



Residual Income and Value-Creation: The Missing Link

JOHN O'HANLON* AND KEN PEASNELL
Management School, Lancaster University, Lancaster LA1 4YX, U.K.

J.O'hanlon@lancaster.ac.uk

Abstract. This paper extends the residual income literature to provide a framework for the use of residual income in performance measurement, applicable in value-based management. It shows that, under a simple initializing assumption, an accounting-free measure of 'excess value created' over a multi-period interval can be written entirely in terms of (i) within-interval realized residual incomes and (ii) end-of-interval expected future residual incomes, both appropriately adjusted for the time value of money. It also shows that, when the simple initializing assumption is relaxed, excess value created can be expressed in terms of 'excess residual incomes,' measured by comparison with expectations as at the beginning of the multiperiod interval.

Keywords: residual income, EVA, value-based management, performance measurement

JEL Classification: D8, G3, J33, M4

Residual income is a measure of accounting income in excess of a normal (required) return on capital employed. It has a long history as a performance measure, and was the object of extensive academic debate in the management accounting literature in the 1960s and 1970s.¹ It played no prominent role in financial accounting research until Ohlson's (1989, 1995) seminal work introduced to a new generation the old idea that the economic value of an entity equals its accounting book value plus the present value of all of its expected future residual incomes. This residual income-based valuation relationship (RIVR) has now become a familiar feature of recent research into the role of accounting numbers in business valuation.² RIVR is a forward-looking relationship that specifies how economic value, book value and expected future residual incomes articulate with one another. It does not encompass a backward-looking articulation between past accounting numbers and the value created during a multi-period interval, but there appears to be some demand for such an articulation. For example, the consulting firm Stern Stewart & Co. propose their economic value added (EVA™) version of residual income as a periodic performance measure, to be used in conjunction with another measure they call market value added (MVA), which is the excess of market value over the (adjusted) book value of capital employed. Stern Stewart cite RIVR in support of their advocacy of EVA and MVA as measures of management's success in value-creation (Stewart, 1991, pp. 153–154). However, the articulation given by RIVR provides no formal support for the use of residual income or MVA as measures of value-creation.

In this paper, we fill this gap by extending RIVR to provide an articulation between residual incomes and a measure of the excess return in dollar terms during a multi-period interval. We show that, if the initial accounting book value of shareholders' funds is equal

* Address correspondence to: Management School, Lancaster University, Lancaster LA1 4YX, U.K.

to the capital invested by shareholders at incorporation of the firm, then the excess return in dollar terms earned over a multi-period interval starting at incorporation is equal to the sum of (i) the end-of-interval terminal value of all residual incomes arising during that interval and (ii) the present value at the end of the interval of all residual incomes expected to arise subsequently. An augmentation extends the articulation to an interval that starts at a date subsequent to incorporation, when the book value and economic value of shareholders' funds might differ from each other. This augmented articulation is between excess dollar return and a measure we term excess residual income, and provides a rationale for procedures promoted in the value-based management literature.

The contribution of the analysis in this paper is threefold. First, it provides a broader basis for the study of links between accounting numbers and the economic value of firms than is provided by RIVR alone. Second, the analysis is of relevance to value-based management practitioners in that it establishes a formal role for the use of residual income in measuring managerial success at creating shareholder value, and provides a way of understanding the impact of accounting conservatism on the measurement of business performance. Finally, our analysis provides a rationale for supplementing the conventional presentation of the shareholders' funds section of the balance sheet by subdividing the shareholders' funds account into an 'invested capital' component and a 'cumulative residual income' component, in a manner similar to that advocated by Anthony (1983).

The remainder of the paper is organized as follows. Section 1 states a number of definitions and assumptions that underpin our analysis. Section 2 describes the articulation between a dollar measure of excess return, realized residual incomes and expected future residual incomes, where the initial book value of shareholders' funds is set equal to the initial capital invested by shareholders. Section 3 extends the articulation to allow the cumulation period to begin subsequent to incorporation, when the book value and economic value of shareholders' funds might differ from each other. Section 4 introduces the concept of excess residual income, and relates this to the use made by value-based management practitioners of residual income in the design of executive compensation schemes. Section 5 outlines the impact of accounting conservatism on the interpretation of realized residual incomes in the context of business performance measurement. Section 6 discusses the implications of our analysis for the reporting and analysis of the shareholders' funds account in financial statements. Section 7 concludes the paper.

1. Definitions and Assumptions

In this section we state a number of definitions and assumptions upon which our analysis relies. Throughout, the analysis is done from the shareholders' perspective,³ firm subscripts are suppressed, and cash flows are assumed to occur at discrete intervals at the end of each period.

1.1. Accounting Relationships

We assume that the 'clean surplus relation' (CSR) holds. According to CSR, all changes in book value during a period are reflected in that period's accounting income or in that

period's net distributions to shareholders:

$$A_t - A_{t-1} = P_t - C_t, \quad (\text{CSR})$$

where A_t is the accounting book value of shareholders' funds at time t , P_t is the accounting income attributable to shareholders for period t , and C_t is the net distribution by the firm to its shareholders (dividends less the proceeds of share issues) at time t . The definition of residual income is as follows:

$$X_t = P_t - kA_{t-1}, \quad (\text{RI})$$

where X_t denotes the residual income for period t , and k is the (assumed constant) cost of shareholders' funds.

1.2. Valuation Relationships

We assume that the economic value of the shareholders' funds at time t is equal to the present value at time t of the expected future net distributions to shareholders. This is termed the present value relationship (PVR):

$$V_t = \sum_{s=1}^{\infty} E_t[C_{t+s}](1+k)^{-s}. \quad (\text{PVR})$$

V_t denotes the economic value of the shareholders' funds at time t , and $E_t[.]$ is the expectations operator at time t . Provided that $E_t[A_{t+s}](1+k)^{-s} \rightarrow 0$ as $s \rightarrow \infty$,⁴ substitution of CSR and RI into PVR yields the residual income-based valuation relationship (RIVR):

$$V_t = A_t + \sum_{s=1}^{\infty} E_t[X_{t+s}](1+k)^{-s}. \quad (\text{RIVR})$$

According to RIVR, the economic value of shareholders' funds at time t equals the book value of shareholders' funds at time t plus the present value of all expected future residual incomes.

1.3. A Definition of Unrecovered Capital

We define unrecovered capital to be an accounting-free cumulation of the capital invested in the firm by its shareholders, net of distributions and inclusive of the opportunity cost of that capital, from incorporation at time 0 to the end of a cumulation interval at time t . Unrecovered capital at time t is denoted U_t^0 , where the superscript denotes the start of the cumulation interval (time 0) and the subscript denotes the end of the cumulation interval (time t), and is defined as follows:

$$U_t^0 = U_0^0(1+k)^t - \sum_{s=1}^t C_s(1+k)^{t-s},$$

where U_0^0 is the starting value of unrecovered capital at incorporation. The cost of capital, k , used in arriving at U_t^0 must be the same as that used to measure residual incomes up to time t .⁵

It is necessary to specify the initialization condition for this recursive relationship. An implication of CSR is that the book value of shareholders' funds at the time of incorporation (A_0) is equal to the initial infusion of shareholders' funds, $-C_0$, where C_0 can be thought of as a negative dividend. In addition, we assume that the starting value of unrecovered capital at incorporation (U_0^0) is set equal (but opposite in sign) to this initial negative dividend. With these initial conditions (IC),⁶

$$U_0^0 = -C_0 = A_0, \quad (\text{IC})$$

unrecovered capital can be defined as follows:

$$\begin{aligned} U_t^0 &= U_0^0(1+k)^t - \sum_{s=1}^t C_s(1+k)^{t-s} \\ &= -\sum_{s=0}^t C_s(1+k)^{t-s} \\ &= A_0(1+k)^t - \sum_{s=1}^t C_s(1+k)^{t-s}. \end{aligned} \quad (\text{UC})$$

1.4. A Dollar Measure of Excess Return: Excess Value Created

We define excess value created (EVC) to be the excess of the economic value of shareholders' funds at the end of a multi-period cumulation interval over unrecovered capital at the end of that interval. EVC over the interval from 0 to t is denoted EVC_t^0 , where the superscript denotes the start of the cumulation interval and the subscript denotes the end of the cumulation interval. EVC is defined as follows:

$$EVC_t^0 = V_t - U_t^0. \quad (\text{EVCR})$$

EVC_t^0 is a measure of the excess return on the funds retained within the firm over the interval from 0 to t , expressed in terms of money rather than as a rate.

A feature of EVC is that, if time t represents the point of liquidation of the firm, where $V_t = 0$, the aggregate EVC during the interval from 0 to t is given by $-U_t^0$. In other words, EVC at the liquidation date is the ex-post net terminal value of the firm. If the venture is successful, U_t^0 will be negative because the cumulative value of distributions to shareholders will exceed that of the cumulative value of the proceeds of share issues during the firm's life.

2. The Articulation between Excess Value Created and Lifetime Residual Incomes

In this section, we present two propositions. The first proposition gives the relationship between (i) unrecovered capital at the end of a multi-period interval commencing at

incorporation and (ii) book value at the end of that interval. The second proposition gives the relationship between (i) EVC over the multi-period interval, (ii) the residual incomes arising during that interval and (iii) the residual incomes expected to arise after the end of that interval.

Proposition 1 *The accounting book value of the firm at time t is equal to the sum of (i) the unrecovered capital cumulated over the multi-period interval from incorporation of the firm to time t , and (ii) the terminal value at time t of all residual incomes arising over the interval from incorporation to time t :*

$$A_t = U_t^0 + \sum_{s=1}^t X_s(1+k)^{t-s}, \quad (\text{RIBR})$$

where RIBR denotes 'residual income book value relationship.'

Proof: Using IC to set $A_0 = -C_0$, it follows from the CSR and RI definitions that the evolution of the book value of shareholders' funds in terms of residual incomes is as follows:

$$\begin{aligned} A_1 &= A_0(1+k) + X_1 - C_1 = -C_0(1+k) - C_1 + X_1 \\ A_2 &= A_1(1+k) + X_2 - C_2 = -C_0(1+k)^2 - C_1(1+k) - C_2 + X_1(1+k) + X_2 \\ &\dots \text{etc.} \end{aligned}$$

By induction, this residual income-based representation gives book value of shareholders' funds at time t as

$$A_t = -\sum_{s=0}^t C_s(1+k)^{t-s} + \sum_{s=1}^t X_s(1+k)^{t-s}. \quad (1)$$

Substitution of UC into (1) yields RIBR. ■

Under our previously stated assumptions, RIBR gives the relationship between the book value of shareholders' funds, the value of the resources previously committed to the business by its shareholders and *past* residual incomes. This relationship is a backward-looking counterpart of the now well-known relationship between economic value, book value and expected *future* residual incomes given by RIVR. In fact, the two relationships are complementary components of a more general relationship linking residual incomes and a dollar measure of excess return, in which RIBR provides a hitherto 'missing link.' This more general relationship is given by combining RIVR and RIBR in terms of EVC, which we now do in Proposition 2.

Proposition 2 *Excess value created (EVC) over the multi-period interval from incorporation to time t is equal to the sum of (i) the terminal value at time t of residual incomes that*

arose between incorporation and time t and (ii) the present value at time t of the residual incomes expected to arise after that date:

$$EVC_t^0 = \sum_{s=1}^t X_s(1+k)^{t-s} + \sum_{s=1}^{\infty} E_t[X_{t+s}](1+k)^{-s}. \quad (2)$$

Proof: Expand EVCR to give

$$EVC_t^0 = V_t - U_t^0 = (V_t - A_t) + (A_t - U_t^0).$$

Substitute RIVR into $(V_t - A_t)$ and RIBR into $(A_t - U_t^0)$ in the above expression, and (2) follows immediately. ■

Proposition 2 reveals that EVC comprises two components:

- *The terminal value at time t of residual incomes that arose between time 0 and time t .* This is equal to the excess at time t of the book value of shareholders' funds over the terminal value at that time of capital invested by shareholders, inclusive of the opportunity cost of those funds $(A_t - U_t^0)$. This excess can be characterized as the component of EVC represented by performance that has been recognized by the accounting system as having been delivered during the interval 0 to t .
- *The present value at time t of residual incomes expected to arise after that date.* This is the excess of the economic value of shareholders' funds over their book value at time t $(V_t - A_t)$. This amount could be characterized as the component of EVC represented by expected future performance as at time t , which the accounting system has yet to recognize at that time. This corresponds to what EVA practitioners have termed MVA.

The term $V_t - A_t$ can be thought of as 'promised goodwill,' being the discounted value at time t of expected future 'super profits' (Edey, 1962), and the term $A_t - U_t^0$ can be thought of as 'realized goodwill,' being the compounded value of 'super profits' recognized between time 0 and time t . The articulation between these two components and EVC, as stated in Proposition 2, will hold regardless of the book value of shareholders' funds at time t (A_t). A change of accounting measurement method or estimate that results in a different value for A_t will simply alter the balance between (i) the terminal value at time t of the residual incomes recognized during the interval 0 to t (realized goodwill) and (ii) the present value at time t of the expected future residual incomes (promised goodwill). Realized and promised goodwill will still sum to EVC which, if nothing else alters, will not change.

Proposition 2 is relevant to understanding the EVA system devised and promoted by Stern Stewart & Co. and used by a number of major companies. Stern Stewart recommend that value-based incentives to managers should be determined by reference to their trade-marked version of residual income, EVA.⁷ Their advocacy of EVA rests in considerable measure on the linkage that RIVR provides between EVA and MVA, MVA being the excess of market value over book value $(V_t - A_t)$. Stern Stewart attach great weight to MVA as a measure of the success of managers in creating value for shareholders, and have published

'league tables' in different countries ranking companies by MVA. However, Stern Stewart acknowledge that MVA does not provide a general basis for rewarding executives, because it can only be calculated at the firm level and only provides a snapshot at a given point in time (Ehrbar, 1998, Chapter 3). In addition, Stern Stewart argue that managerial incentive payments should not be made on the basis of single-period residual incomes, but on the basis of multi-period cumulations of past residual incomes, termed 'bonus banks.'⁸

Stern Stewart offer a number of arguments in support of the use of multi-period cumulations of past residual incomes as bases for incentive payments. They refer to the desirability of (i) discouraging a short-termist focus in managers, (ii) avoiding periodic incentive payments that are based on volatile single-period accounting measures of performance, and (iii) removing caps and floors on the range of periodic performance over which bonus awards might vary (Ehrbar, 1998, pp. 108–110). These arguments do not rest on any formally-stated theoretical link between EVA and value-creation (other than RIVR). Proposition 2 makes good the deficiency: if the initial book value of shareholders' funds equals the initial amount of capital invested by shareholders, EVC during a performance measurement interval is simply the sum of (i) an MVA-type measure of expected future EVAs and (ii) a bonus bank-type measure of past EVAs. This linkage is crucially dependent on EVC, a concept that is broader than MVA.

One EVA manual does recognize that MVA is conceptually unsatisfactory as a measure of invested capital and suggests, as a theoretical ideal, a multi-period excess return measure that is mathematically equivalent to what we have called EVC (Young and O'Byrne, 2001, pp. 31–34).⁹ While Young and O'Byrne acknowledge that EVC is a more satisfactory measure of performance than MVA, they do not provide a general linkage between EVC and EVAs.¹⁰ Proposition 2 provides the 'missing link.'

3. The Articulation Where Initialization Occurs after Incorporation

Suppose the measurement process is initialized at some beginning date, b , after incorporation but before time t . In this case, the initial endowment by the shareholders to the firm needs to be represented by a measure of the economic value of shareholders' funds at time b , V_b , rather than by a time b negative dividend. A natural measure of V_b is the market value of the firm's stock at b , but the analysis that follows can be applied more generally. For example, in the case where the firm is an unlisted division of a larger enterprise, V_b could be the replacement cost of the firm's net assets, or some other estimate of the firm's endowment of resources at that date. However V_b is determined, it could differ from the time b book value of shareholders' funds, A_b .

We handle this initialization problem in the following manner. First, we now define unrecovered capital to be initialized at V_b , and denote this V_b -initialized measure as $U(V)_t^b$:

$$U(V)_t^b = V_b(1+k)^{t-b} - \sum_{s=1}^{t-b} C_{b+s}(1+k)^{t-(b+s)}, \quad (3)$$

where $U(V)_b^b = V_b$. Second, we adapt the expression for the book value of shareholders'

funds given by (1) such that the initializing value is the book value at time b (A_b):

$$A_t = A_b(1+k)^{t-b} - \sum_{s=1}^{t-b} C_{b+s}(1+k)^{t-(b+s)} + \sum_{s=1}^{t-b} X_{b+s}(1+k)^{t-(b+s)}. \quad (4)$$

Third, we define a measure, denoted $U(A)_t^b$, that differs from the unrecovered capital measure given by (3) only in that it is initialized by reference to book value rather than economic value at time b :

$$\begin{aligned} U(A)_t^b &= A_b(1+k)^{t-b} - \sum_{s=1}^{t-b} C_{b+s}(1+k)^{t-(b+s)} \\ &= A_t - \sum_{s=1}^{t-b} X_{b+s}(1+k)^{t-(b+s)}, \end{aligned} \quad (5)$$

where $U(A)_b^b = A_b$. These definitions are sufficient to yield the following result.

Proposition 3 *Excess value created (EVC) over the multi-period interval from time b to time t ($0 < b < t$) is equal to*

- the sum of (i) the terminal value at time t of residual incomes that arose between time b and time t and (ii) the present value at time t of the residual incomes expected to arise after that date, minus
- the terminal value at time t of the time b difference between the economic value and the book value of shareholders' funds:

$$\begin{aligned} EVC_t^b &= V_t - U(V)_t^b \\ &= \sum_{s=1}^{t-b} X_{b+s}(1+k)^{t-(b+s)} + \sum_{s=1}^{\infty} E_t[X_{t+s}](1+k)^{-s} - (V_b - A_b)(1+k)^{t-b}. \end{aligned} \quad (6)$$

Proof: We can express EVC over the interval from b to t as

$$\begin{aligned} EVC_t^b &= V_t - U(V)_t^b \\ &= (V_t - A_t) + (A_t - U(A)_t^b) + (U(A)_t^b - U(V)_t^b). \end{aligned} \quad (7)$$

Substitute the following into (7): RIVR for $V_t - A_t$, (3) for $U(V)_t^b$, (4) for A_t and (5) for $U(A)_t^b$. Proposition 3 follows immediately. ■

According to Proposition 3, where there is an initial difference between the economic and book values, the terminal value of this difference must be subtracted from the aggregate of the past and future residual incomes in order to obtain EVC. This subtracted term $(V_b - A_b)(1+k)^{t-b}$ is a 'backward-looking' counterpart of the $E_t[V_{t+T} - A_{t+T}](1+k)^{-T}$ term that appears in a finite-horizon version of RIVR where forecasts of residual income are made only up to time $t + T$. This correction subtracts the additional residual income

engendered by the ‘conservatism’ of the accounting that omitted $V_b - A_b$ from the date b balance sheet.

The analysis in this section deals with the situation where performance is being measured over a period that begins at some date b after the commencement of the life of the enterprise. However, it must not be forgotten that it is possible for an initial difference to be present even at the date of incorporation. For example, an entrepreneur might have a valuable business proposition such that the firm has positive value before it receives any funds. The funds received from outside investors could be invested in tangible assets, with the founder being allocated shares in return for providing the firm with the business idea. If this intangible asset is not recorded in the firm’s books, a difference will immediately emerge, such that $V_0 > -C_0 = A_0$, even though the stock has been fairly priced. Under-pricing an initial public offering will also give rise to an unrecorded intangible asset. Conversely, the ‘winner’s curse’ that arises when an IPO is overpriced might result in $V_0 < -C_0 = A_0$, i.e., the starting difference ($V_0 - A_0$) will have a negative sign, indicating its status as an off-balance sheet liability (or loss provision). With the modification that the initialization date is set at the time of incorporation ($b = 0$), Proposition 3 provides an appropriate characterisation of EVC in these cases where a difference might arise at the beginning of the enterprise’s life.

We conclude this section by observing that the existence of an initial difference ($V_b - A_b$) does not *necessarily* imply that, for the purpose of measuring performance, residual income should be adjusted to reflect the expectations implied by the initial difference. The question of whether to measure performance purely by reference to the realized residual incomes, or to modify these to reflect the initial difference, is for the user to decide. We refer in the next section to a situation where practitioners behave in a manner that implies that the initial difference should be taken into account when using residual income numbers to measure performance.

4. The Concept of Excess Residual Income

Our analysis can throw light on ideas advanced in the value-based management literature for setting multi-period residual income targets in executive compensation schemes. Recall that, if V_b is the market value, RIVR implies that where $V_b - A_b > 0$ the market believes that the present value of future residual incomes (taken together) is positive; in other words, it expects future residual income to be positive on average. In that case, the existence of positive residual incomes may not of itself be sufficient to maintain shareholder value or, more precisely, it could result in negative EVC. Designers of residual income-based executive compensation schemes have therefore devised procedures under which residual income must exceed a target implied by $V_b - A_b$ in order for a residual income-based bonus to accrue.¹¹

We denote the compensation scheme designer’s characterisation of the residual income anticipated by the market in period $b + s$ ($s = 1, 2, \dots$) as $E_b[X_{b+s}]$. Bonuses will be based on any excess of actual time $b + s$ residual income over the amount anticipated at time b . We call this difference ‘excess residual income’ and denote it as X_{b+s}^b :

$$X_{b+s}^b = X_{b+s} - E_b[X_{b+s}], \quad s = 1, 2, \dots, (t - b). \quad (8)$$

For periods subsequent to the measurement interval b to t , X_{b+s}^b needs to be replaced by the difference between the expectation at time t of the residual income at time $t + s$ and the expectation at time b of the same, to give the time t expected excess residual income. We denote this as $E_t[X_{t+s}^b]$

$$E_t[X_{t+s}^b] = E_t[X_{t+s}] - E_b[X_{t+s}], \quad s = 1, 2, \dots, \quad (9)$$

The expectations at time b in (8) and (9), taken together, must satisfy the following rationality constraint implied by RIVR:

$$V_b - A_b = \sum_{s=1}^{\infty} E_b[X_{b+s}](1+k)^{-s}. \quad (10)$$

These definitions lead to Proposition 4.

Proposition 4 *Excess value created (EVC) over the multi-period interval from time b to time t ($0 < b < t$) is equal to the sum of*

- (i) *the terminal value at time t of excess residual incomes that arose between b and t , and*
- (ii) *the present value at time t of the excess residual incomes expected to arise after that date:*

$$\begin{aligned} EVC_t^b &= V_t - U(V)_t^b \\ &= \sum_{s=1}^{t-b} X_{b+s}^b(1+k)^{t-(b+s)} + \sum_{s=1}^{\infty} E_t[X_{t+s}^b](1+k)^{-s}. \end{aligned} \quad (11)$$

Proof: Multiply both sides of (10) by $(1+k)^{t-b}$ to give

$$(V_b - A_b)(1+k)^{t-b} = \sum_{s=1}^{t-b} E_b[X_{b+s}](1+k)^{t-(b+s)} + \sum_{s=1}^{\infty} E_b[X_{t+s}](1+k)^{-s}. \quad (12)$$

Substitute (12) for $(V_b - A_b)(1+k)^{t-b}$ in (6). Then, by substitution of (8) and (9), (11) follows immediately. ■

Proposition 4 decomposes the initial difference into a stream of periodic 'charges' that are matched against residual incomes in (8) and (9) to arrive at a stream of what we have termed excess residual incomes. The 'plug' in Proposition 3, $(V_b - A_b)(1+k)^{t-b}$, disappears. Proposition 4 transforms Proposition 3 into a format structurally identical to that of Proposition 2, where both terms on the right-hand side are written in terms of residual incomes. The dollar measure of excess return given by EVC can now be written wholly in terms of residual incomes (expected and realized), regardless of accounting conservatism. If a manager succeeds in generating a stream of positive excess residual incomes, market expectations will have been exceeded and therefore EVC will be positive.

The key problem facing the scheme designer is in estimating each $E_b[X_{b+s}]$. An approach described in a prominent EVA manual (Young and O'Byrne, 2001, p. 311) assumes that the market expects first differences in residual incomes to grow exponentially at a constant rate. This assumption produces a very similar pattern of future residual incomes to the simpler assumption that future *levels* of residual income grow exponentially at that constant rate.¹² In the following illustration, we employ this simpler assumption that the market expects the future levels of residual income to grow at a rate g , where g is less than k :

$$E_b[X_{b+s}] = (1 + g)^{s-1} E_b[X_{b+1}]. \quad (13)$$

Given (13) and (10), the initial difference can therefore be expressed as

$$V_b - A_b = \frac{E_b[X_{b+1}]}{k - g} \quad (14)$$

and the expected future residual income series can be initialized by setting

$$E_b[X_{b+1}] = (k - g)(V_b - A_b). \quad (15)$$

Substitution of (15) into (13) gives an expression for expected time $b + s$ residual income, as expected at time b , defined in terms of the opening difference and its expected growth:

$$E_b[X_{b+s}] = (k - g)[(V_b - A_b)(1 + g)^{s-1}]. \quad (16)$$

Substituting (16) into (8) gives the time $b + s$ ($b + s \leq t$) realized excess residual income, measured by reference to time b expected residual income:

$$\begin{aligned} X_{b+s}^b &= X_{b+s} - E_b[X_{b+s}] \\ &= X_{b+s} - (k - g)[(V_b - A_b)(1 + g)^{s-1}]. \end{aligned} \quad (17)$$

Likewise, substituting (16) into (9) gives the expected excess residual income after time t :

$$\begin{aligned} E_t[X_{t+s}^b] &= E_t[X_{t+s}] - E_b[X_{t+s}] \\ &= E_t[X_{t+s}] - (k - g)[(V_b - A_b)(1 + g)^{(t-b+s)-1}]. \end{aligned} \quad (18)$$

Inserting (17) and (18) into (11) provides an application of Proposition 4 under the assumption that residual income is expected at time b to grow at a constant rate g :

$$\begin{aligned} EVC_t^b &= \sum_{s=1}^{t-b} [X_{b+s} - (k - g)(V_b - A_b)(1 + g)^{s-1}](1 + k)^{t-(b+s)} \\ &\quad + \sum_{s=1}^{\infty} [E_t[X_{t+s}] - (k - g)(V_b - A_b)(1 + g)^{(t-b+s)-1}](1 + k)^{-s}. \end{aligned} \quad (19)$$

The required residual incomes given by (17) and (18), embedded in the excess residual incomes in (19), can be viewed from a conventional accounting perspective. They bear a structural similarity to the schedule of depreciation and associated capital charges that would arise from applying a reducing balance method to depreciate the initial difference $(V_b - A_b)$, had it appeared as an asset on the initial balance sheet. In this case, $(V_b - A_b)(1 + g)^{s-1}$

would be the book value of the 'asset'¹³ at the beginning of period $b + s$ ($s \leq t - b$), and $(V_b - A_b)(1 + g)^{(t-b+s)-1}$ would be the book value of the 'asset' at the beginning of period $t + s$. The reducing balance depreciation rate would be g , which would be a negative number between zero and minus one. It is interesting to contrast this perspective with that of Young and O'Byrne (2001, Chapter 8), in which residual incomes are expected to grow and, hence, g should be positive. From an accounting perspective, positive g corresponds to the use of an 'increasing balance appreciation' method. This treatment of the off-balance sheet asset contrasts with that normally applied by EVA practitioners to assets that are recognized on the balance sheet (i.e., included in A_b). Further treatment of this issue would require modelling of specific principal-agent settings of the kind provided by Rogerson (1997), Reichelstein (2000) and Dutta and Reichelstein (2002), and is beyond the scope of this paper.

In this section, we have developed a concept of excess residual income, where the excess is measured by reference to expectations impounded in the market price at time b . We conclude our discussion of Proposition 4 by noting that it could be applied more generally, to cover situations where V_b is defined to be some economic measure or attribute other than market price. For example, this could be appropriate when designing an executive compensation system at a time when the board of directors believes that the firm is wrongly valued by the market, or because market price impounds gains expected to arise as a consequence of the implementation of the incentive contract. The rationality constraint (10) must still be met; however, the stream of $E_b[X_{t+s}^b]$ terms might be thought of as accounting allocations rather than as market expectations.

5. The Effect of Accounting Conservatism on Realized Goodwill

The previous sections have shown how the residual income-based valuation framework can be extended by adding a new backward-looking RIBR measure to the well known forward-looking RIVR measure, in a way that yields a dollar measure of excess return capable of a clear economic interpretation. Further, we have shown the role of the market-book premium at the initialization date b and the market-book premium at the cumulation date t in linking EVC with realized residual incomes. It is now well understood in the literature (Feltham and Ohlson, 1995, 1996) that market-book premia are a consequence of accounting conservatism. Our analysis enables us to see how such conservatism impacts on the measurement of multi-period performance.

One way of characterizing accounting conservatism in the multi-period setting considered in this paper is to consider the circumstances under which 'realized goodwill' is a sufficient statistic for EVC. From Proposition 3 and RIVR, the difference between realized goodwill and EVC can be written in terms of the change in conservatism over the interval b to t :

$$\sum_{s=1}^{t-b} X_{b+s}(1+k)^{t-(b+s)} - EVC_t^b = (V_b - A_b)(1+k)^{(t-b)} - (V_t - A_t). \quad (20)$$

Figure 1 summarizes the circumstances where combinations of initial (time b) and closing (time t) conservatism result in realized goodwill being an unbiased (denoted 0), upward-biased (denoted +) or downward-biased (denoted -) measure of EVC, and where the direction of the bias is indeterminate (denoted ?).

	$V_t = A_t$	$V_t > A_t$	$V_t < A_t$
$V_b = A_b$	0	-	+
$V_b > A_b$	+	?	+
$V_b < A_b$	-	-	?

Figure 1. Direction of bias in realized goodwill as a measure of EVC.

Where there is no initial or closing valuation difference, then realized goodwill is an unbiased measure of EVC. If the initial (closing) difference is zero, then the sign of the bias is opposite to (the same as) the sign of the closing (opening) difference. If the initial and closing differences are of opposite sign, then the bias is of the same sign as the opening difference. If the initial and closing differences are of the same sign, then the sign of the bias depends upon the precise magnitudes involved.

Expression (20) and Figure 1 suggest that both the initial and the closing accounting biases may contribute to making a series of realized residual incomes unreliable as a proxy for ex-post EVC. However, from the perspective of a compensation system designer aiming to set ex-ante targets applicable over an indefinite multi-period interval, as adopted by Young and O'Byrne (2001, p. 311), it is unlikely to be practicable or necessary to deal with the closing accounting bias. Indeed, in the limiting case in which the interval stretches to the date of liquidation, when the bias must be zero, the difference between realized goodwill and EVC must be entirely captured by the reversal of the initial bias ($V_b - A_b$).

6. Analysing the Shareholders' Funds Account

Our Proposition 1 decomposes the balance sheet value of shareholders' funds into (i) a cumulation of capital invested by shareholders, net of distributions and inclusive of the opportunity cost of funds, and (ii) a multi-period cumulation of a performance measure. This contrasts with the conventional accounting for shareholders' funds, in which no clear distinction is drawn between the capital invested by shareholders and the firm's cumulative performance in managing the shareholders' capital. The failure of conventional accounting to distinguish between capital invested by shareholders in the firm and the firm's performance in managing that capital was highlighted by Anthony (1983). Anthony highlighted two features of conventional accounting which were responsible for this failure. First, the conventional shareholders' funds account and the conventional accounting income statement do not recognize the opportunity cost of the shareholders' funds. Second, cumulative returns *of* capital (dividends) are netted off against cumulative returns *on* capital (incomes) within the retained earnings component of the shareholders' funds account, a practice that partly reflects legal requirements regarding the relationship between dividends and distributable profits.

In order to deal with these perceived shortcomings in the measurement and presentation of the shareholders' investment within financial statements, Anthony (1983) advocated that the shareholders' funds in the balance sheet should be divided into two accounts, along very similar lines to our RIBR. He termed these two accounts 'shareholder equity' and

'entity equity,' respectively. The former of these accounts would contain the cumulative amount of capital received from shareholders, net of dividends, and each period it would be credited with an amount representing the periodic opportunity cost of the balance on this 'shareholder equity' account. This account would not include any gains or losses arising from the firm's activities. The second of the accounts, 'entity equity,' would comprise cumulative accounting incomes, net of any part of the opportunity cost of 'shareholder equity' that had been expensed, and would be similar to an aggregation of residual incomes as viewed from the shareholders' perspective.¹⁴

Anthony's proposed decomposition of the shareholders' funds account, although very similar to that contained in Proposition 1, differs from it in one important respect. The opportunity cost of shareholders' funds would be based on the balance of the 'shareholder equity' account rather than on the total balance of shareholders' funds, and thus Anthony's periodic income measures are not residual incomes as conventionally defined. Nevertheless, the cumulative balances on Anthony's 'shareholder equity' and 'entity equity' accounts would correspond exactly to those on the U_t^0 component and the $\sum_{s=1}^t X_s(1+k)^{t-s}$ component, respectively, of Proposition 1. This is so because Anthony's omission to credit the opportunity cost of funds to the latter item and the corresponding omission to debit that part of the opportunity cost of funds to the periodic income measure would exactly offset each other within our $\sum_{s=1}^t X_s(1+k)^{t-s}$ component.

Anthony's proposal that the shareholders' funds in the balance sheet should be decomposed into an invested capital component and a cumulative performance component appears to have had little impact on the practice of financial statement analysis or on the structure of published financial statements. Our analysis complements Anthony's by showing in Proposition 2 how a cumulation of residual incomes, which corresponds to his 'entity equity,' together with 'promised goodwill' articulates with a measure of excess return. The revelation of this intuitively appealing articulation provides added support for a decomposition of the shareholders' funds account along the lines proposed by Anthony.

Multi-period cumulations of accounting performance measures, such as that in Proposition 1, can be valuable objects of analysis because they cause periodic errors to cancel out and because they smooth the effect of periodic extremes. These attractive properties of such multi-period cumulations lie at the heart of the bonus bank system recommended by Stern Stewart & Co., in which periodic managerial bonuses are partly determined by reference to multi-period cumulations of residual incomes (Ehrbar, 1998, pp. 108–110). This process of aggregating residual incomes might be useful in other settings. For example, a financial analyst could conduct an analysis of multi-period accounting performance on the basis of a rearrangement of the cumulative balance on the shareholders' funds account, as in Proposition 1. However, it would normally be more meaningful to carry out such analysis on the basis of the augmentation of RIBR that deals with a segment of the firm's life, as suggested by our expression (5), rearranged into 'shareholder equity' and 'entity equity' components:

$$A_t = U(A)_t^b + \sum_{s=1}^{t-b} X_{b+s}(1+k)^{t-(b+s)}.$$

The cumulative balance of residual incomes during a multi-period interval will be partly determined by the initial book value of shareholders' funds (A_b), as well as by their

book value at the end of the interval (A_t). So the book value of the shareholders' funds at the start of the interval would need to figure in such a multi-period residual income analysis.

The introduction within published financial statements of a supplementary decomposition of the shareholders' funds account along the lines of Proposition 1 would require the recognition of the opportunity cost of shareholders' funds. As Anthony (1983) acknowledged, this would be a radical departure from existing practice. Nevertheless, such a decomposition would merely be an alternative way of presenting the total amount of the shareholders' funds account, and would not of itself require any change to existing practice regarding the recognition and measurement of assets and liabilities.

For the financial statement analyst, our articulation between EVC and residual income links a measure of excess return with multi-period cumulations of income measures that could be constructed from published financial statements. A rare appreciation of the confusion caused by the lack of a clear separation between shareholder transactions and incomes can be found in Penman (2001, pp. 232–236). Penman advocates that analysts reformulate the statement of periodic movements in shareholders' equity such as to separate clearly the periodic transactions with shareholders and the periodic comprehensive income, but does not go so far as to suggest that the cumulative balance on the shareholders' equity account be decomposed to isolate the cumulative amount of shareholder transactions and the cumulative incomes.

7. Conclusion

This paper extends the residual income-based valuation framework to encompass an articulation between residual incomes and a dollar measure of excess return earned over a multi-period interval. It shows that, if the initial accounting book value of shareholders' funds is equal to the capital invested by shareholders at incorporation of the firm, the dollar excess return since incorporation can be decomposed into two residual income terms. These are (i) the terminal value at the end of the interval of the cumulative residual incomes accruing during the multi-period interval (realized goodwill), and (ii) the present value at the end of the interval of the residual incomes expected to accrue after the end of the interval (promised goodwill). A simple augmentation extends the articulation to allow the multi-period interval to commence at a date subsequent to incorporation, when the accounting book value of shareholders' funds could differ from the economic value of shareholders' funds. This augmentation allows excess return to be written entirely in terms of excess residual incomes.

Our amplification of the residual income-based valuation framework to encompass an articulation between excess value created and residual incomes relies upon a newly included link between book value, unrecovered capital and realized residual incomes. The articulation adds to the 'toolbox' of those researching into the links between accounting numbers and share prices/returns. It is relevant to value-based management practitioners who use residual income-type metrics as measures of the excess value created by firms and managers. It suggests developments in the practice of financial statement analysis. Also, it strengthens the case for supplementing the conventional presentation of the shareholders' funds in financial

statements such as to draw a clear distinction between the cumulative net investment by shareholders and a cumulative measure of the firm's performance.

Acknowledgments

The authors thank Mary Barth, Richard Brief, Michael Bromwich, Colin Clubb, James Ohlson, Dennis Oswald, Peter Pope, the anonymous reviewer, and participants at the September 2001 *Review of Accounting Studies* conference for their comments on earlier versions of this paper. They also acknowledge financial assistance from the Economic and Social Research Council (grant R000237663).

Notes

1. See, for example, Amey (1969), Bromwich (1973), Flower (1971) and Solomons (1965).
2. See, for example, Dechow, Hutton and Sloan (1999), Francis, Olsson and Oswald (2000), Myers (1999) and Penman and Sougiannis (1997).
3. For ease of exposition, capital structure issues are ignored. All the results reported in the paper extend naturally to a setting in which the focus is on the total cash to and from all providers of capital, including bondholders.
4. This condition is exactly met if the firm is expected to be wound up at some finite date in the future, since after that date book value is zero.
5. From a valuation perspective, Feltham and Ohlson (1999) demonstrate that it is conceptually appealing to represent value and residual income by reference to the risk-free rate(s). In a performance measurement setting, it is probably more natural (or at least more in keeping with the relevant literature) to view k as a risk-adjusted rate. However, issues related to the choice of an appropriate cost of capital are outside the scope of the present paper.
6. In Section 3 we consider the situation where initialization occurs at some date after incorporation of the business. The assumptions embedded in IC are amended accordingly.
7. EVA is calculated from income and balance sheet numbers that are adjusted to eliminate features of standard accounting practice that are claimed to induce short-termism and gaming behavior on the part of corporate managers. 'Undesirable' features of standard accounting practice that give rise to EVA adjustments include the immediate expensing of research & development expenditure and of restructuring costs, and the use of discretionary provisions (Stewart, 1991; O'Hanlon and Peasnell, 1998). The adjustments made in arriving at EVA give rise to CSR-preserving adjustments to the book value used to compute EVA and MVA.
8. Stern Stewart advocate that the periodic residual income-based bonuses awarded to a manager should be accumulated in a bonus bank, rather than being paid to the manager in the period in which they are awarded. In each period, a proportion of any positive balance on this multi-period accumulation of residual income-based bonuses is then paid out to the manager (Ehrbar, 1998).
9. Young and O'Byrne's (2001) excess return measure is equal to the excess of (i) a cum-div market value at time t over (ii) the initial investment cumulated to time t at the required rate of return. Although this metric attributes within-interval dividends to different parts of the right-hand side of EVC, the net result is the same as our measure.
10. Young and O'Byrne (2001) do show that, if dividend is set equal to accounting income in all periods, then the subtraction of residual incomes in arriving at an adjusted measure of invested capital causes multi-period excess return to be equal to the excess of market value over this adjusted measure of invested capital. There is no obvious rationale for subtracting residual incomes in arriving at a measure of invested capital. Indeed, the equality that Young and O'Byrne (2001, p. 33) find between excess return and the excess of market value over their adjusted invested capital only holds because their restrictive assumption in setting dividend equal to income, together with their subtraction of residual income in measuring adjusted invested capital, produces a measure that is equal to our unrecovered capital measure. Setting dividends equal to incomes and subtracting residual incomes in arriving at invested capital, is equivalent to subtracting dividends and adding a capital charge.
11. A comprehensive description of such a procedure can be found in Young and O'Byrne (2001, Chapter 8).

12. A given constant rate of growth in the levels of a series will always yield the same constant rate of growth in the first differences of that series. However, a necessary condition for a given constant rate of growth in first differences to yield the same constant rate of growth in levels is that the initial first difference gives an initial rate of growth in levels equal to that rate. If this condition is not met, the equality between the two rates of growth will only hold asymptotically.
13. If the initial difference were negative, it would correspond to a liability and its recognition would reduce shareholders' funds. Hence a 'capital charge' at the rate of k on this difference would increase residual income. g will be positive or negative depending upon whether the 'liability' is expected to grow or decline though time.
14. Anthony also recommends that the opportunity cost of shareholders' funds routinely be capitalised within the cost of operating assets prior to being expensed. The capitalisation of interest is an accounting issue affecting the measurement of profit and net assets in a manner consistent with the CSR principle. Consideration of such measurement issues falls outside the scope of our analysis.

References

- Amey, L. (1969). *The Efficiency of Business Enterprises*. George Allen and Unwin.
- Anthony, R. (1983). *Tell It Like It Was*. Irwin.
- Bromwich, M. (1973). "Measurement of Divisional Performance: A Comment and Extension." *Accounting and Business Research* 3, 123–132.
- Dechow, P., A. Hutton and R. Sloan. (1999). "An Empirical Assessment of the Residual Income Valuation Model." *Journal of Accounting and Economics* 26, 1–34.
- Dutta, S. and S. Reichelstein. (2001). "Controlling Investment Decisions: Depreciation and Capital Charges." *Review of Accounting Studies* 7, 253–281.
- Edey, H. (1962). "Business Valuation, Goodwill and the Super-Profit Method." In W. Baxter and S. Davidson (eds.), *Studies in Accounting Theory*. Sweet and Maxwell.
- Ehrbar, A. (1998). *EVA: The Real Key to Creating Wealth*. Wiley.
- Feltham, G. and J. Ohlson. (1995). "Valuation and Clean Surplus Accounting for Operating and Financial Activities." *Contemporary Accounting Research* 11, 689–731.
- Feltham, G. and J. Ohlson. (1996). "Uncertainty Resolution and the Theory of Depreciation Measurement." *Journal of Accounting Research* 34, 209–234.
- Feltham, G. and J. Ohlson. (1999). "Residual Earnings Valuation with Risk and Stochastic Interest Rates." *The Accounting Review* 74, 165–183.
- Flower, J. (1971). "Measurement of Divisional Performance." *Accounting and Business Research* 1, 205–214.
- Francis, J., P. Olsson and D. Oswald. (2000). "Comparing the Accuracy and Explainability of Dividend, Free Cash Flow and Abnormal Earnings Equity Value Estimates." *Journal of Accounting Research* 38, 71–102.
- Myers, J. (1999). "Implementing Residual Income Valuation with Linear Information Dynamics." *The Accounting Review* 74, 1–28.
- O'Hanlon, J. and K. Peasnell. (1998). "Wall Street's Contribution to Management Accounting: The Stern Stewart EVA Financial Management System." *Management Accounting Research* 9, 421–444.
- Ohlson, J. (1989). "Accounting Earnings, Book Value and Dividends: The Theory of the Clean Surplus Equation (Part I)." In R. Brief and K. Peasnell (eds.), *Clean Surplus: A Link Between Accounting and Finance*. Garland, 1996, 167–227.
- Ohlson, J. (1995). "Earnings, Book Values, and Dividends in Equity Valuation." *Contemporary Accounting Research* 11, 661–687.
- Penman, S. (2001). *Financial Statement Analysis and Security Valuation*. McGraw-Hill.
- Penman, S. and T. Sougiannis. (1997). "The Dividend Displacement Property and the Substitution of Anticipated Earnings for Dividends in Equity Valuation." *The Accounting Review* 72, 1–21.
- Reichelstein, S. (2000). "Providing Managerial Incentives: Cash Flows versus Accrual Accounting." *Journal of Accounting Research* 38, 243–269.
- Rogerson, W. (1997). "Intertemporal Cost Allocation and Managerial Investment Incentives: A Theory Explaining the Use of Economic Value Added as a Performance Measure." *Journal of Political Economy* 105, 770–795.
- Solomons, D. (1965). *Divisional Performance: Measurement and Control*. Irwin.
- Stewart, G. (1991). *The Quest for Value*. Harper Business.
- Young, S. and S. O'Byrne. (2001). *EVA® and Value-Based Management: A Practical Guide to Implementation*. McGraw-Hill.