adding or reducing debt moves the opportunity cost of capital employed, thus inducing changes in the residual operating income. However, these movements in the performance indicator are an outcome of actions within the finance department of the firm; they are beyond the business managers' control and, therefore, should not be their responsibility.

While the concept of the residual operating income may reasonably be perceived as developed up to the point where no further improvements are visible, taking a closer look at the metric fundamentals suggests that *EVA* may yield uninformative or even misleading reference point for the performance evaluation [Ibragimov, 2015], where the measurement distortions emerge along two dimensions.

The first and probably critical dimension is a measurement bias inherent in the *EVA* design. As the subsequent exposition clarifies, the bias stems from contrasting the net operating profit after tax (*NOPAT*), which is an output of firm's *operating activities* [Stewart, 1991; Koller, Goedhart, Wessels, 2010], with the capital charge that accounts not only for the opportunity cost of funds investors put into the firm, but also for *the side effects of financing*, and the latter is introduced by applying the tax adjustment $(1-T)$ to the cost of debt in the conventional weighted average cost of capital (*WACC*) formula.

The second source of potential distortions is the conventional simplifying assumptions in calculating the *WACC* and subsequent inconsistencies in the performance metric calculations. Accounting for the tax effect of leverage in the discount rate is at the core of the standard valuation techniques like discounting the free cash flows at the after-tax *WACC*. However, calculating the capital charge in *EVA* via the opportunity cost of funds adjusted for the tax deductibility of interest yields artificial figures that generally fall between the economic profit earned from operations and the total economic profit earned from both the operating and financial activities. The calculated *EVA* could take a positive value just due to the interest tax shield effect imputed by the after-tax *WACC* in the capital charge component of the metric, and this positive value would be generally (and, perhaps, erroneously) interpreted as an indication of the operating performance above the minimum acceptable hurdle.

Furthermore, the current *WACC* and hence the current *EVA* are highly sensitive to the changes in the present value of future growth opportunities, implying that contrary to a common sense the *EVA* assessment of past performance depends on anticipated future events unrelated to the financial results in the period under evaluation. Thus, the measurement bias induced by the *EVA*'s basic design may distort performance assessment and remuneration incentives.

In the pages that follow, we demonstrate how and why the measurement bias occurs, and propose a three-step path to calibrate financial performance evaluation. First, we explicitly recognize the two sources of income attributable to investors in a firm: primarily the *NOPAT* generated by the firm's core assets, and an interest tax shield supplement arising as a side effect of financing activities. Second, we use the cost of unlevered equity k^U (corresponding to the risk of firm's assets), rather than the *WACC*, to calculate the full charge on the book invested capital. And third, we measure the aggregate economic profit and its operating constituent concurrently with two nested metrics: the Operating EVA (*OEVA*) and the Total EVA (*TEVA*).

The *OEVA* is a financial performance indicator that provides an informative view of ongoing operations, and the *TEVA* is an unbiased modification of *EVA* for the purpose of measuring overall corporate financial performance. Both measures of past performance are unaffected by the anticipated changes in the firm's future, and the key feature of the *OEVA* is that it is unaffected by the firm's financial policies and their side effects arising in the course of firm's activities.

The power of the dual *OEVA–TEVA* analysis lies in the added managerially relevant information it can offer, and in the transparent computationally simple financial measures of performance it provides. An important feature of the *OEVA–TEVA* approach is that it maintains consistency with the fundamental valuation by the cash flow discounting and can be applied as a self-standing methodology in the capital budgeting and business valuation. Equivalence of the *OEVA–TEVA* and the free cash flow (*FCF*) valuation methods is formally proved in the Appendix A, and the terminal value formulas for the *OEVA–TEVA* valuation are derived from the standard *FCF* constant growth formula in the Appendix B.

A hurdle rate for operations

A required return for different sources of income depends on a riskiness of the related activity. Residual income from operations is earnings for the operations and so it should be calculated and discounted using the required return that compensates for the risk in the operations, i.e. the cost of capital for operations. As the firm's providers of funds, shareholders and lenders, together hold all the firm's assets, the rate of return that is required to compensate for the overall risk they take on is the risk of assets, generally referred to as the cost of unlevered equity k^U. Since the firm is a portfolio of stock and debt, the total required return of the firm is also equal to the weighted average of the expected returns of securities in it. Thus the relevant cost of capital for operations is the before tax weighted average cost of capital, or, equivalently, the required return to unlevered equity,

$$k_t^U = w_{t-1}^E k_t^E + w_{t-1}^D k_t^D, \tag{1}$$

where k_t^E is the period t cost of levered equity, k_t^D is the cost of debt, and the weights $w_{t-1}^E = V_{t-1}^E / V_{t-1}$ and $w_{t-1}^D = V_{t-1}^D / V_{t-1}$ have to be equal to the beginning of the period t economic values of equity V_{t-1}^E and debt V_{t-1}^D relative to the overall economic value of the levered firm $V_{t-1} = V_{t-1}^E + V_{t-1}^D$. These weights are generally referred to as the *market weights*, and using them in the cost of capital calculations is an established rule traced in corporate finance, accounting, valuation and value based management texts.[7]

Note, that **(1)** is strictly correct when the (systematic) risk of cash flows from the tax deductibility of interest is the same as the risk of unlevered equity, and throughout the paper we assume, that the appropriate discount rate for the interest tax shields is the cost of unlevered equity. Although, in rigorous theory, this assumption is not applicable for all feasible financial policies of firms, it is widely accepted as a reasonable approximation in cash flows valuation modelling [Miles, Ezzell, 1985; Harris, Pringle, 1985; Schueler and Krotter, 2008]. Regarding the debt financing, it is generally assumed at market terms, meaning that the interest rate on debt in any period is equal to the cost of debt capital, and the value of debt V_t^D at any time t is equal to its accounting book value D_t.

We do not challenge the fact that a firm paying interest at a rate k_t^D on debt outstanding D_{t-1} benefits from the tax deductibility of interest and obtains the right for the tax shield (*TS*) subsidy $TS_t = k_t^D D_{t-1} T_t$. The point here is that the tax advantage of debt does not affect the risk inherent in the firm's operating activities and corresponding required return. The regular tax adjustment $(1 - T)$ applied to the cost of debt in the conventional weighted average cost of capital formula

$$WACC_t \equiv w_{t-1}^E k_t^E + w_{t-1}^D k_t^D (1 - T) \tag{2}$$

is generally interpreted as the after tax cost of debt. However, the net expense $k_t^D (1 - T_t)$ incurred by the firm is actually the effective book cost of borrowing, not the economic cost of debt capital, which is in essence the creditors' opportunity cost contingent on the

[7] See [Yong, O'Byrne, 2000, p. 253–255; Penman, 2001, p. 432; Koller, Goedhart, Wessels, 2010, p. 802; Berk, DeMarzo, 2012, ch. 12].

expected return on alternative investments in the same risk class. What creditors expect to collect are the full (not after-tax) interest payments, and regarding the economic cost of debt capital the tax adjustment $(1-T)$ to make it the "after-tax cost" is irrelevant with the implication that the composite return expected by all firm's investors is the cost of unlevered equity k^U, not the after-tax *WACC*.

Discounting the expected as if fully equity financed cash flows at the tax adjusted cost of capital is the standard technique in valuation that incorporates the tax benefits of financing decisions indirectly via the denominator of the present value calculations. However, the capital charge calculations in the *EVA* formula by applying the after tax *WACC* implicitly assume that *WACC* is the appropriate rate of return required to compensate investors for the risk of investing in the firm, while it is not. In effect, the after-tax *WACC* is an overall expected return corresponding to the particular *mix of both operating and financing activities*.

By combining expressions (1) and (2) one can see that the after-tax *WACC* is actually the cost of unlevered equity k_t^U reduced by the amount equal to the ratio of period t tax shield to the beginning of period value V_{t-1} of the levered firm[8]:

$$WACC_t = k_t^U - \frac{TS_t}{V_{t-1}}. \tag{3}$$

Intuitively, it means that investors in the firm (debt and equity) together may be willing to accept a rate of return from operations lower than prescribed by the associated risk k^U on condition that the shortfall in operations is covered by the interest tax shield subsidy from the government. However, this exogenous benefit does not make operations themselves less risky, and consequently, any metric based on a spread between the return on investment and the *WACC* is generally predisposed to deliver a misleading benchmark in measuring operating performance. We illustrate this point with numerical examples in the next section.

Measurement errors induced by the basic design of EVA

EVA is designed to be a measure of operating performance. It departs from the net after tax operating income and subtracts the charge on the book *invested capital* (*IC*) to generate this income:

$$EVA_t = NOPAT_t - IC_{t-1} \cdot WACC_t. \tag{4}$$

Since the after-tax *WACC* sets an understated benchmark for the opportunity cost of funds employed, the straightforward implication of applying *WACC* to calculate the capital charge is that *EVA* will generally overstate results when implemented as the financial measure of efficiency in operations.

Assume, for example, a hypothetical Alpha Corporation with the following book and market information at time $t = 1$: $IC_0 =$ $= \$845$, $EBIT_1 = \$120$, $D_0 = \$380$, $k^D = 6.0\%$, $T = 35\%$, $V_0 = \$950$, and $k^U = 9.9\%$. Calculations from this data yield

$$NOPAT_1 = EBIT_1(1-T) = \\ = 120 \cdot (1-0.35) = \$78.00,$$

$$TS_1 = 0.06 \cdot 380 \cdot 0.35 = \$7.98,$$

$$WACC_1 = 9.90\% - (7.98/950) = 9.06\%,$$

$$EVA_1 = NOPAT_1 - IC_0 \cdot WACC_1 = \\ = 78 - 845 \cdot 9.06\% = \$1.44.$$

Positive *EVA* apparently indicates that the Alpha's dollar return is above the minimum acceptable level. However, $EVA_1 =$ $= \$1.44$ is the difference of $NOPAT_1 = \$78.00$ earned from operations, which is, in fact, 6.8% below the factual required dollar return of $IC_0 \cdot k^U = 845 \cdot 9.9\% = \$83.66$, and the capital charge of $IC_0 \cdot WACC_1 = 845 \times$ $\times 9.06\% = \$76.56$, which is imputed (by the "after tax" adjustment in *WACC*) to be 8.5% lower than the \$83.66 dollar opportunity cost of capital employed. Subtracting the full capital charge based on the factual

[8] The formula was first introduced by [Taggard, 1991] and derived in a more general setting by [Tham, Vélez-Pareja, 2004].

benchmark $k^U = 9.9\%$ from $NOPAT_1$, one finds a negative value $78.00-83.66 = -\$5.66$ as an input for judgment, indicating that contrary to the positive EVA-signal the operating assets are underperforming. This example advocates that EVA could be misleading when used for its intended purpose.

Next, recall that the two basic sources of income attributable to providers of funds, both debt and equity, are the $NOPAT$ from operations and the tax savings, arising from tax deductibility of interest expenses. By rationally capturing the tax advantages of debt, managers can mitigate poor returns from operations and even pull the aggregate financial result above the threshold required by investors. However, decisions on the side of financing per se do not affect the operating efficiency of the firm, as well as they do not reduce the risk inherent in operations. The total economic profit earned by a firm (the excess of earnings over the opportunity cost of capital invested in the business) is a composition of operating earnings above the hurdle for operations and the benefits gained due to the tax deductibility of interest. This amendment alters the assessment of Alpha's performance.

Going back to numbers, the negative value of difference between the operating profit and the full capital charge $NOPAT_1 - IC_0 \cdot k^U = -\$5.66$ is a clear warning of operating return being lower than required to cover the opportunity cost of funds. However, adding the contribution from financing, the shortfall in operations is more than covered by the tax savings on interest $TS_1 = \$7.98$. The aggregate economic profit of the Alpha Corporation amounts to $-5.66 + 7.98 = +\$2.32$, which is a healthy overall outcome warranted by the tax advantage of debt. Another observation from this readjusted viewpoint is that the conventional $EVA_1 = \$1.44$ significantly (by 38%) understates the aggregate economic profit in the measurement period, suggesting that EVA may also yield a biased reference point for making decisions when accepted as a flow financial measure of firm's overall performance.

In sum, EVA accounts for the tax benefits of debt indirectly through the reduced cost of capital and the lower capital charge as a substitute for the direct increase in income by dollars of actually earned interest tax shields. Since $WACC$ is not the threshold rate of return for operations, but the investors' required return for a particular blend of operating and financing activities, the conventional EVA-based analysis may produce a fuzzy assessment of financial performance and distort management remuneration.

Calibrated tools for measuring performance

A sensible path to sharpen the view of performance is to decompose the whole into the operating and financing components, and to evaluate them concurrently to see the contribution of each into the end-result in the measurement period. The logical starting point is the core operations, and we introduce the Operating EVA ($OEVA$) as a metric for measuring operating performance:

$$OEVA_t \equiv NOPAT_t - IC_{t-1} \cdot k^U. \tag{5}$$

By applying the cost of unlevered equity to calculate the capital charge, we make two important modifications. First, we account for the factual required return on capital employed (both debt and equity), and second, we eliminate distortions that may arise out of the side effects of financing decisions implicitly introduced into the assessment of operating performance by the conventional $WACC$–based EVA.

$OEVA$ can be expressed in an equivalent form as the beginning of period invested capital multiplied by the operating performance spread (the difference between the return on invested capital $ROIC_t \equiv NOPAT_t / IC_{t-1}$ and the cost of unlevered equity k^U):

$$OEVA_t \equiv IC_{t-1} \cdot (ROIC_t - k^U). \tag{6}$$

For the purpose of measuring firm's overall performance, the Total EVA ($TEVA$) is defined as the sum of $OEVA$ and the interest tax shield:

$$TEVA_t \equiv OEVA_t + TS_t. \quad (7)$$

TEVA explicitly adds the interest tax subsidy from the government (a side effect of debt financing) to what is earned by the firm in excess of dollar opportunity cost of funds invested in its business activities:

$$TEVA_t = NOPAT_t - IC_{t-1} \cdot k^U + TS_t. \quad (8)$$

Remembering the conventional relation

$$NOPAT_t = NI_t + Int_t \cdot (1 - T), \quad (9)$$

the Total *EVA* can be restated in terms of net income (*NI*) and interest expenses (*Int*):

$$TEVA_t = NI_t + Int_t - IC_{t-1} \cdot k^U. \quad (10)$$

Expression (10) provides an intuitive interpretation for the metric: *TEVA* is an aggregate income of the stockholders and debt holders less the dollar opportunity cost of the book capital invested to earn this income. The advantage of formulation (10) is that it requires minimum effort to collect input data. To calculate *TEVA* analyst needs the net income and the interest expenses from the Income Statement and the total assets less non-interest bearing current liabilities from the Balance Sheet.[9]

Calculation of *TEVA* by the formula (7) requires explicit estimation of the tax shields, which in practice may not be as simple as the interest expenses times the corporate tax rate. In a general case, the interest tax shield in a particular period is a piecewise linear function of earnings before interest and tax for that period, and it may also be affected by other sources of tax deductibility available to the firm, such as losses carried forward, exchange losses and inflation adjustments to the equity book value in financial statements.[10] The *TEVA* expression (10) captures these effects (implicitly) from the data in the financial statements.

To see how *EVA* is formally related to *TEVA* and *OEVA*, just substitute the *WACC* formulation (3) into the formal definition (4) of *EVA*, and after elementary rearrangements obtain

$$\begin{aligned} EVA_t &= OEVA_t + TS_t \cdot \frac{IC_{t-1}}{V_{t-1}} = \\ &= TEVA_t - TS_t \cdot \frac{MVA_{t-1}}{V_{t-1}}. \end{aligned} \quad (11)$$

If in period t there is a positive tax shield contribution to the investors' income, i. e. $TS_t > 0$, then EVA_t exceeds the operating component ($OEVA_t$) of the total economic profit by the fraction (IC_{t-1}/V_{t-1}) of the TS_t. And when the Market Value Added (*MVA*),

$$MVA_{t-1} \equiv V_{t-1} - IC_{t-1}, \quad (12)$$

is also positive, then EVA_t is lower than the total economic profit ($TEVA_t$) in period t by the amount of the TS_t multiplied by the ratio (MVA_{t-1}/V_{t-1}), thus falling between the values of the $OEVA_t$ and $TEVA_t$.

Summing up, the conventional *EVA* calculated by applying the after tax *WACC* to impose the capital charge on the operating earnings will generally overestimate the economic profit from operations, will match the aggregate economic profit when *MVA* is zero, and can take hoax values higher than *TEVA* in cases where *MVA* is negative. All three metrics, *EVA*, *OEVA* and *TEVA*, would be expected to yield one and the same value when there is no contribution associated with the debt financing. In fact, when $TS_t = 0$, equation (11) immediately reduces to $EVA_t = OEVA_t = TEVA_t$, and an intuitive example here is an all equity financing. Another relevant situation would be the case of a levered firm incurring losses in period t and therefore no profits to shield by the interest expenses.

The formal analysis above confirms the observations of previous section. By its basic design, *EVA* is prone to be fuzzy, in sense that it measures neither the operating, nor the total profits actually earned by a firm in excess of the dollar opportunity costs of the capital employed. Fundamentally, the scale

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9 This idea was originally introduced in [Vélez-Pareja, Tham, 2004].

10 For an extensive discussion of these issues, see [Vélez-Pareja, Tham, 2010].

of measurement distortion depends on the amount of tax benefits from debt in the measurement period, and on the IC to V ratio.

Measurement improvements

In addition to the measurement slips induced by the EVA design, there are also other sources of potentially significant distortions in the EVA-based performance evaluation. This section covers the relevant issues emphasizing how and why the calibrated measures, $OEVA$ and $TEVA$, perform better than the conventional EVA.

Eliminating the future growth penalty on past performance

A notable situation where the EVA design leads to misrepresentation of results is when a firm experiences a shift in the value of its future growth opportunities. The effect arising is closely related to the issue of accounting for the capital charge, spotted in the practitioners literature as "an important but neglected area for research" [Young, O'Byrne, 2004, p. 253]. To illustrate, assume that all previously stated financial data for the Alpha Corporation remain unchanged at time $t = 2$ as they were at time $t = 1$, except for the beginning of period value of equity, which has doubled (due to emergence at $t = 1$ of inexistent at $t = 0$ future growth opportunities) from $V_0^E = V_0 - D_0 = 950 - 380 = \$570$ at $t = 0$ to $V_1^E = \$1140$ at $t = 1$. A higher equity value entails a higher cost of capital followed by a higher capital charge, and the latter transforms the Alpha Corporation from a positive EVA company into a negative EVA company. Specifically,

$$V_1 = 380 + 1140 = \$1520,$$

$$WACC_2 = 9.90\% - (7.98/1520) = 9.38\%,$$

$$EVA_2 = 78 - 845 \cdot 9.38\% = -\$1.22.$$

Successive EVA figures indicate a deterioration in performance. However, there are no changes in profits or assets base generating those profits, as well as in the financial ratios like the profit margin, assets turnover, return on invested capital etc. Altogether, Alpha's performance in periods 1 and 2 is stable by any conventional accounting criteria, and the negative signal prompted by the observed EVA figures is contrary to the factual results. The origin of this controversy is the capital charge penalty imposed on the current EVA by the $WACC$ appreciation at time $t = 2$, the latter coming from the reduced tax shield adjustment:

$$V_1^E > V_0^E \Rightarrow V_1 > V_0 \Rightarrow TS_2/V_1 < TS_1/V_0 \Rightarrow$$
$$\Rightarrow WACC_2 > WACC_1.$$

From the standpoint of performance assessment, both the increase in $WACC$ and the higher capital charge following the increase in equity value (due to earlier unavailable future growth opportunities) are artificial effects unrelated to the past and current performance. Invested capital, its opportunity costs, profits and tax saving on interest, all are the same at $t = 1$ and at $t = 2$. Therefore, switching from a positive $EVA_1 = \$1.44$ to a negative $EVA_2 = -\$1.22$ is a manifestation of the bias introduced into the performance measurement by the EVA design.

Everything falls into place when the calibrated measures are applied to evaluate performance. Substituting data for the Alpha Corporation into (5) and (7) obtain

$$OEVA_2 = OEVA_1 = 78 - 845 \cdot 9.90\% = $$
$$= -\$5.66,$$

$$TEVA_2 = TEVA_1 = -5.66 + 7.98 = $$
$$= +\$2.32.$$

The operating performance indicator $OEVA$ is stable in periods 1 and 2, but operations are inefficient since $NOPAT$ is lower than required to cover the opportunity cost of capital invested in operating assets. Aggregate financial performance, as indicated by $TEVA$, is also stable, and tax savings on interest ensure a positive overall result. The effect of switching from positive in period 1 to negative in period 2 economic profit is eliminated when $OEVA$ and $TEVA$ are used for performance evaluation.

Cancelling the inconsistency errors

Exposition and conclusions in the previous sections regarding the measurement bias inherent in the *EVA* design and the relationship between *EVA*, *OEVA* and *TEVA* implicitly assume that the necessary conditions for consistency in calculating *WACC* are satisfied. The basic three of them are: (a) the weights are based on the economic (market) values of debt and equity at the beginning of measurement period; (b) interest and taxes are paid in the period they are accrued; and (c) earnings before interest and tax exceed the interest on debt [Vélez-Pareja, Ibragimov, Tham, 2008]. However, it is not uncommon in practice that these assumptions are not met; and since the capital charge component of *EVA* is highly sensitive to the cost of capital, the outcome of *EVA*-based analysis will depend upon how *WACC* is calculated de facto. Inconsistencies easily slip in when the formula (2) is used; introducing even more confusion in the *EVA*-based performance assessment. In this section we explain with examples how the inconsistency errors occur in the *EVA* calculations, and demonstrate that the dual *OEVA–TEVA* financial performance measurement eliminates even the possibility of such errors.

Imputed tax shields error. To be specific, assume for instance that under the terms of loan agreement, the Alpha Corporation does not have to pay interest in the period 1, all other data being the same as stated earlier. Given that $V_0^D = D_0 = \$380$ and $V_0 = \$950$, the value of Alpha's equity is $V_0^E = 950 - 380 = \$570$. Therefore, the Alpha's capital structure is 40% debt, $w_0^D = 380/950 = 0.40$, and 60% equity, $w_0^E = 1 - w_0^D = 0.60$.

To calculate *WACC* by the formula (2) we have to calculate the cost of levered equity first, and this is done by the formula

$$k_t^E = k_t^U + \frac{V_{t-1}^D}{V_{t-1}^E}\left(k_t^U - k_t^D\right). \tag{13}$$

This formulation does not include a tax term $(1-T)$, since tax shields are assumed to be as risky as the company's unlevered cash flows [Taggart, 1991; Inselbag, Kaufold, 1997; Tham, Vélez-Pareja, 2004].

Substituting the relevant data for the Alpha Corporation yields

$$k_1^E = 9.90\% + (0.40/0.60) \times$$
$$\times\ (9.90\% - 6.0\%) = 12.50\%,$$

$$WACC_1 = 0.60 \cdot 12.50\% +$$
$$+\ 0.40 \cdot 6.0\% \cdot (1 - 0.35) = 9.06\%.$$

NOPAT and *IC* are unaffected by the interest payments, therefore

$$EVA_1 = 78 - 845 \cdot 9.06\% = \$1.44.$$

Note, that the resulting figure $EVA_1 = \$1.44$ is the same as if the interest has been paid and the interest tax shield has been earned. However, when a firm does not pay interest, the benefits of sheltering income from tax are forgone, and the economic profits actually earned are reduced by the tax shields missed. This is not captured by the conventional *EVA*, because the tax shield effect is introduced into the calculations irrespective of interest payments by the $(1-T)$ adjustment to the cost of debt in the formula (2).

OEVA and *TEVA* are free from this imputed tax shield bias and react accordingly. Since the Alfa pays no interest on debt, then $TS_1 = 0$ and $TEVA_1 = OEVA_1 = 78.00 - 83.66 = -\$5.66$. Operating performance is unaffected (as captured by *OEVA*), and *TEVA* equals the total economic profit actually earned exclusive of any virtual amount of nonexistent interest tax shields (counted in *EVA*). In line with the analysis in previous section, the values of both metrics match, as will also the value of *EVA* if calculated consistently. In fact, applying formula (4) instead of (2) immediately obtain, that in the case of zero tax shield *WACC* is equal to the cost of unlevered equity k^U, and therefore, $EVA = OEVA = TEVA$.

The target and the book capital structure errors. According to the established rule in corporate finance, *WACC* should be the market weighted average of the cost of equity and the cost of debt. A widespread substitute for this rule is to use the long term target weights to calculate *WACC*. Another fairly common approach is using the book weights. Both methods are attractively simple, but computational simplicity comes at a cost of added distortions in performance assessment.

Assume, for example, that for the purpose of calculating *WACC* the management of Alpha Corporation adheres to the target debt weight $w^D = 0.5$. Under the constant leverage assumption the formula (3) transforms into the *WACC* model introduced by [Harris, Pringle, 1985]

$$WACC_t = k^U - \frac{TS_t}{V_{t-1}} = \\ = k^U - \frac{D_{t-1} k_t^D T}{V_{t-1}} = k^U - w^D k_t^D T, \quad (14)$$

and, therefore,

$$WACC_1 = 9.90\% - 6.0\% \cdot 0.5 \cdot 0.35 = \\ = 8.85\%,$$

$$EVA_1 = 78 - 845 \cdot 8.85\% = \$3.22.$$

One can see that calculations using the target weights in *WACC* yield the *EVA* figure more than two times higher than $EVA_1 = \$1.44$ with the market weights in *WACC*, and 38% higher than the attainable $TEVA_1 = \$2.32$.

With the book weights in *WACC*, the *EVA* view of the Alpha's performance looks distorted as well. Given $IC_0 = \$845$ and $D_0 = \$380$, the book value of equity is $845 - 380 = \$465$, and the book weights are $w^D = 380/845 = 0.45$, $w^E = 1 - w^D = 0.55$. Consequently

$$k_1^E = 9.90\% + (0.45/0.55) \times \\ \times (9.90\% - 6.0\%) = 13.09\%,$$

$$WACC_1 = 0.55 \cdot 13.09\% + 0.45 \times \\ \times 6.0\% \cdot (1 - 0.35) = 8.96\%,$$

$$EVA_1 = 78 - 845 \cdot 8.96\% = \$2.32.$$

Since the book value of the Alpha's invested capital is significantly lower than its market value, calculations yield understated $WACC_1 = 8.96\% < 9.06\%$ and overstated $EVA_1 = \$2.32 > \$1.44$.

In contrast to the *WACC* based capital charge in *EVA*, the opportunity cost of capital applied to calculate the capital charge in *OEVA* and *TEVA* is the risk of assets k^U (the cost of unlevered equity), which is unaffected by the firm's capital structure. Accordingly, *OEVA* and *TEVA* are free from errors associated with the target capital structure assumption and the book capital structure simplification.

Practical implications

Distortions in the performance assessment induced by the *EVA* design and supplement aberrations arising from inconsistency or simplifying conventions when calculating *WACC* can lead to misrepresentations and wrong conclusions regarding the firm's financial performance, trigger unintended errors in making decisions and produce distortions in the corporate reward system. A strong argument in favor of calibrated metrics proposed in the paper is that all prerequisites for the emergence of such errors are eliminated in the performance measurement based on *OEVA* and *TEVA*. *TEVA* fits better than *EVA* for measuring firm's overall financial performance, and *OEVA* is a robust metric that provides an informative view of ongoing operations. A distinct advantage and, perhaps, the most important property of the *OEVA* is that it is unaffected by the firm's financing decisions. Both the *OEVA* and *TEVA* are computationally transparent and straightforward for interpretation. And on top, the valuation models with *OEVA* and *TEVA* as the valuation attributes are equivalent to the fundamental discounted cash flow model. Next section offers a compact presentation of the valuation-related issues.

Valuing a firm by TEVA and OEVA discounting

The value *V* of a levered firm at time *t* in terms of *TEVA* is equal to the book invested capital at time t plus the present value of all expected future $TEVA$s. In symbols,

$$V_t \equiv IC_t + \sum_{s=1}^{L} TEVA_{t+s} \cdot \left(1 + k^U\right)^{-s}, \qquad (15)$$

where the upper value L of a summation index s denotes the expected end of life of the company. Typically, $L = \infty$ for a going concern, but can be a finite year for those cases where the firm is expected to have a finite life.

The structure of $TEVA$ valuation model is similar to that of the conventional EVA model

$$V_t \equiv IC_t + \sum_{s=1}^{L} EVA_{t+s} \prod_{j=1}^{s} \left(1 + WACC_{t+j}\right)^{-1}, \qquad (16)$$

and if done consistently, they both yield the same value as the basic free cash flow (FCF) valuation model

$$V_t \equiv \sum_{s=1}^{L} FCF_{t+s} \prod_{j=1}^{s} \left(1 + WACC_{t+j}\right)^{-1}. \qquad (17)$$

Symbol Π in equations (16) and (17) denotes the product. Appendix A provides an algebraic proof of equivalence of the $TEVA$ and FCF valuation models.

The value of levered firm at time t can also be expressed as the sum of its book invested capital, the present value of expected $OEVA$s (V^{OEVA}) and the value of the interest tax shields (V^{TS}):

$$V_t = IC_t + V_t^{OEVA} + V_t^{TS}, \qquad (18)$$

$$V_t^{OEVA} \equiv \sum_{s=1}^{L} OEVA_{t+s} \left(1 + k^U\right)^{-s}, \qquad (19)$$

$$V_t^{TS} \equiv \sum_{s=1}^{L} TS_{t+s} \left(1 + k^U\right)^{-s}. \qquad (20)$$

Since the value of a levered firm is also equal to the sum of its value V^U were it unlevered and the value of the interest tax shields

$$V_t = V_t^U + V_t^{TS}, \qquad (21)$$

then it immediately follows that discounting expected $OEVA$s at the cost of unlevered equity k^U and adding the book invested capital yields the value V^U of unlevered firm, which is the present value of expected future free cash flows discounted at k^U:

$$V_t^{OEVA} + IC_t = V_t^U \equiv \equiv \sum_{s=1}^{L} FCF_{t+s} \cdot \left(1 + k^U\right)^{-s}. \qquad (22)$$

The key difference between the $TEVA$ and EVA valuation models is that the cost of unlevered equity k^U is applied both to calculate the metric and to discount the forecasted annual $TEVA$s, while EVA is calculated and discounted with $WACC$. This difference is a source of advantage of the $TEVA$ valuation model over the EVA model in the real-life applications. To see why, recall that the value of firm is equal to the present value of its future free cash flows discounted at $WACC$ only when $WACC$ is the market weighted average of the cost of equity and the cost of debt. Therefore, to maintain consistency in the valuation model, $WACC$ has to be recalculated period by period to account for the changes in the capital structure and to a possibly changing cost of debt arising from the operating, investment and financing decisions made by the management. Different numeric values for $WACC$ should be applied each year to calculate and discount EVA, and here the analyst is confronted with a triple circularity problem. To calculate EVA she needs to know $WACC$, to calculate $WACC$ she in turn needs to know V, and to calculate V she needs to know the values of EVA and $WACC$ in all future periods of the forecast horizon. This circularity issue, though solvable either numerically or analytically [Vélez-Pareja, Tham, 2009; Mejia-Pelaez, Vélez-Pareja, 2011], adds substantially to building up computational complexities in structuring and handling consistent EVA valuation model.

On the contrary, the discount rate k^U in the $OEVA$–$TEVA$ based valuation model is independent of changes in the capital structure and could be assumed constant (unless the firm decides to change its business mix, substantially altering the systematic risk of operations). Consequently, the $OEVA$–$TEVA$ valuation requires much fewer restrictive assumptions to estimate the cost of capital and therefore, less prone to errors in the periodic and present value calculations. The *OEVA–TEVA* model is free of implicit and explicit complexities and inconsistences discussed in the previous sections and simpler than the *EVA* model both analytically and computationally.

Decomposition of the Market Value Added

The Market Value Added (*MVA*) can also be reformulated in terms of *TEVA*. Just remembering that the value of firm equals its book invested capital plus the present value of expected future *TEVA*s, one immediately obtains that the firm's *MVA* is equal to the present value of the expected future *TEVAs* discounted at the cost of unlevered equity k^U. Stating in symbols

$$MVA_t = \sum_{s=1}^{L} TEVA_{t+s} \cdot \left(1+k^U\right)^{-s}. \tag{23}$$

Relying on the additivity of present values and in line with the *OEVA–TEVA* approach of disaggregating overall performance into the operating and financing components, we can split *MVA* into the Operations Value Added (*OVA*) and the Financing Value Added (*FVA*):

$$MVA_t = OVA_t + FVA_t. \tag{24}$$

The *OVA* is defined as the present value of expected future *OEVA*s discounted at k^U, and it accounts for the value of firm's operations over and above the capital invested:

$$OVA_t = \sum_{s=1}^{L} OEVA_{t+s} \left(1+k^U\right)^{-s}. \tag{25}$$

The *FVA* measures how much value has been added or destroyed by the firm's financial maneuvers. Basically, it is the present value of expected interest tax shields:

$$FVA_t = V_t^{TS}, \tag{26}$$

but can also include other effects of financing, such as issuance costs and commissions, debt and tax subsidies, financial distress costs.

This decomposition of *MVA* is similar to the Adjusted Present Value (*APV*) analysis of [Myers, 1974] in the capital budgeting, and in the context of performance evaluation, it can help managers to see not only how much value is added to the money investors have put into the firm, but also where the value comes from. [Adserà, Viñolas, 2003] elaborated a method of explicitly incorporating financing effects (such as contributions from tax shields and bankruptcy costs) into the *EVA* and discounted cash flow valuation models, however, their results are limited to the particular case of growing perpetuities.

Terminal value formulae for the OEVA–TEVA valuation model

When performing a valuation the future is usually divided into two periods: the explicit forecast period of N years where the valuation attribute is forecasted a year by year from the projected financial statements, and the perpetuity period after that, accounted for by the terminal value. With respect to the *TEVA* valuation model, there is a choice of several interchangeable options for the terminal value calculation under the standard steady state assumptions of a constant growth rate g_{TV} and a constant return $ROIC_{TV}$ on new investments in perpetuity. Here we present the formulations derived, and details of derivation are available in the Appendix B.

The first formulation is in terms of *TEVA*:

$$TV_N = IC_n + TV_N^{TEVA}, \tag{27}$$

$$TV_N^{TEVA} \equiv \frac{TEVA_{N+1}}{k^U} + \frac{TEVA_{N+2} - TEVA_{N+1}}{k^U \cdot \left(k^U - g_{TV}\right)}. \tag{28}$$

And the second one, similar to the "key value driver formula" mentioned in [Koller, Goedhart, Wessels, 2010, p. 119], is in terms of the *TEVA* drivers:

$$TV_N^{TEVA} \equiv \frac{TEVA_{N+1}}{k^U} + \frac{M + g_{TV} \cdot TS_{n+1}}{k^U \cdot \left(k^U - g_{TV}\right)}, \tag{29}$$

where

$$M = NOPAT_{N+1} \cdot \frac{g_{TV}}{ROIC_{TV}} \cdot \left(ROIC_{TV} - k^U\right).$$

Both expressions (28) and (29) are equivalent to the standard Gordon-type terminal value formula in the free cash flow valuation model

$$TV_N \equiv \frac{FCF_{N+1}}{WACC_{TV} - g_{TV}}, \tag{30}$$

where $WACC_{TV}$ is the weighted average cost of capital for the firm in perpetuity.

The TV expressions (28) and (29) can also be restated in terms of $OEVA$ and the interest tax shields in perpetuity

$$TV_N^{TEVA} = TV_N^{OEVA} + TV_N^{TS}, \tag{31}$$

where

$$TV_N^{TS} = \frac{TS_{N+1}}{k^U - g_{TV}}, \tag{32}$$

$$TV_N^{OEVA} \equiv \frac{OEVA_{N+1}}{k^U} + \frac{M}{k^U\left(k^U - g_{TV}\right)}, \tag{33}$$

or, equivalently,

$$TV_N^{OEVA} \equiv \frac{OEVA_{N+1}}{k^U} + \frac{OEVA_{N+2} - OEVA_{N+1}}{k^U\left(k^U - g_{TV}\right)}. \tag{34}$$

Note, that formulas (28) and (34) require explicit calculations of the valuation attributes for the two extra periods, $N + 1$ and $N + 2$, beyond the forecast horizon of N years.

Concluding Remarks

Measuring financial performance is an essential part of any business management system. None of the established financial metrics is perfect, and very often an idea of improvements falls on the path of increasing complexity that in the end can easily outweigh the benefits gained. Our proposition is taking three steps toward constructive simplification, which make the economic profit based performance assessment easier to perform, interpret and finally integrate into the corporate performance management system. Contrary to what one might expect from "simplification", the steps proposed do not reduce the quality of measurements; they improve it and make results more reliable.

First, we recognize that the aggregate income attributable to the suppliers of funds is essentially the sum of the $NOPAT$ and the tax savings on interest. On the side of the firm's investors, this is exactly the aggregate book income of the stockholders and debt holders, net income plus interest on debt, which provides the factual basis for the estimation of economic profit earned by the firm in a measurement period.

Second, we use the risk of assets to calculate the full charge on the money investors put into the firm. This is a logical extension of the first step, ensuring consistency in the financial model. Since the tax effects of leverage are taken into account explicitly in the flows, the opportunity cost of capital is the weighted average cost of capital unadjusted for taxes. This approach has its counterpart — Capital Cash Flow valuation model in the universe of discounted cash flow analysis [Ruback, 2002].

Third, we replace the traditional EVA, with the two complementary financial metrics: the Operating EVA ($OEVA$) for the purpose of measuring operating performance, and the Total EVA ($TEVA$) for the purpose of measuring overall performance. The $OEVA$–$TEVA$ approach to performance assessment leaves aside distortions, complexities and inconsistencies inherent in the basic design of EVA. It is straightforward for interpretation and computationally simpler relative to EVA; it requires much fewer restrictive assumptions to estimate the cost of capital and so is less prone to errors that distort managerial perception of performance. The key role in the $OEVA$–$TEVA$ analysis clearly belongs to $OEVA$. Undistorted by the side effects of financing decisions it provides an informative financial estimate of the operating efficiency, and being nested in $TEVA$ it forms the basis for the firm's overall performance evaluation.

Additional, but not the least relevant argument in support of our *OEVA–TEVA* proposition is the equivalence of the *OEVA–TEVA* based valuation model to the fundamental approach of valuing a firm by cash flow discounting, so that it may be also utilized as a standalone methodology for investment project appraisal and business valuation.

Appendix A

EQUIVALENCE OF THE TEVA AND FCF VALUATION

First, we show that the yearly dynamics of the two valuation models are equivalent for an arbitrary year t in the forecast period. Since the models and the discounting procedure are applied in the same way for any year, then the equivalence must hold for any and *all* years. By this argument, the equivalence is proved.

The free cash flow valuation model

The *FCF* model suggests that the *levered firm value*, V_t is equal to the present value of all expected free cash flows discounted at a periodically adjusted weighted average cost of capital

$$V_t = \sum_{s=1}^{L} FCF_{t+s} \prod_{j=1}^{s} \left(1 + WACC_{t+j}\right)^{-s}, \qquad (A.1)$$

L denotes the expected end of life of the company.

Since the value at each date t includes the value of all subsequent cash flows, it is simpler to compute V_t by working backward from period $t + 1$, discounting that period free cash flow FCF_{t+1} and the value V_{t+1} of free cash flows in year $t + 2$ and beyond

$$V_t = \frac{FCF_{t+1} + V_{t+1}}{1 + WACC_{t+1}}. \qquad (A.2)$$

Equation (A.2) represents yearly dynamics of a levered firm value according to the *FCF* model.

Following a common definition [Koller, Goedhart, Wessels, 2010, p. 154–156],

$$FCF_t \equiv NOPAT_t - (IC_t - IC_{t-1}). \qquad (A.3)$$

Time index $t - 1$ on a balance sheet or other stock items means end of year $t - 1$, or equivalently, beginning of year t.

Yearly value dynamics in the *TEVA* valuation model

According to the *TEVA* model, the value of a levered firm at time t is:

$$V_t = IC_t + \sum_{s=1}^{L} \frac{TEVA_{t+s}}{\left(1 + k^U\right)^s}. \qquad (A.4)$$

Taking the term $TEVA_{t+1}/\left(1 + k^U\right)$ outside the summation we can rewrite (A.4) as

$$\begin{aligned} V_t &= IC_t + \sum_{s=1}^{L} \frac{TEVA_{t+s}}{\left(1 + k^U\right)^s} = \\ &= IC_t + \frac{TEVA_{t+1}}{1 + k^U} + \frac{1}{1 + k^U} \sum_{s=2}^{L} \frac{TEVA_{t+s}}{\left(1 + k^U\right)^{s-1}}. \end{aligned} \qquad (A.5)$$

Note that the value of the levered firm at time $t + 1$ is

$$V_{t+1} = IC_{t+1} + \sum_{s=2}^{L} \frac{TEVA_{t+s}}{\left(1 + k^U\right)^{s-1}} \qquad (A.6)$$

and, consequently,

$$\sum_{s=2}^{L} \frac{TEVA_{t+s}}{\left(1 + k^U\right)^{s-1}} = V_{t+1} - IC_{t+1}. \qquad (A.7)$$

After substituting (A.7) into the expression (A.5) the latter simplifies to

$$V_t = IC_t + \frac{TEVA_{t+1}}{1 + k^U} + \frac{1}{1 + k^U} \cdot (V_{t+1} - IC_{t+1}). (A.8)$$

Finally, reducing to a common denominator, we obtain the relation of levered firm values for two subsequent time periods according to the *TEVA* valuation model

$$V_t = IC_t + \frac{TEVA_{t+1} + V_{t+1} - IC_{t+1}}{1 + k^U}. \qquad (A.9)$$

Proof of equivalence

By definition

$$TEVA_{t+1} = NOPAT_{t+1} - IC_t \cdot k^U + TS_{t+1}. (A.10)$$

Multiplying both sides of (A.9) with $(1 + k^U)$ obtain

$$\begin{aligned} V_t + V_t \cdot k^U &= IC_t + IC_t \cdot k^U + \\ &+ TEVA_{t+1} + V_{t+1} - IC_{t+1} \end{aligned} \tag{A.11}$$

Substituting (A.10) into (A.11) yields

$$\begin{aligned} V_t + V_t \cdot k^U &= IC_t + IC_t \cdot k^U + \\ &+ NOPAT_{t+1} - IC_t \cdot k^U + \\ &+ TS_{t+1} + V_{t+1} - IC_{t+1}. \end{aligned} \tag{A.12}$$

After making rearrangements and taking into account (A.3), equation (A.12) reduces to

$$V_t + V_t \cdot k^U - TS_{t+1} = FCF_{t+1} + V_{t+1}. \tag{A.13}$$

Factoring out V_t in the left had side of (A.13), obtain

$$V_t \left(1 + k^U - \frac{TS_{t+1}}{V_t} \right) = FCF_{t+1} + V_{t+1}. \tag{A.14}$$

Remembering (3), the expression (A.14) finally transforms into the (A.2) — the yearly dynamics of a levered value in the *FCF* valuation model.

Appendix B

DERIVATION OF THE TERMINAL VALUE FORMULAS FOR THE TEVA AND OEVA VALUATION

Start with the standard *TV* formula in the free cash flow valuation model, assuming constant growth g_{TV} in perpetuity and a constant cost of capital $WACC_{TV}$

$$TV \qquad \frac{FCF}{WACC_{TV} \quad g_{TV}}. \tag{B.1}$$

Under the assumption of constant return $ROIC_{TV}$ on new investments starting year $N + 1$ to infinity, the free cash flow is the *NOPAT* less the reinvestment to grow assets [Koller, Goedhart, Wessels, 2010, p. 214]

$$FCF_{N+1} = NOPAT_{N+1} \cdot \left(1 - \frac{g_{TV}}{ROIC_{TV}} \right), \tag{B.2}$$

therefore

$$TV_N = \frac{NOPAT_{N+1} \cdot \left(1 - \frac{g_{TV}}{ROIC_{TV}} \right)}{WACC_{TV} - g_{TV}}. \tag{B.3}$$

According to (3)

$$WACC_{TV} = k^U - \frac{TS_{N+1}}{TV_N}. \tag{B.4}$$

Substituting (B.4) into (B.3) after rearrangements obtain

$$TV_N = \frac{NOPAT_{N+1} \cdot \left(1 - \frac{g_{TV}}{ROIC_{TV}} \right) + TS_{N+1}}{k^U - g_{TV}}. \tag{B.5}$$

Next, multiply and divide the right hand side of (B.5) by k_U and then subtract and add $(NOPAT_{N+1} \cdot g_{TV} + TS_{N+1} \cdot g_{TV})$ in the numerator of resulting expression. Regrouping members in the numerator yields

$$\begin{aligned} TV_N &= \frac{(NOPAT_{N+1} + TS_{N+1}) \cdot (k^U - g_{TV})}{k^U \cdot (k^U - g_{TV})} + \\ &+ \frac{NOPAT_{N+1} \cdot \frac{g_{TV}}{ROIC_{TV}} \cdot (ROIC_{TV} - k^U)}{k^U \cdot (k^U - g_{TV})} + \\ &+ \frac{+TS_{N+1} \cdot g_{TV}}{k^U \cdot (k^U - g_{TV})} = \\ &= \frac{NOPAT_{N+1} + TS_{N+1}}{k^U} + \\ &+ \frac{NOPAT_{N+1} \cdot \frac{g_{TV}}{ROIC_{TV}} \cdot (ROIC_{TV} - k^U)}{} + \\ &+ \frac{TS_{N+1} \cdot g_{TV}}{k^U \cdot (k^U - g_{TV})}. \end{aligned} \tag{B.6}$$

Remembering (8), it follows that $NOPAT_{N+1} + TS_{N+1} = TEVA_{N+1} + IC_N \cdot k^U$, and (B.6) finally transforms into the formula

$$\begin{aligned} TV_N &= IC_N + \frac{TEVA_{N+1}}{k^U} + \\ &+ \frac{NOPAT_{N+1} \cdot \frac{g_{TV}}{ROIC_{TV}} \cdot (ROIC_{TV} - k^U) + TS_{N+1} \cdot g_{TV}}{k^U \cdot (k^U - g_{TV})}, \end{aligned} \tag{B.7}$$

which is the combination of (27) and (29).

After applying simple algebra to the numerator of the last term on the right-hand side of (B.7)

$$NOPAT_{N+1} \cdot \frac{g_{TV}}{ROIC_{TV}} \cdot \left(ROIC_{TV} - k^U\right) + g_{TV} \cdot TS_{N+1} =$$

$$= NOPAT_{N+1} \cdot g_{TV} + TS_{N+1} \cdot g_{TV} -$$

$$- NOPAT_{N+1} \cdot \frac{g_{TV}}{ROIC_{TV}} \cdot k^U =$$

$$= \left(NOPAT_{N+2} - NOPAT_{N+1}\right) +$$
$$+ \left(TS_{N+2} - TS_{N+1}\right) - \left(IC_{N+2} - IC_{N+1}\right) \cdot k^U =$$

$$= TEVA_{N+2} - TEVA_{N+1}.$$

Formula (B.7) transforms into the terminal value formula in terms of *TEVA*

$$TV_N = IC_N + \frac{TEVA_{N+1}}{k^U} + \frac{TEVA_{N+2} - TEVA_{N+1}}{k^U \cdot \left(k^U - g_{TV}\right)}, \quad \text{(B.8)}$$

which is the combination of (27) and (28).

Next, equation (B.7) remembering (8) is reformulated in terms of *OEVA*

$$TV_N = IC_N + \frac{OEVA_{N+1}}{k^U} + \frac{NOPAT_{N+1} \cdot \frac{g_{TV}}{ROIC_{TV}} \cdot \left(ROIC_{TV} - k^U\right)}{k^U \cdot \left(k^U - g_{TV}\right)} + \frac{TS_{N+1}}{k^U - g_{TV}}, \quad \text{(B.9)}$$

and (B.8) transforms into

$$TV_N = IC_N + \frac{OEVA_{N+1}}{k^U} + \frac{OEVA_{N+2} - OEVA_{N+1}}{k^U \cdot \left(k^U - g_{TV}\right)} + TV_N^{TS}. \quad \text{(B.10)}$$

Consequently

$$TV_N = IC_N + TV_N^{OEVA} + TV_N^{TS}, \quad \text{(B.11)}$$

$$TV_N^{OEVA} = \frac{OEVA_{N+1}}{k^U} + \frac{OEVA_{N+2} - OEVA_{N+1}}{k^U \cdot \left(k^U - g_{TV}\right)} = \frac{OEVA_{N+1}}{k^U} + \frac{NOPAT_{N+1} \cdot \frac{g_{TV}}{ROIC_{TV}} \cdot \left(ROIC_{TV} - k^U\right)}{k^U \cdot \left(k^U - g_{TV}\right)}. \quad \text{(B.12)}$$

REFERENCES

Adserà X., Viñolas P. 2003. FEVA: A financial and economic approach to valuation. *Financial Analysts Journal* **59** (2): 80–87.

Albrecht T. 1998. The search for the best financial performance measure: A comment. *Financial Analysts Journal* **54** (1): 86–87.

Amey L. 1969. *The Efficiency of Business Enterprises*. Allen and Unwin: London.

Amey L. 1975. Tomkins on ‘residual income’. *Journal of Business Finance & Accounting* **2** (1): 55–68.

Anthony R. 1973. Accounting for the cost of equity. *Harvard Business Review* (51): 88–102.

Arnold G. 2005. *Handbook of Corporate Finance. A Business Companion to Financial Markets, Decisions & Techniques*. Financial Times/Prentice Hall: Edinburgh Gate.

Atrill P., McLaney E. 2009. *Management Accounting for Decision Makers*. Pearson Education: Essex.

Bacidore J. M., Boquist J. A., Milbourn T. T., Thakor A. V. 1997. The search for the best financial performance measure. *Financial Analysts Journal* **53** (3): 11–20.

Baker H. K., Deo P., Mukherjee T. 2009. EVA Revisited. *Journal of Financial Education* (35): 1–22.

Berk J., DeMarzo P. 2012. *Corporate Finance: The Core*. Pearson Education: Boston, MA.

Bernstein L. A., Wild J. J. 1997. *Financial Statement Analysis: Theory, Application and Interpretation*. McGraw-Hill: Homewood, IL.

Bhimani A., Horngren C. T., Datar S. M., Foster G. 2008. *Management and Cost Accounting*. Pearson Education: Essex.

Biddle G. C., Bowen R. M., Wallace J. S. 1997. Does EVA® beat earnings? Evidence on associations with stock returns and firm values. *Journal of Accounting and Economics* **24** (3): 301–336.

Bierman H. 1988. Beyond cash flow ROI. *Midland Corporate Finance Journal* **5** (4): 36–39.

Bodie Z. 1982. Compound interest depreciation in capital investment. *Harvard Business Review* **60**: 58–60.

Brealey R., Myers S. 2010. *Principles of Corporate Finance*. McGraw-Hill: Boston, MA.

Bromwich M. 1973. Measurement of divisional performance: A comment and extension. *Accounting and Business Research* (3): 123–132.

Bromwich M., Walker M. 1998. Residual income past and future. *Management Accounting Research* **9** (4): 391–419.

Chen S., Dodd J.L. 2001. Operating income, residual income and EVA™: Which metric is more value relevant? *Journal of Managerial Issues* **13** (1): 65–86.

Dechow P., Hutton A., Sloan R. 1999. An empirical assessment of the residual income valuation model. *Journal of Accounting and Economics* **26** (1–3): 1–34.

Dekker H.C., Groot T., Schoute M., Wiersma E. 2012. Determinants of the use of value-based performance measures for managerial performance evaluation. *Journal of Business Finance & Accounting* **39** (9–10): 1214–1239.

Emmanuel C.R., Otley D.T. 1976. The usefulness of residual income. *Journal of Business Finance & Accounting* **3** (4): 43–51.

Feltham G. Ohlson J. 1995. Valuation and clean surplus accounting for operating and financial activities. *Contemporary Accounting Research* (11): 689–731.

Feltham G., Ohlson J. 1996. Uncertainty resolution and the theory of depreciation measurement. *Journal of Accounting Research* (34): 209–234.

Flower J. 1971. Measurement of divisional performance. *Accounting and Business Research* (1): 205–214.

Francis J., Olsson P., Oswald D. 2000. Comparing the accuracy and explainability of dividend, free cash flow and abnormal earnings equity value estimates. *Journal of Accounting Research* (38): 71–102.

Garrison R.H., Noreen E.W., Brewer P.C. 2010. *Managerial Accounting*. McGraw-Hill: N.Y.

Grinblatt M., Titman S. 2001. *Financial Markets and Corporate Strategy*. McGraw-Hill: Boston, MA.

Harris R., Pringle J. 1985. Risk–adjusted discount rates extensions from the average-risk case. *Journal of Financial Research* **8** (3): 237–244.

Heinrichs N., Hess D., Homburg C., Lorenz M., Sievers S. 2013. Extended dividend, cash flow, and residual income valuation models: Accounting for deviations from ideal conditions. *Contemporary Accounting Research* **30** (1): 42–79.

Horngren C.T., Datar S.M., Rajan M.V. 2012. Cost accounting: A managerial emphasis. Pearson Prentice Hall: Upper Saddle River, NJ.

Ibragimov R.G. 2007. Financial estimate of administrative solutions: About application and interpretation of parameter EVA. *Audit and Financial Analysis* (5): 141–149. (In Russian)

Ibragimov R.G. 2015. Why we should not trust the EVA-based assessment of performance? *Finansovye Issledovania* **3**: 164–170. (In Russian)

Inselbag I., Kaufold H. 1997. Two DCF approaches for valuing companies under alternative financing strategies (and how to choose between them). *Journal of Applied Corporate Finance* **10** (1): 114–122.

Ittner C.D., Larcker D.F. 2001. Assessing empirical research in managerial accounting: A value-based management perspective. *Journal of Accounting and Economics* (32): 349–410.

Koller T., Goedhart M., Wessels D. 2010. *Valuation: Measuring and Managing the Value of Companies*. John Wiley & Sons: Hoboken, NJ.

Lewis R. 1955. *Planning, Managing and Measuring the Business. A Case Study of Management Planning and Control at the General Electric Company*. Controllers Institute Research Foundation: N.Y.

Lundholm R., O›Keefe T. 2001. Reconciling value estimates from the discounted cash flow model and the residual income model. *Contemporary Accounting Research* **18** (2): 311–335.

Malmi T., Ikäheimo S. 2003. Value Based Management practices — some evidence from the field. *Management Accounting Research* **14** (3): 235–254.

McLaren J., Appleyard T., Mitchell F. 2016. The rise and fall of management accounting systems: A case study investigation of EVA™. *The British Accounting Review* **48** (3): 341–358.

McTaggart M., Kontes P.W., Mankins M.C. 1994. *The Value Imperative: Managing for Superior Shareholder Returns*. The Free Press: New York, NY.

Mejia-Pelaez F., Vélez-Pareja I. 2011. Analytical solution to the circularity problem in the discounted cash flow valuation framework. *Innovar* **21** (42): 55–68.

Merchant K.A., Van der Stede W.A. 2007. *Management Control Systems*. Pearson Education: Essex.

Miles J., Ezzell J. 1985. Reformulating tax shield valuation: A note. *Journal of Finance* **40** (5): 1485–1492.

Myers J. 1999. Implementing residual income valuation with linear information dynamics. *The Accounting Review* (74): 1–28.

Myers S. 1974. Interactions of corporate financing and investment decisions — implications for capital budgeting. *Journal of Finance* **29** (1): 1–25.

O'Hanlon J., Peasnell K. 1998. Wall Street's contribution to management accounting: The Stern Stewart EVA® financial management system. *Management Accounting Research* **9** (4): 421–444

Ohlson J. 1995. Earnings, book values, and dividends in equity valuation. *Contemporary Accounting Research* (11): 661–687.

Ohlson J. 2002. Discussion of "residual income and value-creation: The missing link". *Review of Accounting Studies* (7): 247–251.

Penman S., Sougiannis T. 1997. The dividend displacement property and the substitution of anticipated earnings for dividends in equity valuation. *The Accounting Review* (72): 1–21.

Penman S.H. 2001. *Financial Statements Analysis and Security Valuation*. McGraw-Hill: N.Y.

Ruback R.S. 2002. Capital cash flows: A simple approach to valuing risky cash flows. *Financial Management* **31** (2): 55–103.

Schueler A., Krotter S. 2008. The link between residual income and value created for levered firms: A note. *Management Accounting Research* (19): 270–277.

Sharma A.K., Kumar S. 2010. Economic value added (EVA) — literature review and relevant issues. *International Journal of Economics and Finance* **2** (2): 200–220.

Solomons D. 1965. *Divisional Performance: Measurement and Control*. Richard D. Irwin: Homewood, IL.

Stewart G.B. 1991. *The Quest for Value*. Harper Business: N.Y.

Taggart R. 1991. Consistent valuation and cost of capital expressions with corporate and personal taxes. *Financial Management* **20** (3): 8–20.

Tham J., Vélez-Pareja I. 2004. *Principles of Cash Flow Valuation*. Elsevier Academic Press: Burlington.

Tomkins C. 1975. Residual income: A rebuttal of professor Amey's argument. *Journal of Business Finance & Accounting* (2): 161–168.

Vélez-Pareja I., Tham J. 2004. *EVA(c) Made Simple: Is it Possible?* Working paper. Available at: http://ssrn.com/abstract=497545

Vélez-Pareja I., Ibragimov R., Tham J. 2008. Constant leverage and constant cost of capital: A common knowledge half-truth. *Estudios Gerenciales* **24** (107): 13–34.

Vélez-Pareja I., Tham J. 2009. Market value calculation and the solution of circularity between value and the weighted average cost of capital WACC. *Revista de Administração Mackenzie* **10** (6): 101–131.

Vélez-Pareja I., Tham J. 2010. Company's valuation in an emerging economy — case study TIMANCO S.A. *The Valuation Journal* **5** (2): 4–45.

Wallace J.S. 1997. Adopting residual income-based compensation plans: Do you get what you pay for? *Journal of Accounting and Economics* **24** (3): 275–300.

Young D.S., O'Byrne S.F. 2000. *EVA and Value-Based Management: A Practical Guide to Implementation*. McGraw-Hill: N.Y.

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К вопросу улучшения измерения финансовой результативности: надежная OEVA–TEVA как альтернатива смещенной EVA

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В статье показано аналитически и проиллюстрировано на примерах, что традиционные измерители остаточного операционного дохода, такие как экономическая добавленная стоимость (EVA), являются конструктивно смещенными и поэтому могут приводить к ошибкам в анализе финансовой результативности. Величина ошибки измерения зависит главным образом от суммы реализованного процентного налогового щита и соотношения балансовой и рыночной стоимости активов. Также идентифицированы и другие потенциально значимые источники искажений, порождаемые конструкцией EVA. В качестве надежной альтернативы предлагается одновременная оценка операционной и общей результативности фирмы с помощью двух взаимосвязанных показателей: операционной EVA (OEVA) и полной EVA (TEVA). Реализация техники OEVA–TEVA проще, чем EVA, в части как аналитики, так и вычислений. Она также может предоставить дополнительную информацию для принятия управленческих решений. Состоятельность OEVA–TEVA подхода в целом подтверждается формально доказанной эквивалентностью корреспондирующей OEVA–TEVA модели оценки и основополагающей оценки методом дисконтирования денежных потоков.

Ключевые слова: финансовое измерение результативности, операционная EVA, полная EVA, добавленная экономическая стоимость, добавленная рыночная стоимость, оценка.

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