Modelling traditional accounting and modern value-based performance measures to explain stock market returns in the Athens Stock Exchange (ASE)

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Abstract

Purpose – The purpose of this paper is to investigate the explanatory power of two value-based performance measurement models, Economic Value Added (EVA®) and shareholder value added (SVA), compared with three traditional accounting performance measures: earnings per share (EPS), return on investment (ROI), and return on equity (ROE), in explaining stock market returns in the Athens Stock Exchange (ASE).

Design/methodology/approach – The paper uses the Easton and Harris formal valuation model and employs both a relative and an incremental information content approach to examine which performance measure best explains stock market returns; and the explanatory power of the pairwise combinations of one value-based performance measurement model and one traditional accounting performance measure in explaining stock market returns. For this purpose, pooled time-series, cross-sectional data of listed companies in the Athens Stock Exchange (ASE) over the period 1992-2001 have been collected and modelled.

Findings – Relative information content tests reveal that stock market returns are more closely associated with EPS than with EVA® or other performance measures. However, incremental information content tests suggest that the pairwise combination of EVA® with EPS increases significantly the explanatory power in explaining stock market returns.

Practical implications – The results suggest that the market participants in the Greek stock market should pay additional attention to EVA® but they should also consider other determinants to develop their investment strategies.

Originality/value – The paper is one of the first studies on the value relevance of traditional accounting (EPS, ROI, and ROE) and value-based (EVA® and SVA) performance measures in explaining stock market returns in the ASE. The results extend the understanding of the role of EVA® and SVA in explaining stock market returns in the ASE, and, moreover, whether they may affect investors' decisions in a continental European market with market characteristics similar to that of Greece.

Keywords Value analysis, Economic performance, Shareholder value analysis, Accounting standards, Earnings per share, Greece

Paper type Research paper

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Introduction

Traditional accounting performance measures appeared in early 1900s and have been used since then, in various forms, to measure the financial performance of corporations (Epstein, 1925, 1930; Sloan, 1929). Later, Fisher (1930) and Hirschleifer (1958) introduced the discounted cash flow techniques, such as net present value (NPV) and the internal rate of return (IRR). Miller and Modigliani (1961) developed a more consistent determination of valuation and Gordon (1962) incorporated growth and the cost of capital in valuation models. In order to determine the cost of capital, Sharpe (1964), Lintner (1965), Mossin (1966) and Black (1972) developed the capital asset pricing model (CAPM). Solomons (1965) introduced the divisional performance and the adaptation of residual income (RI), while Tobin (1969) suggested the Tobin's *Q* as the proper valuation method, and Stern (1974) worked on free cash flows (FCF). In the 1980s, Rappaport (1986) and Stewart (1991) developed a new concept known as the shareholder value (SHV) approach.

Value-based performance measures, such as shareholder value added (SVA), economic value added (EVA®), economic profit (EP), and cash flow return on investment (CFROI), based on shareholder value approach, have gained popularity since the late 1980s. Thus, the value based management (VBM) approach became increasingly popular both as a decision making tool and as an incentive compensation system (Knight, 1998).

Several empirical studies (see: Milunovich and Tsuei, 1996; O'Byrne, 1996; Uyemura *et al.*, 1996; Biddle *et al.*, 1997; Chen and Dodd, 1997, 2001; Bao and Bao, 1998; De Villiers and Auret, 1998; Günther *et al.*, 2000; Turvey *et al.*, 2000; Worthinton and West, 2001, 2004; Copeland, 2002; Peixoto, 2002; Sparling and Turvey, 2003; Forker and Powell, 2004; Kyriazis and Anastasis, 2007) have been conducted in the last two decades, initially in the USA and later in the rest of the international market community, to answer if "it is really better to use value-based than traditional accounting performance measures to measure the financial performance of corporations, or which performance measure best explains corporations' change of market value". However, the reported results are quite mixed and controversial. This study is motivated by the controversial results of the previous research and aims to conduct a research in a developing market, namely the ASE, to assess:

- which one of those measures best explains corporation's change of market value (relative information content tests); and
- after a pairwise combination of one traditional and one value-based performance measure whether one measure adds information to that provided by the other (incremental information content tests).

The structure of the paper is as follows: the next section presents the theoretical background, the following section describes the methodology followed, the penultimate section presents and analyses the results of the statistical analysis, and the final section concludes the paper with the most important findings which are compared with those already existing from previous research.

Previous literature

Since the early 1980s there has been a global momentum in the economy. Capital markets became more and more global in outlook. Moreover, investors started to be more sophisticated than ever and wanted to know all possible details about a company. What the company has been paying for dividends in the past was not enough to fully satisfy investors' needs for information. Financial statements, such as the balance sheet and profit and loss account, prepared in a traditional way, were no longer enough to fully inform investors. Cash flow had become a more important measure and a significant source of information to investors. Many consulting firms, academics and practitioners were moving forward from the traditional audit, on which they were focused for so many years, in order to keep pace with the new trends. Indeed the essential purpose for many companies became the maximisation of their value so as to keep their shareholders satisfied as well as their employees, customers, suppliers, and their communities (Black *et al.*, 1998).

The idea that the primary responsibility for management is to increase shareholder value, gained prominence and became widely accepted in the USA after Rappaport's (1986) publication of *Creating Shareholder Value*. Moreover, accounting earnings were under attack. Rappaport (1981, 1986, 1998) argued that earnings fail to measure the real change in economic value. Arguments such as: the alternative accounting methods that could be used, the investment requirements exclusion of the calculation of profits, and the ignorance of the time value for money, brought earnings under hard criticism.

To overcome problems associated with earnings-based measures, several scholars have proposed alternative theories and new (modern) performance measures. As a consequence, the shareholder value approach was developed in the late 1980s and early 1990s. Shareholder value approach estimates the economic value of an investment by discounting forecasted cash flows by the cost of capital (Rappaport, 1998). Proponents of shareholder value approach, either academics or consulting firms, based their analysis on free cash flows (FCF) and the cost of capital and developed a variety of such measures. The most common referred variants of those measures are:

- Shareholder value added (SVA) by Rappaport and LEK/Alcar Consulting group (Rappaport, 1986, 1998).
- Cash Flow Return on Investment (CFROI®)[1] by Boston Consulting Group (BCG) and HOLT Value Associates (Black *et al.*, 1998; Madden, 1999; Barker, 2001).
- Cash Value Added (CVA) by Boston Consulting Group (BCG) and the Swedes Ottoson and Weissenrieder (Ottoson and Weissenrieder, 1996; Madden, 1999; Barker, 2001).
- Economic Value Added (EVA®) by Stern Stewart & Co. (Stewart, 1991, 1999; Ehrbar, 1998, 1999; Stern, 2001).

The empirical research for the value relevance of traditional accounting and modern value-based performance measures is broad but with controversial results. Several studies have proved the superiority of EVA® as a performance measure (Stewart, 1991; O'Byrne, 1996; Uyemura *et al.*, 1996; Milunovich and Tsuei, 1996; Bao and Bao, 1998; Forker and Powell, 2004; Worthington and West, 2004) while others (Biddle *et al.*, 1997; Chen and Dodd, 1997; De Villiers and Auret, 1998; Turvey *et al.*, 2000; Chen and Dodd, 2001; Worthington and West, 2001; Copeland, 2002; Sparling and Turvey, 2003) provided different and opposing results.

Especially for Europe, studies conducted by Peixoto (2002) and Kyriazis and Anastasis (2007) revealed interesting results. Peixoto (2002) studied a sample of 39 Portuguese public companies listed on the Lisbon Stock Exchange during the period from 1995 to 1998. The main results of this study suggest that EVA® has no more information content than traditional accounting performance measures in explaining market value added. Similarly, Kyriazis and Anastasis (2007), used a sample of 121 non-financial publicly traded Greek firms in the ASE, covering a period of eight years, from 1996 to 2003, to investigate the relative explanatory power of the EVA® model with respect to stock returns and firms' market value, compared to established accounting variables (e.g. net income, operating income). Relative information content tests revealed that net and operating income appear to be more value relevant than EVA®. Additionally, their incremental information content tests suggested that EVA® unique components add only marginally to the information content of accounting profit. Therefore, they concluded that EVA®, even though useful as a performance valuation tool, need not necessarily be more correlated with shareholder's value than established accounting variables. Thus, the question of relevance still holds well and the empirical research continues.

Since the main body of the previously mentioned research concerns mature international markets, the motivation for this study is to explore the value relevance of both traditional accounting and value based performance measures in explaining stock market returns in an emerging market with different market characteristics (during the examined period, 1992-2001, the Greek stock market began a transitory phase, that is still under way, from the status of an emerging market to that of a developed one). Moreover, it is assumed that since the Greek capital market is under way to becoming a mature one, investors will appreciate time after time the usefulness of value based performance measures and this will probably be reflected in stock market returns.

Methodology

Sample and the data collection

The sample period spans ten years, from 1992 to 2001. There are 163 companies in the sample with a different number of participating years for each of them. These companies gave a total of 984 year-observations. After excluding the extreme observations (three standard deviations), the final sample was reduced to that of 977

Year	Companies' participation/observations	Companies' participation/observations (three std excluded)
1992	37	37
1993	55	55
1994	71	71
1995	73	73
1996	80	80
1997	106	106
1998	120	118
1999	135	130
2000	144	144
2001	163	163
Total	984	977

Table I.
Companies' participation (year-observations) from year 1992 to 2001

year-observations. Table I shows the variation of companies' participation and the number of observations from year to year.

Variables definitions and calculations/dependent variable

The research starts by collecting daily closing prices of the common stocks, which were trading in the ASE during the period from January 1990 to April 2002, even though the investigation period spans from 1992 to 2001. They are raw prices in the sense that they do not include dividends but they are adjusted for capital splits and stock dividends. It starts from January 1990 since it needed at least two years prior trading period for each stock to incorporate it in the sample. The main reason for this was the need for 36-monthly returns for each stock in order to calculate its risk (beta) for each year, although Fama and McBeth (1973) used 60-monthly returns for this calculation. Thus, the stocks that make up the sample of 1992 have a trading presence in the ASE from the January 1990.

It has also included the closing prices three months after the fiscal year end 2001 since the return period for each year spans nine months prior to three months after the fiscal year end (see: Easton and Harris, 1991; Biddle *et al.*, 1997; Chen and Dodd, 2001). Apart from the daily closing prices for each stock, it also collected the daily General Index of the ASE and the three-month Government Treasury Bill rate, which is considered to be the short-term interest rate (risk free interest rate). All data were acquired directly from the ASE data bank.

From the daily closing prices of the common stocks the daily returns for each stock was calculated using the logarithmic approximation (Benninga, 2001):

$$R_{i,t} = \log\left(P_{i,t}/P_{i,t-1}\right)$$

where $R_{i,t}$ is the return of stock i at time t, while $P_{i,t}$ and $P_{i,t-1}$ are the prices of stock i at time t and $t-1$ respectively.

Daily returns were aggregated to compose the monthly returns, which are the primary inputs for our study. Using the same procedure, the monthly returns for the General Index (GI) were also calculated. Employing the first selection criterion, all the financial companies and banks were excluded from the sample, while employing the second selection criterion the companies with penalties or with long periods without transactions (more than two months) or with missing values were also excluded. Using the monthly returns of each stock and the monthly returns of GI, the annual betas for each stock were estimated. Finally, annual returns were calculated as the aggregation of the monthly returns, extending nine months prior to three months after each fiscal year end.

Variables definitions and calculations/independent variables

The estimation of the adopted traditional accounting and value-based performance measures was based on the annual balance sheet and income statement of each listed company included in the sample. This information was taken either from the ASE database or directly from the companies. Two sources of data were mainly used. First, we used the processed data from a developed database (for the stock returns, the market returns, the annual risk factor (beta) for each company, and the risk free rate). We have also used the stock prices, nine months prior to fiscal year end, in order to use them as the deflator factor to decrease heteroscedasticity in the data (Biddle *et al.*, 1997). Second, in order to calculate our independent variables, we developed a calculation framework[2], where, after inserting the appropriate financial data, all relevant variables were automatically calculated.

The independent variables of our models are: EPS, ΔEPS, ROI, ΔROI, ROE, ΔROE, EVA®, ΔEVA, and SVA. We do not include change in SVA in our sample since the SVA by itself represents the change of shareholders' value added from one period to another. As far as the estimation of each variable is concerned we have come up with the following information.

EPS is the most widely used ratio. It tells how much profit was generated on a per share basis. It is calculated by dividing net income (less preferred dividends) to the average number of common shares outstanding (White *et al.*, 2003; Williams *et al.*, 2003). Balance sheet and income statement information are needed for this calculation. Using the calculation framework we produced the yearly EPS for each company included in our sample (we divide net operating profit before taxes by the average of the number of shares outstanding). By itself, EPS does not really convey much information. However, if it is compared to the EPS from the previous quarters or year it indicates the pace of a company's earnings growing, on a per share basis. For the purpose of our study we calculate the ΔEPS by dividing EPS_t of the current year with EPS_{t-1} of the previous year (EPS_t/EPS_{t-1}). Using the calculation framework we produce the yearly ΔEPS for each company included in our sample. In the literature and in the empirical studies, change in EPS can also be calculated as the quotient of the difference between the two observations divided by that of the previous year ($(EPS_t\text{-}EPS_{t-1})/EPS_{t-1}$), but since they produce the same result we adopt the first approach.

ROI or ROA indicate what return a company is generating on its investments/assets. ROI is mostly used as a performance measure for autonomous strategic business units (SBU's), not for the whole company. It is calculated by dividing the net income plus interest expenses with average total assets. In our calculation framework we calculated ROI by dividing the NOPAT with the average total assets. For this calculation, balance sheet and income statement information is needed. ΔROI is also an important ratio for companies. It shows the ROI growth quarterly or from year to year. To calculate ΔROI we adopt a similar approach to the one used to calculate ΔEPS. We divide the current ROI_t by the ROI_{t-1} of the previous year (ROI_t/ROI_{t-1}).

ROE indicates what return a company is generating on the owners' investment. Sometimes ROE is referred to as stockholders' return on their investment equity capital. Similarly to ROI, balance sheet and income statement data is needed for ROE calculation. To calculate ROE for our sample we divided the after tax earnings by the average shareholder's equity. We did so in order to capture the relevance of the new shares issue during the year. ΔROE is calculated as ΔEPS and ΔROI, by dividing current ROE_t with the ROE_{t-1} of the previous year (ROE_t/ROE_{t-1}).

EVA® attempts to capture the true economic profit of a company. Almost all previous studies examining the value relevance of EVA® in international markets obtained the EVA® figures directly from the Stern Stewart & Co database. That means EVA® was calculated according to the adjustments proposed by Stewart (1991, 1999). However, since there are no available EVA® figures for the Greek listed companies in the ASE, we were required to calculate EVA® adopting the Stern Stewart's EVA® formula. The adjustments we made were in terms of NOPAT and invested capital. To calculate EVA® we need balance sheet and income statement information. After revealing the relevant information, we first calculated the adjusted NOPAT where we mainly added back amortisation and subtracted tax benefit on interest expenses as follows:

$$\text{Operating Profit} = \text{EBIT} + \text{Amortisation}$$

$$\text{Cash Operating Taxes} = \text{Tax Paid} + \text{Tax Benefit on interest expenses}$$

$$\text{NOPAT} = \text{Operating Profit} - \text{Cash Operating Taxes}.$$

Then, we calculated the total capital invested and the weighted average cost of capital (WACC). To calculate the total capital invested, we needed the total equity capital and the total outstanding debt. Total equity capital can be found on the liability side of the balance sheet (we add minority interest and accumulated Goodwill amortisation), while the total outstanding debt is the sum of short-term and long-term debt, which can also be found on the liability side of the balance sheet. Thus the adjusted invested capital was calculated as follows:

$$\begin{aligned}\text{Capital Invested} = {} & \text{Capital} + \text{Minority interest} \\ & + \text{Accumulated Goodwill amortisation} + \text{S/T and L/T Debt}.\end{aligned}$$

After the calculation of the total capital invested, we calculated the WACC relying on formula. Except for the total equity capital, and the short and long term debt we needed to know the cost of equity and the cost of short-term and long-term debt. The cost of short-term and long-term debt (interest rates) was obtained from the annual report of the Board of Directors of the Central Bank, while the cost of equity was calculated using the CAPM model. To calculate the cost of equity, we needed the risk free rate, the beta coefficient and the market return. The values of all those variables were provided in our database thus we just imported them into the calculation framework. Change in EVA® was also calculated since according to Stewart (1991, 1999), Stern *et al.* (1995) and Rappaport (1998) it is the change in EVA® that companies should maximise instead of the absolute EVA®. Change in EVA® was calculated using the similar procedure as change in EPS, change in ROI and change in ROE. Namely, we divided the current EVA® to that of the previous year (EVA_t/EVA_{t-1}).

Finally, we estimated the SVA adopting the formula for our calculations:

$$\text{SVA} = \frac{\text{Change in NOPAT}}{K \times (1+K)^{t-1}} - \text{Present Value of Incremental Investment}.$$

To calculate SVA we need to know the change in NOPAT, the WACC, here K, and the time horizon t for the calculations of the first term of the formula. All those values are already available in the calculation framework while the power $t-1$ is calculated for each year using Excel techniques. The second term of the specification is the PV of total annual changes in investment. To calculate this term we discount the total annual changes in investment using the WACC as a discount factor. First, we calculate the Change in NOPAT as ($NOPAT_t - NOPAT_{t-1}$) and then we employ the formula $K \times (1+K)^{t-1}$ for the denominator of the first leg of the equation. Afterwards, we calculate the PV of the incremental investment. By subtracting the PV of incremental investment from the Δ NOPAT/$K^{*}(1+K)$^$(T-1)$, we produce the SVA.

Descriptive statistics

In order to reduce the heteroscedasticity in the data, we deflate all independent variables (Easton and Harris, 1991; Biddle *et al.*, 1997; Chen and Dodd, 2001) by the market value of equity (stock price) nine months prior to fiscal year end (first trading day in April). We do not deflate ROI and ROE since they are already divided by the average investment and average equity respectively.

Descriptive statistics of the variables are provided in Table II showing that ROI (0.854058) and EPS (0.855426) have the lowest standard deviation among the independent variables, followed by EVA® (1.330917). Change in EVA® (79.133410) and change in ROE (26.515549) reveal the highest standard deviation.

Mean statistics show that SVA (−0.622326) and EVA® (−0.282460) are negative, consistent with Biddle *et al.* (1997) who also revealed negative means for EVA® and RI. Near zero or even negative EVA® and SVA is consistent with a competitive economy where even the typical large firm has difficulty earning more than its cost of capital. Low EVA® is also consistent with a potential upward bias in Stern Stewart's cost of capital estimates, that is, when the WACC increases EVA® decreases.

The model

This study uses Easton and Harris (1991) formal valuation model, which has been used by a number of studies worldwide (see: Biddle *et al.*, 1997; Chen and Dodd, 1997, 2001; Worthington and West, 2001). The model links stock returns to earnings levels and earnings changes as below:

$$R_{jt} = \gamma_{t0} + \gamma_{t1} A_{jt}/P_{jt-1} + \gamma_{t2}\,\Delta A_{jt}/P_{jt-1} + \varepsilon^{3}_{jt}$$

where R_{jt} is the return on a share of firm j over the 12 months, extending from nine months prior to fiscal year-end to three months after the fiscal year-end, A_{jt} is the accounting earnings per share of firm j for period t, ΔA_{jt} is the earnings change, and P_{jt-1} is the price per share of firm j at time $t-1$.

Both relative and incremental information content approaches were employed to answer the two research questions under examination. The relative information content approach is used to explore the first research question, while the incremental information content approach is employed to answer the second one (Chen and Dodd, 2001; Worthington and West, 2001).

To explore the first research question five equations (variations) were developed based on Easton and Harris (1991) formal valuation model. Analytically, the earnings and earnings' change variables were replaced with each of the performance measures under examination. Thus, the model is structured as follows:

$$\text{Returns}_t = a_0 + a_1 \text{EPS}/\text{P}_{t-1} + a_2 \Delta\text{EPS}/\text{P}_{t-1} + u_1 \quad (1)$$

$$\text{Returns}_t = b_0 + b_1 \text{ROI} + b_2 \Delta\text{ROI} + u_2 \quad (2)$$

$$\text{Returns}_t = c_0 + c_1 \text{ROE} + c_2 \Delta\text{ROE} + u_3 \quad (3)$$

Table II. Selected descriptive statistics for all variables for the pooled data

	n	Minimum	Maximum	Mean	Std	Skewness		Kurtosis	
	statistic	statistic	statistic	statistic	statistic	Statistic	Std error	Statistic	Std error
RETURNS	984	−1.6165	2.8700	7.71E-02	0.712936	0.675	0.078	0.415	0.156
EPS	984	−16.8475	7.7432	0.134997	0.855426	−9.017	0.078	186.540	0.156
ΔEPS	984	−140.2831	175.7931	0.452017	9.250613	0.739	0.078	228.948	0.156
ROI	984	−25.3113	6.8697	6.35E-02	0.854058	−26.143	0.078	798.910	0.156
ΔROI	984	−29.6298	341.0302	1.611215	14.882655	19.355	0.078	401.476	0.156
ROE	984	−1.8952	126.8380	0.518670	4.081687	30.222	0.078	935.899	0.156
ΔROE	984	−678.4288	73.6537	−0.514879	26.515549	−19.908	0.078	463.077	0.156
EVA	984	−19.9368	7.6913	−0.282460	1.330917	−7.851	0.078	101.359	0.156
ΔEVA	984	−155.7205	2344.0679	3.383079	79.133410	27.326	0.078	789.914	0.156
SVA	984	−292.0832	43.3444	−0.622326	10.310872	−24.509	0.078	667.762	0.156
Valid n (listwise)	984								

$$\text{Returns}_t = d_0 + d_1\text{EVA}/\text{P}_{t-1} + d_2\Delta\text{EVA}/\text{P}_{t-1} + u_4 \quad (4)$$

$$\text{Returns}_t = e_0 + e_1\text{SVA}/\text{P}_{t-1} + u_5 \quad (5)$$

where, for all equations:

- Returns = the annual compounded returns extending nine months prior to current fiscal year end to three months after the current fiscal year end.
- EPS = the earnings per share of firm at time t.
- ΔEPS = the change in earnings per share over period $t-1$ to t.
- P_{t-1} = is the market value per share at the first trading day of the ninth month prior to fiscal year end.
- ROI = the return on investment of firm at time t.
- ΔROI = the change in ROI over period $t-1$ to t.
- ROE = the return on equity of firm at time t.
- ΔROE = the change in ROE over period $t-1$ to t.
- EVA = the economic value added of firm at time t.
- ΔEVA = the change in EVA over period $t-1$ to t.
- SVA = the shareholder value added over time $t-1$ to t.

Through this approach (the relative information content approach) we investigate which one of the performance measures under examination is superior in terms of association with stock returns in the Greek capital market. The equations will be estimated cross-sectionally by years as well as using pooled cross-sectional and intertemporal data (Easton and Harris, 1991; Chen and Dodd, 2001; Worthington and West, 2001). This design facilitates the use of testing procedures that are common in the information content literature and, therefore, will ease the comparison of the present study with those in the literature.

To explore the second research question the incremental information content tests will be employed (Cheng *et al.*, 1993; Chen and Dodd, 2001; Worthington and West, 2001; Francis *et al.*, 2003). The purpose of these tests is to examine whether one measure adds information to that provided by another measure. The coefficient of determination, $R^2_{p/q}$, denotes the increase in R^2 due to variable p, conditional on variable q, and $R^2_{f/q}$ denotes the R^2 due to both variables p and q (Cheng *et al.*, 1993). Pooled time-series cross sectional data (all years) will be employed to reveal the information usefulness of each regression model. For this purpose the Easton and Harris (1991) model was extended incorporating the combination of one traditional and one value-based performance measure. Six equations (variations) have been developed to explore the incremental information content of the pairwise combination of these measures. Thus, the model becomes as follows:

$$\text{Returns}_t = \text{l}_0 + a_1\text{EPS}/\text{P}_{t-1} + a_2\Delta\text{EPS}/\text{P}_{t-1} + d_1\text{EVA}/\text{P}_{t-1} + d_2\Delta\text{EVA}/\text{P}_{t-1} + u_6 \quad (6)$$

$$\text{Returns}_t = m_0 + a_1\text{EPS/P}_{t-1} + a_2\Delta\text{EPS/P}_{t-1} + e_1\text{SVA/P}_{t-1} + u_7 \quad (7)$$

$$\text{Returns}_t = n_0 + b_1\text{ROI} + b_2\Delta\text{ROI} + d_1\text{EVA/P}_{t-1} + d_2\Delta\text{EVA/P}_{t-1} + u_8 \quad (8)$$

$$\text{Returns}_t = o_0 + b_1\text{ROI} + b_2\Delta\text{ROI} + e_1\text{SVA/P}_{t-1} + u_9 \quad (9)$$

$$\text{Returns}_t = p_0 + c_1\text{ROE} + c_2\Delta\text{ROE} + d_1\text{EVA/P}_{t-1} + d_2\Delta\text{EVA/P}_{t-1} + u_{10} \quad (10)$$

$$\text{Returns}_t = q_0 + c_1\text{ROE} + c_2\Delta\text{ROE} + e_1\text{SVA/P}_{t-1} + u_{11}. \quad (11)$$

Results

Relative information content approach

Relative information content is assessed by comparing R^2s from five separate regressions (1 to 5), one for each performance measure, EPS, ROI, ROE, EVA® and SVA. R^2s from these regressions are provided in Table III. The higher R^2 is shown on the left and the lowest is shown on the right.

Following the Easton and Harris (1991) and Chen and Dodd (2001) methodology, the model was estimated using both the pooled cross-sectional and intertemporal (all years) sample and the individual year cross-sectional sample.

First, there is significant difference between the five regressions in the relative information content tests. Regressions (1) and (4) are significant at 0.01 level, regression (2) is significant at 0.1 level, while regressions (3) and (5) are not statistically significant. Secondly, comparing the reported R^2s of the five pooled regressions, it is noticed that all are largely consistent to those of Biddle, Bowen and Wallace (1997), Worthington and West (2001), Chen and Dodd (2001), Peixoto (2002), and Kyriazis and Anastasis (2007).

Results show that EPS ($R^2 = 1.9$ per cent) provide more information in explaining stock returns than EVA® ($R^2 = 0.9$ per cent). This is consistent with relevant studies conducted in the US (see: Biddle *et al.*, 1997; Chen and Dodd, 2001) and Australia (see Worthington and West, 2001) examining the value relevance of earnings and EVA® in explaining stock market returns. Biddle, Bowen and Wallace (1997) found that earnings before extraordinary items (EBEI) with an $R^2 = 9.0$ per cent provides more information than residual income (RI) ($R^2 = 6.2$ per cent), and EVA® ($R^2 = 5.0$ per cent). Worthington and West (2001) also found similar results: EBEI ($R^2 = 23.6$ per cent), RI ($R^2 = 19.2$ per cent) and EVA® ($R^2 = 14.3$ per cent). Chen and Dodd (2001) reported that operating income (OI) with an $R^2 = 6.2$ per cent better explains the stock returns than RI ($R^2 = 5.0$ per cent) and EVA® ($R^2 = 2.3$ per cent). Our results suggest

Table III. Summary (all years) results from the five (1-5) regressions

All years	Regression (1) EPS	Regression (4) EVA	Regression (2) ROI	Regression (5) SVA	Regression (3) ROE
R^2	0.019	0.009	0.004	0.001	0.000
F	9.577**	4.546**	2.781*	0.910	0.005
Significance	0.000	0.01	0.062	0.340	0.995

Notes: *Significance at 10 per cent level; **significance at 1 per cent level that for the Greek capital market, the new information provided by the EVA® measure is less value relevant than EPS, at least from a stock return perspective. On the other hand, the low explanatory power of the five regressions is consistent to the results of Copeland (2002) who also found low R^2s for EPS and EVA® (although EPS outperformed EVA®), i.e. scaled EPS 4.5 per cent, change in EPS 5.1 per cent, scaled EVA 0.3 per cent, and change in EVA 3 per cent.

Sensitivity analysis have been conducted using different testing periods (1992-1996, 1997-2001, 1992-1994, 1995-1997, 1998-2001) and by results from the different testing periods are largely similar to that showed for the whole testing period (1992-2001) supporting the general conclusion that EPS outperforms EVA® and SVA. Additionally, examining each independent variable year by year we still remain at the same conclusion. Indicatively, in the following Tables IV and V we present results for the EPS and EVA®.

Table IV shows the results (all years and annually) of the regression model, which represents earnings levels and earnings changes. First, for the pooled cross-sectional and intertemporal (all years) sample, the model is significant at 0.01 level ($F = 9.577$ and sign. $= 0.000$), suggesting that the Easton and Harris (1991) model provides a satisfactory description of the relationship between stock returns and the EPS. Second, the coefficients a_1 and a_2 are statistically significant at the 0.01 and 0.05 level respectively suggesting that both EPS levels and EPS changes are associated with stock returns. The reported R^2 is 0.019, relatively low to be considered as the main explanatory factor for stock returns. Results from the individual year cross-sectional sample revealed the following: nine out of the ten regressions (except the year 1993) are significant according to F statistics, and six of them (years 1992, 1994, 1995, 1999, 2000, 2001) are significant at the 0.01 level, two are significant at the 0.05 level (years 1996 and 1998), while one is significant at the 0.1 level (year 1997). This suggests that the Easton and Harris (1991) model provides a satisfactory description of the relationship between stock returns and the EPS. Moreover, most of the coefficients in annual regressions are statistically significant according to t-statistics, suggesting that EPS is associated with stock returns. What is important to notice in these annual regressions is the relatively high R^2s, ranging from 0.286 in year 1992 to 0.149 in year 2001.

EVA® results are reported in Table V. For the pooled cross-sectional and intertemporal (all years) sample, according to F statistics the model is significant at the 0.01 level, suggesting that the Easton and Harris (1991) model provides a satisfactory description of the relationship between stock returns and the EVA®. However, only the coefficient d_1 is statistically significant at the 0.01 level while the same does not happen for the coefficient d_2 suggesting that EVA® is associated with stock returns while change in EVA® is not. As for the individual year cross-sectional sample, reported results are not encouraging. Only two out of the ten regressions (years 1997 and 1998) are significant at the 0.05 and 0.1 level according to F statistics. Most of the coefficients in annual regression are not statistically significant according to t-statistics, suggesting that EVA® is not associated with stock returns at least at the individual year's level. Significant R^2s are those of the years 1997 and 1998, which are 0.074, and 0.040 respectively.

Incremental information content approach

To test the incremental information power, each traditional performance measure (EPS, ROI and ROE) is combined pairwise with each one of the value-based performance measures (EVA® and SVA) forming six different equations (6 to 11). An

	a_0	a_1	a_2	R^2	F	Number of observations
All years						
Coef.	0.0441	0.0950	0.0058	0.019		977
t	(2.003)**	(3.748)***	(2.478)**		(9.577)***	
Sign.	[0.045]	[0.000]	[0.013]		[0.000]	
2001						
Coef.	−0.5220	2.6550	0.0003	0.149		163
t	(−18.662)***	(5.242)***	(0.140)		(13.993)***	
Sign.	[0.000]	[0.000]	[0.889]		[0.000]	
2000						
Coef.	−0.7120	3.3080	−0.2630	0.067		144
t	(−20.269)***	(3.187)***	(−1.243)		(5.090)***	
Sign.	[0.000]	[0.002]	[0.216]		[0.007]	
1999						
Coef.	0.7480	0.0288	0.2430	0.178		130
t	(16.860)***	(0.473)	(4.763)***		(13.724)***	
Sign.	[0.000]	[0.637]	[0.000]		[0.000]	
1998						
Coef.	0.8150	0.2370	−0.0030	0.071		118
t	(16.825)***	(2.899)***	(−0.358)		(4.394)**	
Sign.	[0.000]	[0.004]	[0.721]		[0.014]	
1997						
Coef.	0.0697	0.1820	0.0009	0.046		106
t	(1.256)	(2.231)**	(0.119)		(2.505)*	
Sign.	[0.212]	[0.028]	[0.906]		[0.087]	
1996						
Coef.	−0.2040	0.0030	0.0418	0.094		80
t	(−5.186)***	(0.162)	(2.750)***		(3.977)**	
Sign.	[0.000]	[0.872]	[0.007]		[0.023]	
1995						
Coef.	0.1120	0.0480	0.0068	0.165		73
t	(3.339)***	(1.756)*	(3.249)***		(6.902)***	
Sign.	[0.001]	[0.083]	[0.002]		[0.002]	
1994						
Coef.	−0.2610	0.0350	0.0611	0.200		71
t	(−7.630)***	(1.097)	(4.114)***		(8.476)***	
Sign.	[0.000]	[0.277]	[0.000]		[0.001]	
1993						
Coef.	0.4740	−0.0326	0.0216	0.053		55
t	(7.210)***	(−0.445)	(1.666)*		(1.463)	
Sign.	[0.000]	[0.658]	[0.100]		[0.241]	
1992						
Coef.	−0.2860	0.2410	0.0082	0.286		37
t	(−5.006)***	(2.847)***	(3.681)***		(6.814)***	
Sign.	[0.000]	[0.007]	[0.001]		[0.003]	

Table IV. Relative information content approach

Notes: *Significance at 10 per cent level; **significance at 5 per cent level; ***significance at 1 per cent level. Regressions of annual stock returns to earnings levels and earnings changes; Model (1): $\text{Returns}_t = a_0 + a_1\ \text{EPS}/P_{t-1} + a_2\ \Delta\text{EPS}/P_{t-1} + u_1$

	d_0	d_1	d_2	R^2	F	Number of observations
All years						
Coef.	0.0455	−0.0467	0.0003	0.009		977
t	(2.039)**	(−2.856)***	(0.997)		(4.546)***	
Sign.	[0.042]	[0.004]	[0.319]		[0.011]	
2001						
Coef.	−0.4540	−0.0258	−0.0078	0.019		163
t	(−17.472)***	(−1.348)	(−1.086)		(1.578)	
Sign.	[0.000]	[0.179]	[0.279]		[0.210]	
2000						
Coef.	−0.6560	0.0883	−0.0575	0.014		144
t	(−22.675)***	(1.279)	(−0.598)		(0.997)	
Sign.	[0.000]	[0.203]	[0.551]		[0.372]	
1999						
Coef.	0.8670	0.0748	0.0083	0.033		130
t	(20.277)***	(1.700)*	(1.402)		(2.173)	
Sign.	[0.000]	[0.092]	[0.163]		[0.118]	
1998						
Coef.	0.8330	0.0187	0.0288	0.040		118
t	(14.570)***	(0.304)	(1.957)*		(2.397)*	
sign	[0.000]	[0.761]	[0.053]		[0.095]	
1997						
Coef.	0.1910	0.1590	0.0001	0.074		106
t	(3.455)***	(2.700)***	0.678		(4.128)**	
Sign.	[0.001]	[0.008]	[0.499]		[0.019]	
1996						
Coef.	−0.1600	−0.0154	0.0020	0.016		80
t	(−4.327)***	(−0.932)	(0.565)		(0.614)	
Sign.	[0.000]	[0.354]	[0.573]		[0.529]	
1995						
Coef.	0.1270	0.0397	−0.0018	0.039		73
t	(3.409)***	(1.640)*	(−0.301)		(1.409)	
Sign.	[0.001]	[0.100]	[0.764]		[0.251]	
1994						
Coef.	−0.2400	0.0006	0.0248	0.007		71
t	(−6.206)***	(0.024)	(0.634)		(0.232)	
Sign.	[0.000]	[0.981]	[0.529]		[0.793]	
1993						
Coef.	0.4470	−0.0345	−0.0048	0.032		55
t	(6.293)***	(−1.096)	(−0.810)		(0.853)	
Sign.	[0.000]	[0.278]	[0.422]		[0.432]	
1992						
Coef.	−0.1830	−0.0820	0.0115	0.050		37
t	(−3.224)***	(−0.572)	(1.265)		(0.888)	
Sign.	[0.003]	[0.571]	[0.241]		[0.421]	

Notes: *Significance at 10 per cent level; **significance at 5 per cent level; ***significance at 1 per cent level. Regressions of annual stock returns to EVA® levels and EVA® changes; Model (4) $\text{Returns}_t = d_0 + d_1\ \text{EVA}/P_{t-1} + d_2\ \Delta\text{EVA}/P_{t-1} + u_4$

Table V. Relative information content approach assumption of a linear relationship between these variables was made. All regression models were tested for multicollinearity using the variance inflation factor (VIF). According to Neter *et al.* (1985) a VIF in excess of 10 is often taken as an indicator of severe multicollinearity, while mild multicollinearity exists when the VIF is between 5 and 10. A VIF lower than 5 indicates that multicollinearity does not exist. The reported VIF from our regressions are mostly less than 5. Examination of residual plot and normality plot reveal no serious violations of the regressions' assumptions. There was an attempt to correct these minor violations, but the outcome was either produced regressions with insignificant coefficients or regressions with similar explanatory power to the initial ones.

Table VI shows the detailed results from the pairwise combinations of one traditional performance measure and one value-based performance measure. It is noticed that regressions (6), (7), (8), (9), and (10) are significant at 0.05 level or better, whereas regression (11) is statistically insignificant. The highest R^2 (7.2 per cent) is reported in regression (6), which combines EPS, ΔEPS and EVA®, ΔEVA. This suggests that the combination of EPS and EVA® represents the most satisfactory explanation for stock returns in the Greek stock market. Chen and Dodd (1997, 2001) and Worthington and West (2001) revealed almost similar results for the US and Australian capital markets respectively. They found that EVA® is a useful measure for measuring the financial corporate performance, especially when it is combined with EPS. All other examined models have reported low R^2s (lower than 2.1 per cent). Sensitivity analysis for different testing periods (1992-1996, 1997-2001, 1992-1994, 1995-1997, 1998-2001) showed almost similar results.

Conclusions

Relative information content approach revealed that in the Greek stock market earnings levels and earnings changes are associated with stock returns and outperform the other performance measures under examination (ROI, ROE, EVA® and SVA) in explaining stock returns, largely consistent with that revealed by Kyriazis and Anastasis (2007) for the same market. These results are consistent to those reported for various international markets. Easton and Harris (1991) found that earnings levels and earnings changes are associated with stock returns for the US market. Biddle *et al.* (1997) and Chen and Dodd (2001) found that earnings outperform EVA® and residual income in the US stock market. Günther *et al.* (2000) and Worthington and West (2001) revealed similar results for the German and Australian stock markets respectively, while Peixoto (2002) found that EVA® does not have more information content than traditional performance measures in explaining equity market value in the Portuguese Stock Market. On the other hand, our results do not support the claims of Stewart (1991) and the advocates of EVA® financial management system that EVA alone is the best performance measure.

However, incremental information content approach revealed that when EPS is examined along with EVA®, the explanatory power in explaining stock returns increases significantly from 1.9 to 7.2 per cent. This suggests that the new information provided by the EVA® is of some value relevance in explaining stock returns. The relatively low explanatory power of performance measures under examination is largely consistent with the reported results from several relevant studies conducted for the US market. Chen and Dodd (1997) found that EVA® variables and accounting profit variables could not explain more than 47 per cent of the variation of stock returns. Moreover, a study of Chen and Dodd (2001) provided evidences that EPS and

Table VI. Incremental information content approach – pairwise combinations

Regression	All years	CONST	EPS	ΔEPS	ROI	ΔROI	ROE	ΔROE	EVA	ΔEVA	SVA	R^2	F	Number of observations
6	Coef.	−0.0249	0.2580	0.0056					−0.1570	0.0001		0.072		976
	t	(−1.073)	(7.772)***	(2.464)**					(−7.355)***	(0.405)			(18.761)***	
	Sign.	0.283	0.000	0.014					0.000	0.686			0.000	
	VIF		1.834	1.004					1.824	1.006				
7	Coef.	0.0406	0.0958	0.0057							−0.0020	0.020		976
	t	(1.848)*	(3.795)***	(2.451)**							(−0.966)		(6.773)***	
	Sign.	0.065	0.000	0.014							0.334		0.000	
	VIF		1.004	1.004							1.001			
8	Coef.	0.0281			0.0630	0.0032			−0.0680	0.0003		0.021		976
	t	(1.243)			(2.195)**	(2.173)**			(−3.730)***	(1.000)			(5.141)***	
	Sign.	0.214			0.028	0.030			0.000	0.317			0.000	
	VIF				1.293	1.025			1.267	1.000				
9	Coef.	0.0366			0.1480	0.0022					−0.0126	0.015		976
	t	(1.635)			(2.887)***	(1.465)					(−3.005)***		(4.904)***	
	Sign.	0.102			0.004	0.143					0.003		0.002	
	VIF				4.119	1.080					4.021			
10	Coef.	0.0420					0.0001	0.0009	−0.0528	0.0003		0.011		976
	t	(1.869)*					(0.027)	(1.027)	(−3.072)***	(0.977)			(2.599)**	
	Sign.	0.062					0.979	0.305	0.002	0.319			0.035	
	VIF						1.002	1.113	1.115	1.001				
11	Coef.	0.0556					−0.0003	0.0013			−0.0044	0.002		976
	t	(2.519)**					(−0.059)	(1.102)			(−1.458)		(0.711)	
	Sign.	0.012					0.953	0.271			0.145		0.546	
	VIF						1.000	2.126			2.126			

Notes: *Significance at 10 per cent level; **significance at 5 per cent level; ***significance at 1 per cent level. Incremental/One traditional measure + One value-based measure

EVA® could not explain more than 23.49 per cent of stock returns. These results support the claims of many scholars that more determinants should be employed to assess the value of the firm. This evidence suggests that the participants in the Greek stock market should pay additional attention to that relatively new value-based performance measure but they should also examine more other determinants to develop their investment strategies.

There are various ways in which this study may be extended. As for the value relevance of performance measures in explaining stock returns:

- to test the data using alternative dependent variables (two-year or five-year return interval);
- to adopt the same methodology in a sample which will be constituted of data coming from a greater ten-year window than we have employed;
- to compare companies adopting national accounting standards and those adopting International accounting standards (IAS);
- to use as a dependent variable the market value added (MVA), since most of the studies supporting the superiority of EVA® are based on this model (Stewart, 1991; Milunovich and Tsuei, 1996; O'Byrne, 1996; Uyemura *et al.*, 1996);
- to calculate the cost of capital in a different way, such as employing the suggested method of Rappaport (1998) and Stewart (1999) where they proposed a standard risk premium, or to use Arbitrage Pricing Theory (APT);
- to use Stern Stewart & Co. tailored EVA® figures, which however are still not available for the Greek companies; and
- to examine other performance measures such as Tobin's *Q* or other integrated financial management systems such as balanced scorecard and intellectual capital.

This study could not separate those who adopted the value-based performance measures from those that did not. A study comparing performance of companies that have implemented an EVA® system to those who have not would also be valuable. It also seems essential to investigate the ability of other measures of short-term performance to reflect long-run value added. We also think that it should be useful (over a longer time frame and with more available data) to repeat our study and to compare the results, following the methodology of Wallace (1997). Perhaps the results of this study will reveal the real prospect of the value relevance of EVA® in the Greek capital market. EVA® proponents have also argued that an effective implementation of EVA® requires a commitment on the part of companies to make it the cornerstone of a total financial management system. It is proved that the company attributes the lack of success in many EVA® implementations to four factors:

(1) EVA® is not a way of life;

(2) EVA® is implemented too fast;

(3) lack of conviction by the CEO or division head; and

(4) inadequate training (Stern *et al.*, 1995).

These discussions suggest a number of testable hypotheses regarding determinants of the measure effectiveness. However, at the moment this kind of research cannot be carried out in Greece since we do not have EVA® adopters.

Another important suggestion for further research is to explore the value relevance of other factors beyond the above examined performance measures in explaining stock market returns. Behavioural finance provides a good ground for this. Moreover, comparative studies within stock markets with similar market characteristics as these of Greece (e.g. transitory from emerging to mature market, owner structure, small capitalisation, and especially the monetary relations with the EU) should add value to this kind of research.

Notes

1. CFROI® is a registered trademark of Holt Value Associates, LLP.
2. This calculation framework is available on request.

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