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The Usefulness of Economic Value-Added (EVA®) and its Components in the Australian Context

by

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Abstract:

In this study, pooled time-series, cross-sectional data on 110 Australian companies over the period 1992-1998 is employed to examine whether EVA® is more highly associated with stock returns than conventional accounting-based measures: namely, earnings before extraordinary items, net cash flow from operations and residual income. A related empirical question concerns those components unique to EVA® that help explain these stock returns beyond that explained by other accounting-based measures. The five components of EVA® examined are net cash flows, operating accruals, after-tax interest, and cost of capital and accounting adjustments. Relative information content tests reveal returns to be more closely associated with earnings than residual income, net cash flow and EVA® respectively However, consistent with

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the construction of EVA®, incremental information content tests suggest that EVA® adds more explanatory power to earnings than either net cash flow or residual income. An analysis of the components of EVA® confirms that the capital charges and GAAP-related accounting adjustments most closely associated with EVA® add more explanatory power to net cash flow than accruals or after-tax interest, though these measures are relatively more significant alone in explaining market returns.

1. Introduction

One professedly recent innovation in the field of internal and external performance measurement is a trademarked variant of residual income (net operating profits less a charge for the opportunity cost of invested capital) known as economic value-added (EVA®). In response to claims that EVA® is a superior financial performance measure, an emerging empirical literature has addressed the issue as to whether EVA® is more highly associated with stock returns and firm values than other accounting-based figures. Most notably, Biddle *et al.* (1997) used relative and incremental information tests to examine whether stock returns were more highly associated with EVA®, residual income or cash flow from operations. Biddle *et al*. (1997, p. 333) concluded that while "for some firms EVA may be an effective tool for internal decision making, performance measurement, and incentive compensation, it does not dominate earnings in its association with stock market returns".

Chen and Dodd (1997) likewise examined different dimensions of the EVA® system and concluded: "… not a single EVA measure [annualised EVA return, average EVA per share, change in standardised EVA and average return on capital] was able to account for more than 26 percent of the variation in stock return". Lehn and Makhija (1997) and Rogerson (1997) reached similar conclusions. More recently, Clinton and Chen (1998) compared share prices and returns to residual cash flow, economic value-added and other traditional measures, and recommended that companies using EVA consider residual cash flow as an alternative.

Nevertheless, Bao and Bao (1998, p. 262) in an analysis of price levels and firm valuations concluded that the "results are not consistent for earnings and abnormal economic earnings, but are consistent for value added, i.e., value added is significant in both levels and changes deflated by price analyses". Similarly, Uyemura *et al*. (1996) demonstrated that EVA® has a high correlation with market value added (the difference between the firm's value and cumulative investor capital) and thereby stock price, while O'Byrne (1996) estimated that changes in EVA® explain more variation in long-term stock returns than changes in earnings. Finally, and from a stock selection perspective, Herzberg (1998, p. 52) concluded that the residual income valuation model (including EVA) "appears to have been very effective in uncovering firms whose stock is underpriced when considered in conjunction with expectations for strong earnings and growth".

At least five dominant themes may be identified in the literature. First, despite an increasing amount of research effort in this area, the evidence concerning the superiority of EVA® vis-à-vis earnings (as variously defined) has been mixed. This is in part attributable to the diversity of samples and methods employed. Second, notwithstanding that EVA® figures are readily available and promoted in the UK, Australia, Canada, Brazil, Germany, Mexico, Turkey and France, amongst others [see Stern Stewart (1999)], no empirical studies of this type (as far as the authors are aware) have been conducted outside the United States. This is despite several international companies adopting EVA® for performance measurement and/or incentive compensation packages. Examples in Australia include the ANZ Banking Group, Fletcher Challenge Limited, James Hardie Industries and the Wrightson Group (Rennie, 1997). There is an obvious requirement to examine the usefulness of EVA® versus traditional financial statement measures in an alternative market and regulatory milieu.

Third, Biddle *et al*. (1997, p. 303) posit that "data on the information content of EVA [and other measures of performance] provide potentially useful input to the normative policy debate on what performance measure(s) should be reported in financial statements". In Australia, as elsewhere, there is renewed interest in the types of information provided by investment analysts, with EVA studies now appearing in stockbroking reports (Wood, 1996). Both developments are equally deserving of empirical attention. Fourth, Biddle *et al*. (1997, p. 333) suggest that "an avenue for future research suggested by the findings of this study is to examine more closely which components of EVA and earnings contribute to, or subtract from, information content". Put differently, given that EVA® consists of nearly 150 potential changes to accounting figures grouped across adjustments to accounting measures of operating profits and capital, there is the requirement to quantify the contribution of these sub-components to overall firm performance.

Finally, there has been an emphasis in previous empirical work in this area on either single cross-sections of listed companies or limited pooled time-series, cross-sectional data. For example, Bao and Bao (1998) employ a cross-section of 166 firms over the period 1992/93. Contrary to the oft-maintained hypothesis of semi-strong form market efficiency, it may be the case that market participants only recognise the reporting benefits of EVA® over an extended time period. This would suggest that valid examination of EVA® should incorporate extensive time-series data with some allowance for these behavioural modifications. It is with these considerations in mind that the present study is undertaken.

The paper itself is divided into four main areas. Section 2 deals with the empirical methodology used in the paper, and the requisite data is presented in Section 3. The results of the analysis are discussed in Section 4. The paper ends with some brief concluding remarks in Section 5.

2. Methodology

Examination of the usefulness of EVA entails two closely related empirical questions. The first question relates to the purported dominance of EVA over both residual income and the conventional accounting performance measures of earnings before extraordinary items and net cash flow from operations in explaining contemporaneous stock returns. The second empirical question concerns those components unique to EVA that help explain these stock returns beyond that explained by residual income, earnings before extraordinary items and net cash flow from operations. The 'usefulness of EVA' is therefore defined in two ways.

First, usefulness is defined in terms of a quantitative relationship between a particular performance measure (or components of a performance measure) and stock returns; and this is measured by the parameter estimate on the performance measure and the regression sum of squares. This measure of usefulness then indicates the ability of investors and other parties to use this performance measure to predict future stock returns. Second, usefulness is also defined in terms of the improvement in explaining the variation in stock returns when several competing performance measures are used together, rather than alone. Since financial analysts frequently employ a number of alterative measures to examine particular dimensions of firm performance, it is often necessary to examine the interaction between these measures.

Assuming that equity markets are (semi-strong form) efficient, stock market returns may be used to compare the information content (or value-relevance) of these competing accounting-based performance measures in a regression-based approach (Bowen *et al*. 1987, Jennings 1990, Easton and Harris 1991, Ali and Pope 1995, Biddle *et al*. 1995, Sloan 1996). Both relative and incremental information content comparisons are made. In terms of specific studies, the approach selected in the current study is most consistent with that used by Biddle *et al*. (1997) and Bao and Bao (1998), amongst others.

The first methodological requirement is to describe the linkages that exist between the competing measures of firm performance; namely, earnings before extraordinary items (*EBEI*), net cash flow from operations (*NCF*), residual income (*RI*) and economic value-added (*EVA*). Starting with *EBEI* as the most basic indicator of firm value we have:

$$EBEI = NCF + ACC \tag{1}$$

where *EBEI* is the sum of net cash flow from operations (*NCF*) and accruals (*ACC*). *ACC* is defined as total accruals relating to operating activities and is composed of depreciation, amortisation, changes in non-cash current assets, changes in current liabilities, and changes in the non-current portion of deferred taxes. Net operating profit after tax (*NOPAT*) is a closely related indicator of current and future firm performance and is calculated by adding after-tax interest expense (*ATI*) to *EBEI* (1):

$$NOPAT = EBEI + ATI = NCF + ACC + ATI \tag{2}$$

As indicated, the most significant difference between *EBEI* (1) and *NOPAT* (2) is that the later separates operating activities from financing activities by including the after-tax effect of debt financing (interest expense). As a measure of operating profit, no allowance is therefore made in (2) for the financing activities (both debt and equity) of the firm. One measure that does is residual income (*RI*) where operating performance is reduced by a net charge for the cost of all debt and equity capital employed:

$$RI = NOPAT - (WACC \times CAP) = NCF + ACC + ATI - CC \tag{3}$$

where *WACC* is an estimate of the firm's weighted average cost of capital, and capital (*CAP*) is defined as assets (net of depreciation) invested in going-concern operating activities, or equivalently, contributed and retained debt and equity capital, at the beginning of the period. The product of the firm's *WACC* and the amount of contributed capital thereby forms a capital charge (*CC*) against which *NOPAT* is reduced to reflect the return required by the providers of debt and equity capital. A positive (negative) *RI* indicates profits in surplus (deficit) of that required by the suppliers of debt and equity capital and is associated with an increase (decrease) in shareholder wealth.

The primary point of departure for *EVA* from *RI* (3) is the adjusting of both *NOPAT* and *CAP* for purported 'distortions' in the accounting model of performance. EVA-type adjustments are made to both accounting measures of operating profits (*NOPAT*), and accounting measures of capital *(CAP)*. EVA thereby reflects adjustments to GAAP in terms of both operating and financing activities. Simplifying, *EVA* is thus determined by:

$$EVA = NCF + ACC + ATI - CC + ADJ \tag{4}$$

where the total *EVA* accounting adjustment (*ADJ*) is the net figure of adjustments to *NOPAT* (*NCF* + *ACC* + *ATI*) less the adjustment to capital in determining *CC* (*WACC* $\times$ *CAP*). Suitably detailed discussions of the capital charge and accounting adjustments made under EVA® may be found in Young (1999) and Worthington and West (2001).

The second methodological requirement is to specify the models used to: (i) calculate the relative and incremental content of the competing measures of firm performance, and (ii) calculate the relative and incremental content of the components of economic value-added (EVA®) itself. The approach selected is identical to that used by Biddle *et al*. (1997) and Bao and Bao (1998) to evaluate the 'usefulness' of EVA in the US. In these studies, EBEI, NCF, RI and EVA are specified as explanatory variables in regressions, both singly and in various combinations, with stock market returns specified as the dependent variable. Biddle *et al*. (1997) extend this approach by specify stock market returns as the dependent variable in a second set of regressions, though with the components of EVA as explanatory variables; namely, *NCF*, *ACC*, *ATI*, *CC* and *ADJ*. This two-part process enables the 'usefulness' of EVA to be gauged in terms of both competing measures of firm performance and in terms of the unique adjustments entailed in EVA calculations.

The first set of specifications in this study are referred to as the 'firm valuation models':

$$
\begin{aligned}
MAR_{it} &= b_0 + b_1 EBEI_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 NCF_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 RI_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 EVA_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 EBEI_{it} + b_2 EVA_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 NCF_{it} + b_2 EVA_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 RI_{it} + b_2 EVA_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 EBEI_{it} + b_2 NCF_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 EBEI_{it} + b_2 RI_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 NCF_{it} + b_2 RI_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 EBEI_{it} + b_2 NCF_{it} + b_3 RI_{it} + b_4 EVA_{it} + e_{it}
\end{aligned} \tag{5}
$$

The dependent variable in all the models in (5) is the compounded annual stock market return (*MAR*). The market return is calculated using a 12-month non-overlapping period ending three months following the firm's fiscal year end to allow time for financial statement information to be impounded in market prices. Biddle *et al*. (1997) and Bao and Bao (1998) used this same rationalisation in their studies on the usefulness of EVA in the US context. For example, in any given year the financial statement information on which the explanatory variables are based is for the period 1 July to 30 June while the annual market return (dependent variable) is calculated over the period 1 October to 30 September. The explanatory variables in the firm valuation model are earnings before extraordinary items (*EBEI*), net cash flows from operations (*NCF*), residual income (*RI*) and economic value-added (*EVA*). Following the value-relevance literature on financial statement information, positive coefficients for *EBEI*, *NCF, RI* and *EVA* are expected when used as explanatory variables for market returns. These models are identical to those used in Biddle's *et al*. (1997)

EVA study save one respect. In the Biddle *et al*. (1997) approach the independent variables (market returns) are normalised (divided) by the lagged market value of equity, while in this study the independent variables are normalised by the number of outstanding shares. While both approaches are commonly used to reduce heteroskedasticity in firm-level data, White's heteroskadastic-consistent estimator is also employed, along with an equivalent correction for time-wise autocorrelation.

The second set of specifications examined are referred to as the 'EVA components models':

$$
\begin{aligned}
MAR_{it} &= b_0 + b_1 NCF_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 ACC_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 ATI_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 CC_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 ADJ_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 ATI_{it} + b_2 CC_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 ACC_{it} + b_2 CC_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 CC_{it} + b_2 ADJ_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 NCF_{it} + b_2 CC_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 ACC_{it} + b_2 ATI_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 ATI_{it} + b_2 ADJ_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 NCF_{it} + b_2 ATI_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 ACC_{it} + b_2 ADJ_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 NCF_{it} + b_2 ACC_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 NCF_{it} + b_2 ADJ_{it} + e_{it} \\
MAR_{it} &= b_0 + b_1 NCF_{it} + b_2 ACC_{it} + b_3 ATI_{it} + b_4 CC_{it} + b_5 ADJ_{it} + e_{it}
\end{aligned} \tag{6}
$$

These models are also estimated using a pooled time-series, cross-sectional least squares regression with corrections for heteroskedasticity and autocorrelation. While a number of alternative specifications for panel data are available, a common effects model is used: that is, the financial relations are assumed to be homogeneous across all firms. This assumption follows from the facts that: (i) Stern-Stewart's EVA figures already include several financial adjustments that are intended to eliminate much cross-sectional variation amongst firms (Young, 1999; Worthington and West, 2001) and (ii) the Australian firms for which EVA figures are available are relatively homogenous, being large, well-established, industrial companies (Stern-Stewart, 1999). The dependent variable is given as *MAR*. The independent variables are the five components of *EVA*: namely, net cash flows (*NCF*), operating accruals (*ACC*), after-tax interest (*ATI*), cost of capital (*CC*) and accounting adjustments (*ADJ*). Net cash flow (*NCF*) is defined as above. The variable *ACC* is defined as earnings less net cash flow from operations (*EBEI - NCF*). Accruals can either be positive or negative, but are usually negative (reflecting non-cash expenses such as depreciation and amortisation). The *ex ante* sign on the coefficient for accruals is thought to be positive when specified as an explanatory variable for market returns. *ATI* is calculated as one minus the firm's tax rate (assumed to be 36 per cent) multiplied by interest expense. A positive coefficient is hypothesised when market returns are regressed against interest expense. *CC* is defined as each firm's weighted-average cost of capital times its beginning of year capital ($WACC \times CAP$). A negative coefficient is hypothesised. Finally *ADJ* reflects Stern Stewart's adjustments to earnings and capital, and is defined as economic value-added less residual income (*EVA - RI*). Given the fact that the direction of change for *ADJ* may vary across firms in the sample depending on both financing and operations (GAAP-related accounting adjustments can either be positive or negative), it is somewhat difficult to postulate the relationship between GAAP adjustments and market returns. No *a priori* coefficient is postulated.

As discussed, tests of these models are based on incremental and relative information specification tests. The first sets of tests are joint hypothesis tests that *EBEI, NCF, RI* and *EVA* have equal relative information content. The comparisons of the estimated coefficients and R^2 of the regression results are made to determine which variable better explains variation in *MAR*. Rejection of this hypothesis is viewed as evidence of a significant difference in the relative information content. The second set of tests indicates whether one of these predictors of firm value provides value-relevance data beyond that provided by another. Rejection of this hypothesis is viewed as evidence of incremental information content. Similar tests of relative and incremental information content are performed in the 'EVA components models'. The components in this instance are *EVA*, *NCF*, *ACC*, *ATI*, *CC* and *ADJ*. The incremental and relative information specification tests are once again identical to those used in Biddle *et al*. (1997) and Bao and Bao (1998).

3. Data Description

Three separate sources of data are used in this study. First, data for EVA® and its components are obtained directly from Stern Stewart's Australian EVA® Performance Rankings. This data contains EVA®, the weighted average cost of capital (*WACC*), return on capital (*ROC*), net operating profit after-tax (*NOPAT*), capital (*CAP*) and average shareholder returns for Australia's 110 largest listed (non-financial) companies. The sample of firms consists of both adopters and non-adopters of the EVA® Financial Management System over the period of 1992–1998. Of course, while it would be extraordinarily useful to distinguish between these two groups, such information is not currently available. Selected descriptive statistics for these variables are given in Table 1.

Table 1
Descriptive Statistics for Firm Valuation and EVA Components Pooled Data

Variable	Mean	Std. dev.	Skewness	Kurtosis
MAR	0.1418	3.0776	-13.7930	188.7363
EBEI	23.7240	313.4500	-2.3891	3.7187
NCF	12.8700	322.1800	-2.2060	2.8748
RI	2.6445	53.9650	-1.4432	0.0831
EVA	2.0739	28.9380	-0.6653	-1.5614
ACC	2.2116	66.1570	-2.4497	4.0116
ATI	-2.3931	28.3360	-1.9429	1.7796
CC	0.8360	9.4616	-1.0152	-0.9713
ADJ	-1.0601	50.4630	-1.4143	0.0002

Firm valuation models: *MAR* = compound annual stock returns lagged 3 months to fiscal year end; *EBEI* = earnings before extraordinary items; *NCF* = net cash flow; *RI* = residual income; *EVA* = Stern Stewart measure of economic value-added. All variables are per share.

EVA components models: *MAR* = compound annual stock returns lagged 3 months to fiscal year end; *NCF* = net cash flow; *ACC* = accruals; *ATI* = after-tax interest; *CC* = cost of capital; *ADJ* = Stern Stewart accounting adjustments. All variables are per share.

Second, financial statement data for *EBEI*, *ATI*, *RI*, *NCF*, *ACC* and *ADJ* are collected from the Australian Stock Exchange's (ASX) *Datadisk* database and the Connect-4 *Annual Report Collection* database. Finally, share price data is obtained from the Australian Graduate School of Management's (AGSM) *Share Price and Price Relative* database (incorporating capitalisation adjustments and dividends).

Table 2
Pearson (Product Moment) and Spearman (Rank) Correlation Coefficients for Firm Valuation and EVA Components Pooled Data

Firm valuation variables						
MAR	1.0000	0.2745	0.2564	0.3797	0.3155	
EBEI	0.4413	1.0000	0.8162	0.5061	0.4174	
NCF	0.3638	0.8926	1.0000	0.3793	0.3591	
RI	0.2916	0.6997	0.6392	1.0000	0.5600	
EVA	0.3014	0.5044	0.4625	0.6975	1.0000	
	MAR	EBEI	NCF	RI	EVA	
EVA components variables						
MAR	1.0000	0.2564	0.1429	0.1729	0.2676	0.2223
NCF	0.3638	1.0000	0.0390	0.0171	0.4948	0.1175
ACC	0.4001	0.8991	1.0000	0.1610	0.2593	0.0390
ATI	0.3697	0.7729	0.8203	1.0000	0.1552	0.2611
CC	0.3233	0.5416	0.5718	0.5592	1.0000	0.6081
ADJ	0.2872	0.6408	0.6788	0.6752	0.8222	1.0000
	MAR	NCF	ACC	ATI	CC	ADJ

Firm valuation models: *MAR* = compound annual stock returns lagged 3 months to fiscal year end; *EBEI* = earnings before extraordinary items; *NCF* = net cash flow; *RI* = residual income; *EVA* = Stern Stewart measure of economic value-added.

EVA components models: *MAR* = compound annual stock returns lagged 3 months to fiscal year end; *NCF* = net cash flow; *ACC* = accruals; *ATI* = after-tax interest; *CC* = cost of capital; *ADJ* = Stern Stewart accounting adjustments.

Cells above the diagonal contain Spearman rank correlation coefficients and those below contain Pearson correlation coefficients.

Pearson and Spearman correlation coefficients between the two sets of variables are provided in Table 2. For the 'firm valuation' variables the highest Pearson correlation coefficients are between *EBEI* and *NCF* (0.8926) and *EBEI* and *RI* (0.6997). These findings are comparable with the less-restrictive distributional assumptions underlying the Spearman rank correlation coefficients. Pearson correlations between the firm valuation variables and market returns are ranked (in descending order) *EBEI*, *NCF*, *EVA* and *RI*, while the non-parametric Spearman rank correlations are placed *RI*, *EVA*, *EBEI* and *NCF*. In the case of the 'EVA components' variables, the highest product-moment (Pearson) correlations are between *ACC* and *NCF* (0.8991) and *ACC* and *ATI* (0.8203) with the highest rank (Spearman) correlations between market returns and *ACC* (0.4001) and *CC* (0.2676).

4. Empirical Results

Table 3 provides the estimated coefficients and standard errors of the firm valuation models discussed in the previous section. The dependent variable is specified as compounded annual market returns (with a lagged period of three months following fiscal year end) and the explanatory variables are variously specified as earnings before extraordinary items, net cash flow, residual income and economic value-added. An assumption of a linear relationship between these variables is made. All regressions are estimated using the statistical program EViews 3.1.

One particular issue that arises is the presence of multicollinearity, almost entirely because the regressands in both the firm valuation and EVA components models are composed of closely related measures of firm performance. While the technique of decomposing R^2 into its component parts to provide tests of relative and incremental information content is widespread in accounting-based research [see, for instance, Ali and Pope (1995), Biddle *et al*. (1995), Biddle *et al*. (1997), Bao and Bao (1998), Brown *et al*. (1999)] high collinearity among the independent variables may compromise the interpretation of such tests. In the typical case in which the regressors are correlated in the sample, partitioning of R^2 may simply not be meaningful because it cannot be allocated to particular independent variables (Kennedy, 1998). One simple rule for detecting collinearity is if the pair-wise or zero-order correlation coefficient between two regressors is high, say, in excess of 0.9 in absolute value (Gujarati, 1995; Kennedy, 1998). As indicated by the product-moment correlation coefficients in Table 2, none of the regressors in either the 'firm valuation' or 'EVA components' models have correlations above this level.

Nonetheless, high pair-wise correlations may not provide an infallible guide to collinearity due to interaction between several regressors. Accordingly, a 'variance inflation factor' (VIF) is also calculated using auxiliary regressions to obtain the R^2 for each independent variable when regressed on the remaining independent variables. As a rule of thumb, if the VIF of an independent variable exceeds 10, collinearity may be a problem (Gujarati, 1995; Kennedy, 1998). In the case of the regressors in the 'firm valuation' model, the highest VIF is only 5.71 (*EBEI*) while the highest VIF in the 'EVA components' model is 6.76 (*ACC*). Other VIFs in the firm valuation' model are 4.93 (*NCF*), 2.85 (*RI*) and 1.95 (*EVA*), while in the 'EVA components' model they are 5.35 (*NCF*), 3.37 (*ATI*), 3.09 (*CC*) and 4.04 (*ADJ*). These suggest that collinearity, while present, is not significant.

Table 3
Association with Market-Adjusted Returns for the Firm Valuation Models

CONS.	EBEI	NCF	RI	EVA	F	$\bar{R}^2$
-0.1259***	0.3243***				46.01	23.67
(0.0219)	(0.0478)					
-0.1376***		0.2590***			35.70	18.10
(0.0233)		(0.0433)				
-0.1813***			0.2346***		47.74	19.29
(0.0251)			(0.0336)			
-0.2817***				0.1544***	47.83	14.29
(0.0501)				(0.0223)		
-0.1128***	0.2805***			0.0584***	29.53	24.55
(0.0195)	(0.0508)			(0.0190)		
-0.1161***		0.2013***		0.0884***	27.56	20.36
(0.0201)		(0.0447)		(0.0201)		
-0.1699***			0.2066***	0.0314	28.56	19.36
(0.0258)			(0.0492)	(0.0306)		
-0.1261***	0.4047***	-0.0861			24.36	23.86
(0.0218)	(0.0711)	(0.0564)				
-0.1386***	0.2547***		0.0768***		26.06	24.24
(0.0241)	(0.0452)		(0.0183)			
-0.1591***		0.1404***	0.1526***		24.50	21.27
(0.0253)		(0.0400)	(0.0292)			
-0.1208***	0.3449***	-0.0908*	0.0321	0.0471	16.42	24.75
(0.0235)	(0.07010	(0.0549)	(0.0375)	(0.0301)		

Asterisks indicate significance at the *** – 0.01, ** – 0.05 and * – 0.10 level. Figures in brackets are standard errors. All *F*-test statistics are significant at the .01 level.

Estimated coefficients are from (5) where MAR_{it} = compound annual stock returns lagged 3 months to fiscal year end; $EBEI_{it}$ = earnings before extraordinary items; NCF_{it} = net cash flow; RI_{it} = residual income; EVA_{it} = Stern Stewart measure of economic value-added.

The significance of the estimated coefficients in Table 3 suggests that all four accounting-based performance measures are positively associated with market returns over the period 1992–1998. Of the twenty estimated slope coefficients, seventeen are significant at the .10 level or lower and only two are not in the predicted direction (both *NCF*). The change in the sign on the estimate of *NCF* is an obvious indicator of multicollinearity (with *EBEI*), however, it should be stressed that the emphasis in these various models is not on finding the most appropriate model, rather examining the interaction between the competing measures of firm performance. Nevertheless, and in general, the significance of the individual coefficients hold even when a pairwise combination of performance measures is specified in the same regression. The summary results of these regressions in the form of relative and incremental information content tests are presented in Table 4.

Table 4
Relative and Incremental Information Content for Firm Valuation Models

A. Relative Information Content						
EBEI	>	RI	>	NCF	>	EVA
23.67%		19.29%		18.10%		14.29%

B. Incremental Information Content											
EVA/ EBEI	EBEI/ EVA	EVA/ NCF	NCF/ EVA	EVA/RI	RI/EVA	EBEI/ NCF	NCF/ EBEI	EBEI/RI	RI/EBEI	NCF/RI	RI/NCF
0.88%	10.26%	2.26%	6.07%	0.07%	5.07%	5.76%	0.19%	4.95%	0.57%	1.98%	3.17%

The relative and incremental information content is calculated using the values of R^2 in Table 3. Relative information content uses the R^2 from the univariate regressions. The incremental information content uses the R^2 from the univariate and pairwise regressions. For example, the incremental information content for *EVA*/*EBEI* is calculated as the adjusted R^2 from the pairwise regression minus the individual adjusted R^2 for *EBEI*.

Part A of Table 4 indicates that there is a significant difference in relative information content. The highest adjusted R^2 from the single coefficient regressions is shown on the left, with lower explanatory power in descending order to the right. The suggestion is that *EBEI* (23.67%) better explains *MAR* than *RI*, (19.29%), *NCF* (18.10%) and *EVA* (14.29%). In terms of international comparisons, Biddle's *et al*. (1997) results also indicated that earnings *(EBEI*) was more highly associated with market-adjusted returns than either *RI* or *EVA*, but that all three measures dominate net cash flow (*NCF*). In this study, the relative information content of *EVA* is the lowest of the four accounting-based performance measures, accounting for only some 14.29 percent of variation in market returns. Put differently, when stock returns are specified as the dependent variable, *EVA* accounts for only some 60.3 percent of the variation that *EBEI* does, 74.1 percent as found in *RI*, and 78.9 percent of the variation attributed to *NCF*. Notwithstanding the low explanatory of accounting-based measures in general and EVA in particular, the estimated coefficients are highly significant, with joint hypothesis *F*-tests that all slope coefficients are zero rejected at the .05 level or better. Furthermore, the explanatory power of all four accounting-based measures is significantly higher than that found in a number of comparable studies. For example, Biddle *et al*. (1997) estimated the relative information content of *EBEI*, *RI*, *EVA* and *NCF* at 9.04, 6.24, 5.07 and 2.38 percent respectively.

Table 5
Association of Market Returns with Components of Economic Value-Added Models

CONS.	NCF	ACC	ATI	CC	ADJ	F	$\bar{R}^2$
-0.2839***	0.2616***					32.60	13.12
(0.0641)	(0.0458)						
-0.1335***		0.2997***				38.96	20.52
(0.0231)		(0.0482)					
-0.1422***			0.2553***			42.40	19.47
(0.0225)			(0.0392)				
-0.1431***				0.1947***		49.64	17.81
(0.0223)				0.0276			
-0.2935***					0.1699***	28.59	8.13
(0.0650)					(0.0317)		
-0.1338***			0.1760***	0.1148***		28.38	22.41
(0.0213)			(0.0388)	(0.0246)			
-0.1284***		0.2136***		0.1058***		27.78	22.90
(0.0218)		(0.0532)		(0.0274)			
-0.1679***				0.0776	0.1606***	27.73	19.80
(0.0252)				(0.0495)	(0.0622)		
-0.1305***	0.1695***			0.1241***		27.30	21.61
(0.0218)	(0.0449)			(0.0265)			
-0.1337***		0.1970***	0.1169**			22.15	21.39
(0.0228)		(0.0634)	(0.0465)				
-0.1602***			0.1527***		0.1335***	25.28	21.82
(0.0242)			(0.0296)		(0.0221)		
-0.2174***	0.1394***		0.1480***			18.93	14.96
(0.0619)	(0.0508)		(0.0448)				
-0.2588***		0.2904***			0.0171	18.26	15.83
(0.0652)		(0.0547)			(0.0231)		
-0.2748***	0.0155	0.2907***				18.05	15.79
(0.0644)	(0.0292)	(0.0546)					
-0.2238***	0.2193***				0.0542**	17.34	13.51
(0.0665)	(0.0459)				(0.0239)		
-0.1329***	-0.0064	0.1396**	0.0841**	0.0877*	0.0183	11.61	23.14
(0.0249)	(0.0253)	(0.0625)	(0.0371)	(0.0492)	(0.0559)		

Asterisks indicate significance at the *** – 0.01, ** – 0.05 and * – 0.10 level. Figures in brackets are the standard errors. All *F*-test statistics are significant at the .01 level.

Estimated coefficients are from (6) where MAR_{it} = compound annual stock returns lagged 3 months to fiscal year end; NCF_{it} = net cash flow; ACC_{it} = accruals; ATI_{it} = after-tax interest; CC_{it} = capital charge; ADJ_{it} = Stern Stewart accounting adjustments.

The results in Part B of Table 4 are also based on (5) and provide incremental information content tests for the pairwise combinations of *EVA*, *EBEI*, *RI* and *NCF*. For example, *EVA*/*EBEI* (0.88 percent) is equal to the information content of the pairwise comparison of *EVA* and *EBEI* (24.55 percent) minus the information content of *EBEI* (23.67 per cent). The pairwise combinations of *EVA* and *EBEI*, *NCF* and *RI* indicate that explanatory power has increased by 10.26, 6.07 and 5.07 respectively over the *EVA* measure alone.

A comparison with the incremental information tests contained in Bao and Bao (1998) for pooled data indicates that earnings have a zero impact on *EVA* alone, while residual income increases explanatory power by some 38 percent. Overall, the results indicate that *EBEI* exhibits the largest relative information content among the measures, with *EVA* (0.88 percent), *RI* (0.57 percent) and *NCF* (0.19 percent) providing limited incremental information content beyond earnings. Nevertheless, the most logical pairing of information variables in explaining market returns is composed of *EBEI* and *EVA*.

The second phase of the study is to examine the components of EVA. These components are net cash flows from operations (*NCF*), accruals (*ACC*), after-tax interest (*ATI*), and the cost of capital (*CC*) and accounting adjustments (*ADJ*). Table 5 presents the results of the individual and pairwise regressions of the components on *EVA*. In these regressions the estimated coefficients for *NCF*, *ACC*, *ATI*, *CC* and *ADJ* are all significant at the 0.01 level in the individual variable regressions. The measure for capital charge adjustments (*CC*) is insignificant when paired with operating adjustments (*ADJ*) suggesting a high degree of collinearity between the two steps of EVA® GAAP adjustments.

Table 6
Relative and Incremental Information Content for the EVA Components Models

A. Relative Information Content									
ACC	>	ATI	>	CC	>	NCF	>	ADJ	
20.50%		19.47%		17.81%		13.12%		8.13%	
B. Incremental Information Content									
CC/ATI	ATI/CC	CC/ACC	ACC/CC	CC/ADJ	ADJ/CC	CC/NCF	NCF/CC	ATI/ACC	ACC/ATI
2.94%	4.60%	2.40%	5.09%	11.67%	1.99%	8.49%	3.80%	-0.89%	1.92%
ATI/ADJ	ADJ/ATI	ATI/NCF	NCF/ATI	ACC/ADJ	ADJ/ACC	ACC/NCF	NCF/ACC	ADJ/NCF	NCF/ADJ
13.69%	2.35%	1.84%	-4.51%	7.66%	-4.71%	2.67%	-4.71%	0.39%	5.38%

The relative and incremental information content is calculated using the values of R^2 in Table 5. Relative information content uses the R^2 from the univariate regressions. The incremental information content uses the R^2 from the univariate and pairwise regressions. For example, the incremental information content for *ATI/ADJ*, for example, is calculated as the adjusted R^2 from the pairwise regression minus the individual adjusted R^2 for *ATI*.

In the final regression specification in Table 5 the *ex post* signs for *CC* (negative) and *NCF* (positive) do not correspond with *a priori* reasoning, while the figure for Stern

Stewart operating performance adjustments (*ADJ*) is insignificant. In none of the single coefficient or pairwise regressions does the estimated sign for *ATI* and *CC* correspond with the *ex ante* sign (both negative). Notwithstanding this result, all of the one-tail *F*-tests are significant at the .01 level or better, thereby rejecting the null hypothesis of the joint insignificance of the slope coefficients.

Part A of Table 6 gives the results of relative information content tests of the components of *EVA*. When specified as a single slope coefficient *ACC* (20.50 percent) has greater explanatory power than *ATI* (19.47 percent), *CC* (17.81 percent), *NCF* (13.12 percent) and *ADJ* (8.13 percent). This is consistent with the previous part of the analysis since *ACC* is shared by *EVA* with *EBEI*, *RI* and *NCF*, *ATI* and *CC* with *RI*, and *ADJ* by itself alone. Part B of Table 6 presents the incremental information content results. Starting with the base *NCF*, *ACC* adds 2.67 percent in explanatory power, *ATI* adds 1.84 percent, *CC* 8.49 percent and *ADJ* only 0.39 percent. Overall, the component of *EVA* that explains most variation in stock returns is accruals, followed by after-tax interest, capital charges, net cash flow and accounting adjustments. This also highlights the results obtained in the first part of the analysis, where most variation in returns is explained by conventional accounting-based measures of performance, with a lesser amount explained by EVA-specific adjustments.

5. Summary and Conclusions

A number of points emerge from the present study. The first part of the analysis uses pooled time-series, cross-sectional data of 110 listed Australian companies to evaluate the usefulness of EVA® and other accounting-based performance measures. The measures of relative and incremental information content indicate that over the period 1992 to 1998 no more than 24 percent of the variation in stock returns could be explained by any of these measures. Of that explanatory power, the bulk was encompassed in conventional earnings, with relatively minor improvements in explanatory power associated with the inclusion of accruals, after-tax interest and capital charges and GAAP-based accounting adjustments. In common with Biddle *et al*. (1997, p. 301), "…these results do not support claims that EVA dominates earnings in relative information content, and suggest rather that earnings generally outperforms EVA". Nevertheless, and notwithstanding the obvious importance of earnings in value-relevance studies, EVA® is still significant at the margin in explaining variation in market returns adding 0.88% explanatory power to earnings, compared to 0.19% for net cash flow and 0.57% for residual income. This would support the potential usefulness of EVA-type measures for internal and external performance measurement and would assist the normative policy debate on its inclusion in financial statements.

In the second part of the paper, the components of EVA® are specified as explanatory variables in regressions with market returns. When examining the components of EVA® (some of which are shared with the related accounting-based performance measures), accruals (*ACC*) is found to be the most significant component (held in common with *EBEI* and *RI*) with a relative information content of 20.50%. This is followed by after-tax interest (*ATI*) (held in common with *RI*), and the capital (*CC*) and operating activity GAAP-related adjustments (*ADJ*) associated with EVA®. Of the EVA-specific adjustments, the capital charge (*CC*) has a relative information content of 17.81% compared to accounting adjustments (*ACC*) with 8.13%. All other things being equal, variation in stock returns is largely explained by the commonly available financial statement variables (*NCF*, *ACC* and *ATI*), though the adjustments most closely associated with EVA®, namely GAAP-related accounting adjustments and capital charges, add at least some explanatory power.

There are at least three ways in which this research may be extended. First, a limitation in this study is that a comparison could not be made of firms who use the *EVA® Financial Management System* (incorporating redesigned executive compensation plans) against firms that use traditional accounting earnings-based incentives. While the results in the present study are suggestive of the benefits of EVA as a tool for internal performance measurement and compensation design, it is conceivable that the association between EVA® and returns may be stronger for EVA® adopters (Biddle *et al*., 1997, Wallace 1997).

Second, there is abundant empirical evidence to suggest that models relating accounting and market returns have more explanatory power when the accounting returns are expressed by relative changes and the relation is a non-linear, convex-concave function [see, for example, Freeman and Tse (1992), Riahi-Belkaoui (1996) and Frankel and Lee (1998)]. Similarly, recent work by Brown *et al*. (1999, p. 85) on the use of R^2 in value relevance studies suggests that "…some (if not all) of the differences between the ‘too low’ R^2 in returns regressions and the higher R^2 in levels regression are caused by scale effects”. This would indicate that the low levels of explanatory power found in this study and others may be the result of specification issues in relation to firm scale. A further avenue of research would therefore consist of alternative specifications of accounting and market returns, along with the use of non-linear regression techniques with allowance for scale effects.

Finally, there is ample scope for the investigation of the usefulness of EVA® as an internal and external performance measure in other settings. Stern Stewart also provide performance rankings for listed companies in the U.K., Canada, Brazil, Germany, Mexico, Turkey, and France, and empirical evidence from these institutional milieus would provide additional evidence regarding the contextual and/or substantive usefulness of accounting-based value-added measures.

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