Relationship between Shareholder Value Added and the Accounting-based Performance Measures: An Econometric Analysis

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Abstract

This empirical study aimed to investigate the most important accounting-based performance measures that contribute to shareholder value added (SVA). Our research employed econometric modelling, with a specific emphasis on panel data analysis. We carefully selected variables by analysing the quarterly earnings announcements from companies in the Dow Jones. The chosen variables were then subjected to fixed- and random-effects regressions, with several specification tests used to determine the best estimator. To avoid spurious regression in our panel data analysis, we applied a causality framework that involved testing for stationarity, cointegration, and causality. Additionally, we estimated an error-correction model and a cointegration regression to identify the long-run relationship between the dependent and independent variables. Our sample data covered the 30 companies in the Dow Jones over 20 years (2001-2020), and Stata 17.0 and EViews 12 were used to perform the econometric analysis.

The key findings of the research were as follows: First, the analysis provides evidence that diluted earnings per share, the change in free cash flow, return on assets, the change in total debt, and investment have a positive and significant impact on shareholder value added. Second, the variables are cointegrated, and the cointegration regression was successfully identified. Third, the error-correction term was significant in the error-correction model, confirming its role in adjusting to deviations from the long-run equilibrium. Finally, after thorough testing, a fixed-effects panel-data model was estimated.

Our empirical study focused on accounting-based measures and examined a larger number of variables than prior research. This differs from previous studies that compared the theoretical explanatory power of value-based and traditional accounting-based measurements using only a few variables of each. Our selection of variables was based on semantic analysis of quarterly earnings announcements, ensuring the consistency of our findings. In summary, this study aims to identify the accounting measures to develop an econometric model that predicts annual shareholder value added (SVA).

Keywords: shareholder value added, accounting-based performance measures, Sarbanes-Oxley act, SEC-Security Exchange Commission and panel data models

1. Introduction

1.1 Problem Statement

Prior studies on Shareholder Value primarily examined the differences between accounting-based and value-based measures. However, these studies lacked an in-depth analysis of each approach. The accounting-based measures have shown stronger results in empirical research, while the value-based measures have proven their strength in theoretical research. Recognising a gap in the literature concerning accounting-based measurements, our study aims to enhance discrimination by using key accounting measures to generate shareholder value added.

Due to the situation in the US stock market, which prompted the Securities and Exchange Commission (SEC) to issue Regulation G on Nov. 2, 2002, we were motivated to conduct this research. Prior to the SOX (Sarbanes-Oxley) Act, issued on July 30, 2002, management in poor-performing industries was opportunistic and, due to their stock-option compensation, was oriented toward dubious earnings management practices (Cohen et al., 2005, p. 2).

The quarterly earnings announcements were driving stock prices and market values higher through fraudulent activities. As a result, the earnings to be considered for academic research were unreliable. In response to the situation, the Securities and Exchange Commission (SEC) issued cautionary guidance on the use of pro forma information in earnings releases on Dec. 4, 2001. It established rules limiting the use of non-GAAP financial information in Regulation G on Nov. 2, 2002. The main objective of the SEC was to implement the requirements of the Sarbanes-Oxley Act and ensure that companies' quarterly earnings announcements (Bowen et al., 2005, p. 1010) were more reliable, transparent, and comparable than in the past, without misleading or biased accounting adjustments. Our research covers the 30 companies of the US Dow Jones Index during the post-SOX period from 2001 to 2020. This era demonstrated a significant decline in earnings management (Cohen, 2005, p. 2). Further, data reliability improved compared to the pre-SOX era.

1.2 Research Hypothesis

Our main objective, to be tested by the research, is to determine which accounting-based variables have a positive and significant association with explaining Shareholder Value (SVA). The main discipline requires econometrics, and related subdisciplines include stationarity (unit root tests), cointegration tests, causality tests, the error-correction model, cointegration regression, and panel data.

The related research sub-objectives are:

(1) To search for the key accounting variables to be considered

(2) To identify the data source and collection

(3) To examine the preferred specification for the econometric model

(4) To define the statistical hypothesis testing

(5) To understand causality (stationarity, cointegration and causality tests)

(6) To estimate the error-correction model and cointegration regression.

(7) To identify the correct panel data estimator and final estimation

2. Literature Review

2.1 Theoretical Review

Friedman (1970) proposed the shareholder value theory in an essay for 'The New York Times' titled "A Friedman Doctrine: The social responsibility of business to increase its Profits". He argued that the company is only responsible to the shareholders. As a result, the firm's main goal is to increase revenue and profits and maximise returns to shareholders.

Before Friedman's article, certain authors exerted significant influence on the development of shareholder value theory. For instance, Hamilton (1777) and Marshall (1890) introduced crucial concepts such as the value to the owner and excess profit (residual income), while Modigliani & Miller (1958) contributed to our understanding of firm value, the cost of capital, capital structure, and the theory of investment. Similarly, Jensen (1986) made noteworthy contributions regarding the advantages of debt, takeovers and expansion, and the productivity of financial restructurings and debt.

In the late 1970s and early 1980s, the shareholder value theory was growing due to the active market for corporate control (takeovers), restructuring of firms, pay packages of senior management related to the increase of market value (MV), and increased penetration of equity holdings as a percentage of household assets (Copeland et al., 2000).

The differences and inconsistencies between accounting-based performance measures and shareholder value creation have long been recognised, and different approaches have been developed (Martin & Petty, 2000). The main value-based measures were defined by Stewart (1991) with economic value added (EVA) and market value added (MVA), Rappaport (1986) with shareholder value added (SVA), Madden (1999) with cash flow return on investment (CFROI), Ottoson & Weissenrieder (1996) with cash value added (CVA), and Fernández (2002) with SVA and created shareholder value (CSV). All of them are prominent authors who have developed various theories on shareholder value creation. Their frameworks offer valuable insights into value creation, including identifying key business value drivers, developing new performance indicators, and gaining acceptance within organisations (Warner et al., 2001, p. 95).

Biddle et al. (1997) studied a sample of 6,174 American companies from 1983 to 1994. They found that earnings before extraordinary items had greater explanatory power than residual income, EVA, and cash flows from

operations in explaining stock returns. O'Byrne et al. (1998) argued that Biddle's regressions ignored the cost of capital, and the explanatory power they attributed to net operating profit after tax (NOPAT) is really attributable to 'NOPAT plus capital', and they needed to consider a model of expected EVA improvement from the EVA valuation equation.

Fernández (2002) analysed 582 American companies using EVA, MVA, NOPAT, and the weighted average cost of capital (WACC) data from Stern Stewart over 10 years. The average correlations between the annual increase in MVA and the increases of EVA, NOPAT, and WACC were substantially low. He also found that for the 100 most profitable companies in the world, the correlation between shareholder returns and increases in CVA was low at 1.7% over the period 1994 to 1998. Additionally, he analysed the relationship between shareholder value creation and various other parameters, including economic profit and EVA, for the 28 largest Spanish companies during the period 1991 to 1997. Economic profit had the highest correlation with shareholder value creation in only 4 companies; with EVA, the highest correlation was found in only 2 companies; and with interest rate, the highest correlation was found in 18 companies. He concluded that EVA, economic profit, and CVA cannot measure value creation.

In our case, we adopted SVA (Fernández, 2002, p. 5) as the dependent variable. The shareholder value added is calculated as follows:

SVA = Increase of equity market value + Dividends paid during the year + Other payments to shareholders (discounts on par value, share buy-backs…) – Outlays for capital increases, exercise of options and warrants – Conversion of convertible debentures. (1)

We adopted the following as a proxy:

SVA (proxy) = Increase of equity market value + Dividends paid during the year + Other payments (share buy-backs). (2)

From a theoretical perspective, Fernández's (2002) theory of Shareholder Value Added (SVA) and Created Shareholder Value (CSV) provides a comprehensive and critical approach to value-based management, emphasising the alignment of corporate strategy with shareholder interests. His work introduces concepts and refinements that differ from those of other value-based measures such as EVA, MVA, CFROI, and CVA.

2.2 Empirical Review

We will proceed to a critical review of the most relevant and significant research on our topic. Based on the methodology, Panigrahi (2015, 2017) examined stationarity (unit root tests), the error-correction model, and random-effects panel data, with EPS, EVA, and the dividend payout ratio showing a positive and significant contribution to the created shareholder value (CSV). Pasha & Ramzan (2019) studied stationarity (unit root tests), cointegration tests, and cointegration models (FMOLS and DOLS) using EVA, ROA, liquidity, and leverage, with the highest contribution to stock returns. Barth et al. (2023) used classification and regression trees (CART) under the assumption of a decreasing value relevance of accounting measures. However, their findings revealed no indication of a decline in the explanatory power of earnings. All the other studies focused on pairwise correlations, simple and multiple OLS regressions, and panel data.

We found panels of 3 to 10 years per cross-section in previous research, except for Barth et al. (2023), which used a sample of 192,463 firm-years observations covering the period from 1962 to 2014. We used panel data with 19 years per cross-section to ensure the reliability of the tests.

Toft et al. (2015) studied a sample of 618 articles citing Biddle's (1997) seminal article from 1997 to 2014. They classified researchers who supported accounting-based measures separately from those who believed that value-based measures held greater explanatory power for shareholder value, and analysed the 21 articles that contributed new evidence. They found that the theoretical perspective favours management control systems based on residual income measures, whereas the empirical perspective favours accounting-based measures as superior for measuring shareholder value creation. The value-based measures are theoretically superior to the accounting-based measures, but have not been empirically more robust. According to Pasha & Ramzan (2019, p. 1), it is unclear whether anyone can be deemed more efficient or superior.

During this period of 1997 to 2014, the articles supporting the use of accounting-based measures were: Chen & Dodd (2001), Ismail (2006), Kyriazis & Anastassis (2007), Holler (2008), Kaur & Narang (2009), Maditinos et al. (2009), and Kumar & Sharma (2011), and those supporting the value-based measures were: Bacidore et al. (1997), Feltham

et al. (2004), Worthington & West (2004), and Parvaei & Farhadi (2013). Our research focuses deeply on accounting-based measures, as studies that specifically address value or accounting-based measures are lacking.

Fama & French (2015) studied the five-factor model, which adds operating profitability and investment factors to the market, size, and book-to-market (B/M) factors of their previous three-factor model (Fama & French, 1992). The importance of their work lies in estimating expected stock returns at both the individual-stock and portfolio-management levels. This means that the accounting variables at the end of the fiscal year (t-1) explain the stock returns from July of the year (t) to June of the following year (t+1). Investment was considered an independent variable in our study; it had not been explored in previous research, except for Fama & French (2015), Altaf (2016), Gunaratne et al. (2016), and Barth et al. (2023).

Panigrahi et al. (2015) studied 28 publicly listed construction companies in the main market of Bursa Malaysia stock exchange and using a fixed-effects panel data found a positive and significant relationships of earnings per share (EPS) and EVA to the SVA, return on assets (ROA) was also negatively associated with SVA, and return on equity (ROE), return on net worth (RONW) and return on capital employed (ROCE) were not significantly associated. Additionally, Panigrahi (2017) studied a sample of 43 publicly listed construction companies in the Malaysian market and identified random-effects panel data as the best estimator for the CSV, and found it to be positively associated with EPS, EVA, and the dividend payout ratio (DPR). Unit root tests were performed on the analysed variables; they were found to be stationary and non-parametric. The error-correction model and the long-run relationship between variables were identified using the Engle-Granger two-step method, and the coefficient of the first lag of the residuals at -0.58 indicates that the speed of convergence (error-correction term) in the error-correction model is acceptable.

Numerous studies supported the use of accounting-based measures between 2015 and 2023, including Agrawal (2017), Aladwan & Alzubaidi (2023), Ali Khan et al. (2016), Alipour & Pejman (2015), Altaf (2016), Barth et al. (2023), Chattopadhyay et al. (2015), Gunaratne & Anuradha (2017), Makhija & Trivedi (2020), Mathangi & Vijaykarthigeyan (2020), Nugroho et al. (2019), Panigrahi (2017), and Pasha & Ramzan (2019). Those that supported the use of value-based measures were Alsoboa (2017), Blendinger & Michalski (2018), Deepa & Thilagavathi (2017), Fayed & Dubey (2016), Gupta & Sikarwar (2016), Panigrahi et al. (2015), and Rakshit et al. (2017). In summary, 66.7% of the studies favoured accounting and mainly empirical aspects, and 33.3% favoured value-based measures and focused on theoretical aspects.

The following dependent variables were specified in percentages in the articles between 2015 and 2023: stock returns at 42.8%, MVA at 23.8%, stock prices at 14.3%, CSV at 9.5%, EVA at 4.8%, and SVA at 4.8%. Value creation cannot be measured by EVA, economic profit, and cash value added (CVA) (Fernández, 2002). Stock prices are not an accurate measure of value creation. This indicates that 19.1% of the articles were incorrectly specified as the dependent variable.

Zumente & Bistrova (2021) examined the impact of environmental, social, and governance (ESG) performance on long-term shareholder value by identifying the critical factors. Based on a qualitative analysis, the main critical factors are improving financial performance, reducing uncertainty and risk, improving capital policy and management, and fostering more positive relationships with stakeholders such as employees and customers. Moreover, increase shareholder value by developing intangible asset value. During our investigation, the ESG scores could not be considered as the Reuters data has only been available since 2015. It was not feasible to lose 13 observations.

Researchers have consistently used the same independent variables from 2015 to 2023, including EVA, EPS, net income (NI), ROE, ROA, ROCE, as well as NOPAT, DPR, and RONW. However, no variables from the literature on expected stock returns were considered.

Stock returns as a dependent variable were specified in 42.8% of the articles from 2015 to 2023, and this measure has certain limitations. It is only good for measuring performance in the short term; thus, to measure shareholder value performance in the long term, it is advisable to use other proxies such as MVA (Nugroho et al., 2019, p. 6) or SVA. We adopted shareholder value added (SVA) as the dependent variable.

3. Methodology

3.1 Identification of the Independent Variables

In our investigation, we examined how often the variables appeared in quarterly earnings announcements for the first quarter of 2022. Table 1 summarises the identified variables and their frequencies of appearance.

Table 1. Variables and frequency of appearance. Sample period Q1-2022

Variables	Frequency	Variables	Frequency
Diluted earnings per share (EPS)	30	Capital expenditures – Investments	3
Revenue	20	Operating earnings before interest and taxes (EBIT)	3
Net income	17	Gross margin	3
Operating income	14	Adjusted free cash flow (FCF)	2
Operating cash flow	13	Market share	2
Sales	12	Operating earnings before interest, taxes, depreciation and amortisation (EBITDA)	2
Dividend per share	10	Book value per share	2
Share repurchases	10	Selling general and administrative expenditures (SG&A)	2
Free cash flow (FCF)	8	Return on capital employed (ROCE)	1
Return on equity (ROE)	5	Efficiency ratio	1
Tax rate	4	Interest expenditures	1
Debt ratio	3	Research and development (R&D)	1
		Operating expenditures	1

At this stage of the analysis, we selected the following independent variables: Diluted earnings per share (EPS), Revenue, Net Income, Dividend per share, Share repurchases, Free Cash Flow, Return on equity, Return on assets, Total debt, and Investments. The dependent variable is the Shareholder Value Added. It has been defined in equation 2 as a proxy to Fernandez's formula (1) already mentioned in the theoretical literature review.

3.2 Data Collection

The sample data covered the 30 Dow Jones companies over the period 2001 to 2020. Based on calculations, we have 19 years of cross-section data, totalling 570 observations, and the financial data were sourced from the LSEG Eikon Workspace (Note 1). Stata 17.0 and EViews 12 were used to perform the econometric analysis.

3.3 Formulation of a General Model

The variables were specified in levels (1^{st} lag) and first differences to capture their significance in the long and short-term contributions (Easton & Harris, 1991, p.23). As the authors note, there is no theoretical support for this approach, but it is empirically very efficient. We scaled (divided) each term in the regression by total assets at the beginning of the fiscal year to mitigate potential heteroskedasticity and enhance cross-firm comparability. In summary, every variable was divided by the total assets for the fiscal year ending in t-1.

Based on the first attempt at a fixed-effects panel data regression and the correlation matrix, we reduced the variables from a general unrestricted model, one at a time, by removing the variable with the least significant coefficient (Hendry, 1985).

In the end, the following variables were selected: shareholder value added as the dependent variable; diluted earnings per share; the change in free cash flow; return on assets; the change in total debt; and investment as independent variables. The dependent and independent variables were scaled by total assets at the beginning of the year (Baker et al., 2003, p. 20).

Investment data was obtained from the statement of cash flows, specifically cash flow from investing activities, including capital expenditures and other investing cash flow items such as the acquisition of businesses (Bond et al., 1997, p. 7).

The general specification of the model, based on Easton & Harris (1991), is the following:

$$\frac{Y_{it}}{A_{i,t-1}} = \beta_0 + \sum_{i=1}^{N}\sum_{t=1}^{T}\left(\beta_i \frac{X_{i,t-1}}{A_{i,t-1}} + \beta_{i+1}\frac{\Delta X_{it}}{A_{i,t-1}}\right) + \varepsilon_{it} \quad (3)$$

The model with the final selection of variables is the following:

$$\frac{SVA_{it}}{A_{i,t-1}} = \beta_0 + \beta_1 \frac{EPS_{i,t-1}}{A_{i,t-1}} + \beta_2 \frac{\Delta FCF_{it}}{A_{i,t-1}} + \beta_3 \frac{ROA_{i,t-1}}{A_{i,t-1}} + \beta_4 \frac{\Delta DEBT_{it}}{A_{i,t-1}} + \beta_5 \frac{INV_{i,t-1}}{A_{i,t-1}} + \varepsilon_{it} \quad (4)$$

where:

SVA_{it} = Shareholder value added

EPS_{it-1} = Diluted earnings per share (1st lag)

ΔFCF_{it} = The change in free cash flow (1st diff.)

ROA_{it-1} = Return on assets (1st lag)

$\Delta DEBT_{it}$ = The change in total debt (1st diff.)

INV_{it-1} = Investment (1st lag)

A_{it-1} = Total assets (1st lag)

β_0 = Intercept

$\beta_1 \ldots \beta_6$ = coefficients

ε_{it} = residuals

3.4 Statistical Hypothesis Testing

The following null hypothesis has been defined based on the shareholder value theory, literature review and the selected variables:

$H_0$1: Diluted earnings per share (EPS) are not statistically significant in explaining the Shareholder Value Added.

$H_0$2: The change in free cash flow (ΔFCF) is not statistically significant in explaining the Shareholder Value Added.

$H_0$3: Return on assets (ROA) is not statistically significant in explaining the Shareholder Value Added.

$H_0$4: The change in total debt (ΔDEBT) is not statistically significant in explaining the Shareholder Value Added.

$H_0$5: Investment (INV) is not statistically significant in explaining the Shareholder Value Added.

3.5 Cointegration and Causality

To avoid spurious regression in our panel data analysis, we applied a causality framework that involved testing for stationarity (using Lütkepohl's lag-order selection and Fisher-type unit-root tests), cointegration (using methods such as Kao, Pedroni, Engle-Granger two-step method and Johansen tests), and causality (specifically using the pairwise Granger causality test).

3.6 Error-correction Model and Cointegration Regression

An error-correction model was estimated using the Engle-Granger two-step method to determine the coefficient and significance of the error-correction term. At the same time, a cointegration regression was conducted using the FMOLS estimator to ensure robustness of the long-run relationship.

3.7 Panel Data Estimation

Fixed- and random-effects were regressed, and the Hausman test and several other tests were conducted.

4. Results and Discussion

4.1 Descriptive Statistics

This section presents the statistical analysis, multicollinearity analysis based on the correlation matrix, and the variance inflation factor (VIF) test of the independent variables. The variance inflation factor (VIF) is widely accepted and recommended in literature (Kutner et al., 2005).

Table 2. Descriptive statistics

Variable	Transformation	Mean	Std. dev.	Variance	Skewness	Kurtosis
SVAa	SVA_{it}/A_{it-1}	0.2764	1.0555	1.1142	9.2406	124.15
EPSc	$EPS_{it-1}*1000/A_{it-1}$	0.0452	0.1135	0.0128	-14.892	297.85
ΔFCFa	$\Delta FCF_{it}/A_{it-1}$	0.0117	0.0508	0.0025	3.9744	42.501
ROAb	ROA_{it-1}/A_{it-1}	-0.0067	0.1448	0.0209	-22.816	532.85
ΔDEBTa	$\Delta DEBT_{it}/A_{it-1}$	0.0255	0.0652	0.0042	2.3461	11.774
INVb	INV_{it-1}/A_{it-1}	0.0620	0.0692	0.0047	0.8132	9.2426

Number of observations = 569

Variable's subindexes indicate the type of variable's transformation.

The statistical analysis shows very low means, standard deviations, and variances, indicating that the variable transformation is consistent. The variables show a consistent positive sign, as expected, while the return on assets (ROA) shows a slightly negative mean over the entire period.

Table 3. Correlation matrix

	SVAa	EPSc	ΔFCFa	ROAb	ΔDEBTa	INVb
SVAa	1.0000					
EPSc	0.0319	1.0000				
ΔFCFa	0.2641	-0.4114	1.0000			
ROAb	0.0218	0.4194	-0.5235	1.0000		
ΔDEBTa	0.1460	0.0845	-0.1416	0.0440	1.0000	
INVb	0.2193	-0.1181	0.1317	0.0072	0.0251	1.0000

Number of observations = 559

The correlation matrix displays the correlations between all pairs of variables. Among these, one value exceeded the absolute value of 0.5: two fell within the range of 0.40 to 0.50, and all the remaining values were below 0.40. To assess the impact of these correlations on our regressions, we used a more comprehensive test of multicollinearity, the Variance Inflation Factor (VIF). This method is commonly utilised and recommended in existing literature (Kutner et al., 2005).

Table 4. Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
ΔFCFa	1.52	0.65803
ROAb	1.50	0.66556
EPSc	1.31	0.76439
INVb	1.04	0.96265
ΔDEBTa	1.03	0.97447
Mean VIF	1.28	

Analysts rely on informal rules of thumb to interpret multicollinearity when the largest VIF exceeds 10 (some analysts use a more conservative threshold of 30) and the mean VIF exceeds the critical value of 5. In our case, we did not violate the rules; the test indicated low multicollinearity, and we concluded that no significant multicollinearity or reliability problems would arise in our regressions.

4.2 Stationarity

We studied lag-order selection and panel-data unit roots for each variable to analyse their stationarity.

4.2.1 Lag-order Selection

We adopted the pre-estimated Lütkepohl's lag-order selection, which reports the final prediction error (FPE), Akaike's information criteria (AIC), Schwarz's Bayesian information criteria (SBIC) and Quinn information criteria (HQIC) lag-order selection statistics for vector autoregressions VARs and vector error- correction models VECMs. The different tests selected a model with four lags (Lütkepohl, 2005). As shown by Nielsen (2001), the lag-order selection discussed here can be used in the presence of I(1) variables.

Table 5. Lutkepohl's lag-order selection criteria

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	4895.59				8.5e-18	-39.330	-39.330	-39.330
1	5622.33	1453.5	36	0.000	3.7e-19	-42.477	-42.345	-42.142
2	5963.51	682.36	36	0.000	9.1e-20	-43.867	-43.603	-43.198
3	6104.75	282.47	36	0.000	5.7e-20	-44.347	-43.950	-43.342
4	6278.62	347.76*	36	0.000	3.0e-20*	-44.975*	-44.446*	-43.635*

Number of observations = 439

(*) Optimal lag

Endogenous: SVAa, EPSc, ΔFCFa, ROAb, ΔDEBTa, and INVb

Exogenous: _constant

4.2.2 Panel Data Unit-root Tests

To ensure the accuracy of our regression results (i.e., non-spurious), we had to analyse the seasonality of the variables. To do this, we performed the Fisher unit-root test (Whitehead, 2002, sec. 9.8) based on the augmented Dickey-Fuller test with four lags, and we demeaned the series to mitigate potential cross-sectional dependence (Levin et al., 2002).

Table 6. Panel data unit-root tests

Variable	Statistic (Z)	p-value	Variable	Statistic (Z)	p-value
SVAa	-4.0040	0.0000	ΔSVAa	-6.1819	0.0000
EPSc	4.1148	1.0000	ΔEPSc	-6.5515	0.0000
ΔFCFa	-4.1883	0.0000	ΔΔFCFa	-7.3828	0.0000
ROAb	-4.9506	0.0000	ΔROAb	-10.2446	0.0000
ΔDEBTa	-0.5792	0.2812	ΔΔDEBTa	-3.2093	0.0007
INVb	0.5630	0.7133	ΔINVb	-3.2725	0.0005

Fisher-type based on augmented Dickey-Fuller tests.

H_0: All panels contain unit roots.

H_a: At least one panel is stationary.

ADF regressions: 4 lags

The Fisher tests revealed that all of the variables in the model show three probabilities (p-values) exceeding 0.05, which indicates a lack of stationarity; however, when examining the first differences of the variables, all of the tests have p-values lower than 0.05, rejecting the null hypothesis that all panels contain unit roots and indicating evidence of the stationarity of the first differences of the variables. This indicates that the model's variables are integrated of order one I(1).

4.3 Cointegration

We need to test whether there is evidence that the current variables are cointegrated in all panels and that the long-run relationship exists. We will use methods such as Kao, Pedroni, Engle-Granger two-step method and Johansen tests.

4.3.1 Kao and Pedroni Tests for Cointegration

We performed both cointegration tests on variables (time series) that are nonstationary to determine whether they exhibit a stable long-run cointegration relationship in our panel data.

Table 7. Kao and Pedroni Cointegration tests

Kao test	Statistic (t)	p-value
Modified Dickey-Fuller	-3.6157	0.0001
Dickey-Fuller	-7.2167	0.0000
Pedroni test	Statistic (t)	p-value
Modified Phillips-Perron	3.5073	0.0002
Phillips-Perron	-8.9922	0.0000

H_o: No cointegration

H_a: All panels are cointegrated

Lags (4), kernel (Bartlett) and demean

Both the Kao (1999) and Pedroni (1999, 2004) cointegration tests yield p-values below 0.05, thereby rejecting the null hypothesis. This leads to the conclusion that all panels exhibit evidence of cointegrated variables.

4.3.2 Engle-Granger Cointegration Test

The test proposed by Engle & Granger (1987) reports the test statistic and the critical values calculated by MacKinnon (2010).

Table 8. Augmented Engle-Granger test for cointegration

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-11.132	-5.292	-4.737	-4.449

Number of lags = 4

N(test) = 409

H_0 = The variables are not cointegrated

The augmented Engle-Granger cointegration test indicates that the statistic does not exceed the 1% critical value, and the null hypothesis is rejected. Consequently, we concluded that all panels exhibit evidence of cointegrated variables.

4.3.3 The Johansen Cointegration Test

The trace test reports the number of cointegration vectors, conditional on a trend specification and lag order (Johansen, 1995). We allowed for a linear deterministic trend and lag intervals (in first differences) of 1 to 4.

Table 9. Johansen cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.23544	508.882	95.753	0.000
At most 1*	0.20223	362.839	69.818	0.000
At most 2*	0.16707	239.928	47.856	0.000
At most 3*	0.10963	140.481	29.797	0.000
At most 4*	0.07798	77.311	15.494	0.000
At most 5*	0.05911	33.145	3.841	0.000

Unrestricted cointegration rank test (trace)

(*) denotes rejection of the hypothesis at the 0.05 level

(**) MacKinnon-Haug-Michelis (1999) p-values

The Johansen cointegration test yields p-values below 0.05, rejecting the null hypothesis of no cointegration equations. Additionally, the test confirms the existence of six cointegration equations at the 5% level.

Based on the results of the Kao, Pedroni, Engle-Granger, and Johansen cointegration tests, we concluded that there is strong evidence that the variables are cointegrated across all panels and that the regression is valid (not spurious).

4.4 Causality

By utilising pairwise Granger causality tests, we can test for causality within each equation of a vector autoregressive (VAR) model, providing a convenient alternative to testing (Granger, 1969).

Table 10. Pairwise Granger Causality tests

Null Hypothesis	Obs.	F-Statistic	Prob.
EPSc does not Granger-cause SVAa	561	91.6760	1.E-59
SVAa does not Granger-cause EPSc	561	1.34500	0.2520
ΔFCFa does not Granger-cause SVAa	559	53.4862	4.E-38
SVAa does not Granger-cause ΔFCFa	559	1.87852	0.1127
ROAb does not Granger-cause SVAa	561	178.184	7.E-98
SVAa does not Granger-cause ROAb	561	0.23170	0.9206
ΔDEBTa does not Granger-cause SVAa	549	0.94917	0.4351
SVAa does not Granger-cause ΔDEBTa	549	0.93188	0.4450
INVb does not Granger-cause SVAa	561	2.85005	0.0233
SVAa does not Granger-cause INVb	561	6.02950	9.E-05

Sample: 1 to 570 observations

Lags: 4

We concluded that the independent variables cause shareholder value added (SVA), and the Granger tests rejected the null hypothesis with p-values below 0.05 at the 5% level. The only exception was the change in total debt (ΔDEBTa), with a p-value of 0.435 > 0.05, which failed to reject the null hypothesis and did not affect shareholder value added (SVA).

There is a bi-directional causal relationship between Investment (INVb) and shareholder value added (SVAa) with p-values below 0.05 at the 5% level.

In conclusion, there is strong evidence of causality in only one direction between the independent variables and shareholder value added, except for the change in total debt, which failed to reject the null hypothesis. Investment has a bidirectional causal relationship with shareholder value added.

4.5 Error-correction Model

We adopted the Engle-Granger two-step method to estimate the error-correction model, which determines the error-correction term (ECT). This is critical to understanding the adjustment for any deviation in long-term shareholder value added due to changes in the independent variables. The first step is to regress shareholder value added on the independent variables, including the intercept, and then predict the residuals. The second step is to estimate the first differences of shareholder value added using the first differences of the independent variables and the first lag of the residuals (Engle & Granger, 1987).

Table 11. Engle-Granger two-step: Error-correction model (ECM)

ΔSVAa	Coefficient	Std. err.	T	P>/t/
ΔEPSc	5.39076	0.27583	19.54	0.000
ΔΔFCFa	4.57486	0.59311	7.71	0.000
ΔROAb	3.24703	0.28111	11.55	0.000
ΔΔDEBTa	3.17671	0.37463	8.48	0.000
ΔINVb	2.52230	0.45567	5.54	0.000
uhat_1	-0.75760	0.03337	-22.70	0.000
_cons	-0.00132	0.03264	-0.04	0.968

Number of observations = 529

F(6, 522) = 173.36

Prob > F = 0.0000

R-squared = 0.6658

Adj. R-squared = 0.6620

Root MSE = 0.74801

The coefficient on the lagged residuals measures the speed of correction of the cointegrated model to equilibrium in the long run. We found a high, extremely significant coefficient of -0.75760 for the error-correction term (ECT), indicating a swift movement towards balance. The stabilisation process is notably speedy, resulting in rapid adjustments to shareholder value added in response to short-term changes in the independent variables.

4.6 Cointegration Regression

We identified the cointegration regression using fully modified ordinary least squares (FMOLS), with long-run covariance estimated using the Bartlett kernel and the Newey-West automatic bandwidth method. This estimator eliminates the problems caused by the long-run correlation between the cointegrating equation errors and the regressors innovations (Phillips & Hansen, 1990).

Table 12. Cointegration regression

SVAa	Coefficient	Std. err.	t	P>/t/
EPSc	0.77949	0.52380	1.48	0.137
ΔFCFa	9.01346	1.26425	7.13	0.000
ROAb	1.05015	0.43864	2.39	0.017
ΔDEBTa	3.14509	0.81644	3.85	0.000
INVb	2.78337	0.78931	3.52	0.000
_cons	-0.10350	0.08117	-1.27	0.202

Method: Fully modified least squares (FMOLS)

Long-run covariance estimate (Bartlett kernel, Newey-West automatic bandwidth = 9.3414 and lag length = 5)

Number of observations = 556

R-squared = 0.17509

Adjusted R-squared = 0.16759

Standard error of the regression = 0.97009

Long-run variance = 1.52396

We concluded that there is evidence of a positive and significant long-run relationship between the independent variables and shareholder value added at the 1% level. However, earnings per share did not show significance at the 5% level and did not contribute to the long-run relationship.

4.7 Panel Data Estimations

We conducted regressions using both fixed- and random-effects estimators and recorded the residuals for each. Then, we applied the Hausman test to determine if there was a systematic difference between the two estimates under the null hypothesis. Our initial results showed that the Hausman test failed to reject the null hypothesis (p-value = 0.078), indicating that the random effects estimator was the better choice.

However, we identified a significant heteroskedasticity issue in the fixed-effects estimator. The Wald test for groupwise heteroscedasticity strongly rejected the null of homoscedasticity (p-value = 0.000), indicating unequal variances across groups. This constitutes a critical violation of the model's assumptions, rendering the traditional Hausman test inapplicable.

In this context, we have performed several alternative tests based on the theory to solve this situation. These are summarised in the following table.

Table 13. Alternative tests to the traditional Hausman test

Test	Null hypothesis	Statistic	Conclusion	Final estimator
1. Baltagi and Khanti-Akom test	Coefficients are jointly zero.	F(5,29)=78.90 p-value=0.000	Null hypothesis rejected	Fixed effects are satisfied
2. Cluster-Robust Hausman test	Diff. in coefficients not systematic	Chi2(5)=11.29 p-value=0.045	Null hypothesis rejected	Fixed effects are satisfied
3. Mundlak test	Coefficients are jointly zero.	Chi2(5)= 394.50 p-value=0.000	Null hypothesis rejected	Fixed effects are satisfied

Baltagi & Khanti-Akom test (1990) is very robust to certain violations, such as heteroskedasticity and serial correlation. In the case of the Mundlak test (1978), it is very robust to test the correlation between the time-invariant unobserved individual effects and the regressors and heteroskedasticity, and the Cluster-Robust Hausman test uses a cluster-robust bootstrap procedure, and takes care of heteroskedasticity, serial correlation and clustering issues (Cameron et al., 2005).

Based on the results of the previous tests, we concluded that the fixed-effects estimator is the better choice.

Table 14. Shareholder Value Added Estimates

SVAa	Coefficient	Std. err.	t	P>/t/
EPSc	1.94618	0.42939	4.53	0.000
ΔFCFa	7.64441	0.98752	7.74	0.000
ROAb	1.47228	0.32865	4.48	0.000
ΔDEBTa	2.50494	0.61929	4.04	0.000
INVb	1.86681	0.66979	2.79	0.006
_cons	-0.06847	0.06557	-1.04	0.297

Cross-sectional Time Series. Fixed-effects estimator.

Number of observations = 559

R-squared (overall) = 0.1625

F(5,524) = 19.15

Prob > F = 0.0000

We estimated the coefficients of the FE model and concluded that all independent variables were positively associated with Shareholder Value Added at the 1% level.

The panel-data estimates with fixed-effects and standard errors closely resembled the cointegration regression (FMOLS) estimates, indicating a long-term relationship between the independent variables and shareholder value added. However, diluted earnings per share did not show significance in the cointegration regression.

4.8 Discussion

We assessed the null hypothesis outlined in Section 3.4 based on the FE panel data results detailed in Table 14 and the related theory and literature review.

$H_0$1. The test of significance rejected the null hypothesis (p-value=0.00<0.01), indicating that the diluted earnings per share (EPSc) has a positive and significant association with shareholder value added (SVAa) at the 1% level. Several studies in the literature support the significance of EPS. Altaf (2016) identified EPS, along with other traditional variables, as statistically significant in explaining market value added (MVA) in India. Gunaratne & Anuradha (2017) determined that both earnings per share (EPS) and return on investment (ROI) were the most significant measures to explain stock returns based on the Easton & Harris (1991) specification. Other research has shown that EPS serves as a significant factor in explaining stock returns: Ismail (2006), Gupta & Sikarwar (2016), Mathangi & Vijaykarthigeyan (2020), Nugroho et al. (2019), and Rakshit et al. (2017). The studies that demonstrated EPS as statistically significant in explaining created shareholder value (CSV) were Panigrahi et al. (2015) and Panigrahi (2017).

$H_0$2. The test of significance rejected the null hypothesis (p-value=0.00<0.01), indicating that the change in free cash flow (ΔFCFa) has a positive and significant association with shareholder value added (SVAa) at the 1% level. Aladwan & Alzubaidi (2023) found a similar positive and significant association between free cash flow (FCF) and market value added (MVA), as well as other factors such as economic value added (EVA), net income (NI), cash flow from operations (CFO), and residual income (RI). These variables were all found to have a positive and significant impact on market value added (MVA).

$H_0$3. The test of significance rejected the null hypothesis (p-value=0.00<0.01), indicating that return on assets (ROAb) has a positive and significant association with shareholder value added (SVAa) at the 1% level. Several studies with similar findings included Ali Khan et al. (2016), who showed that return on assets (ROA) and the debt-to-equity ratio are significant factors and outperform economic value added (EVA) in explaining stock returns. Alsoboa et al. (2017) found that economic value added (EVA) and return on assets (ROA) are statistically significant in explaining Fernández´s created shareholder value (CSV) and market value added (MVA). Makhija & Trivedi (2020) found that return on equity (ROE), return on capital employed (ROCE), and return on assets (ROA) provide more predictive power for total shareholder return (TSR) than value-based measures. Additionally, Pasha & Ramzan (2019) identified return on assets (ROA) as the most significant variable in explaining stock returns. They studied a cointegrating equation, and return on assets (ROA) showed a superior long-run relationship with stock returns than economic value added (EVA).

$H_0$4. The test of significance rejected the null hypothesis (p-value=0.00<0.01), indicating that the change in total debt (ΔDEBTa) has a positive and significant association with shareholder value added (SVAa) at the 1% level. Similar findings are reported by Ali Khan et al. (2016), who showed that the total debt-to- equity ratio is a significant factor in explaining stock prices. Additionally, larger companies have lower debt-to-total assets ratios than smaller companies. We include Table 15 showing the 5.44 pp. lower debt-to-total assets, comparing the Dow Jones 30 against S&P 500 companies:

Table 15. Total Debt to total assets ratio

Panel	No. Co's.	Obs.	Mean	Std. Dev.	Years
Dow Jones 30	30	570	0.2639	0.1788	2002-2020
S&P 500	503	10060	0.3183	0.6627	2005-2024

Any increase in debt at larger companies generates cash and contributes to higher volume, net income, and shareholder value, due to the efficiency of positive net present value projects in the Dow Jones companies. In smaller companies, issuing debt generates cash. However, there is a higher probability that it will be used in negative net present value projects, and with a high cost of debt, it may induce negative net income and a reduction in shareholder value added. This is not the case in the large companies of the Dow Jones. This is consistent with McConnell &

Servaes (1995), who stated that firms with few positive net present value projects have a positive effect of debt on a firm's value, in consequence on shareholder value added.

The Dow Jones companies show an inverted U-shaped concave function of Debt to total assets and company size, measured by total assets. The left side positive slope of the inverted U-concave function indicates that any increase in debt to total assets (DEBTa) generates cash and contributes to increases in volume, net income, and shareholder value added. This moderate increase in debt to assets is consistent with the theory of Modigliani & Miller (1958) that taking on more debt might be good for business financial results, and Kraus & Litzenberger (1973) stated that the influence of debt on profitability (ROA) increases as the firm moves closer to its optimal capital structure. In consequence, shows higher shareholder value added.

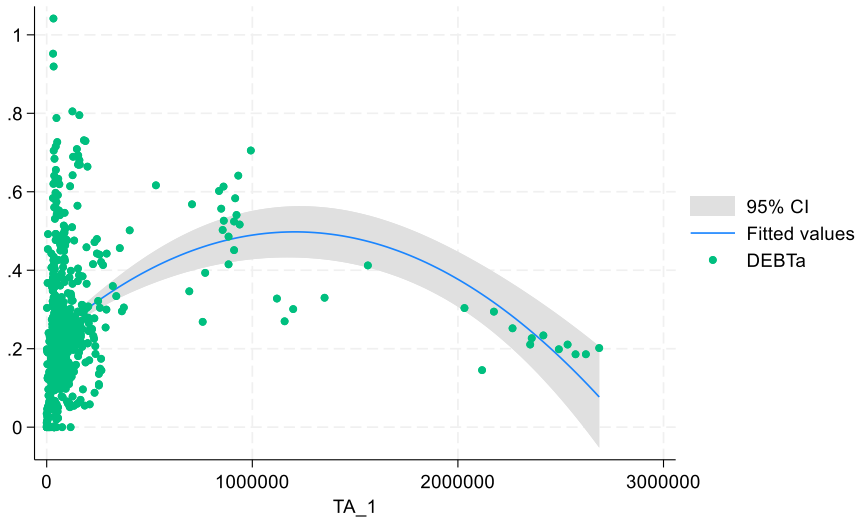

Figure 1. Debt-to-total assets vs Total Assets (1st lag)

Y-Axis: Debt to total assets (DEBTa),

X-Axis: Total assets (1st lag). Annual standardised in Millions of U.S. Dollars

The Dow Jones companies face strong pressure to keep debt lower due to the cost of debt. The typical maximum Net Debt to EBITDA for conservative loans is 3x to 4x for normal corporate loans and 2x to 3x for conservative-investment-grade loans (Erickson, 2021). The financing alternative to debt is mainly the issuance of shares, but there is a trade-off because the cost is critical. It is important to maintain a certain level of approved debt to give new investors confidence to invest in the company (Damodaran, 2002, p. 310) (Myers & Majluf, 1984), and satisfy the limitations imposed by lenders.

$H_0$5. The test of significance rejected the null hypothesis (p-value=0.00<0.01), indicating that investment (INVb) has a positive and significant association with shareholder value added (SVAa) at the 1% level. Similar research findings can be found in Altaf (2016), who studied multivariate regression, one per year, and the return on investment (ROI) remained significant for six years, explaining the market value added (MVA). Additionally, Gunaratne & Anuradha (2017) found that return on investment (ROI) is statistically significant to the stock returns.

We need to clarify that corporate investments in positive net present value projects generate cash, net income, and shareholder value added. The Dow Jones companies are the largest in the marketplace, highly efficient at project selection, and much less likely to fail than smaller companies. At the financing level, companies may increase debt, equity capital or retained earnings. Investment and ΔDEBTa were significant for shareholder value added, whereas DEBTa measured in levels was not significant. The correlation matrix (Table 16) shows that Investment, ΔDEBTa, and DEBTa are uncorrelated.

Table 16. Correlation matrix INVb, DEBTa and ΔDEBTa

	INVb	dDEBTa	DEBTa
INVb	1.0000		
dDEBTa	0.0230	1.0000	
DEBTa	-0.2038	0.3798	1.0000

It is important to note that certain variables, such as revenue, net income, dividend per share, share repurchases, and return on equity, were excluded from the regression analysis due to their high correlation and lower statistical significance relative to other variables.

Furthermore, other variables, such as operating income, sales, tax rate, operating EBIT, gross margin, market share, operating EBITDA, book value per share, and SG&A expenditures, were not included because they showed high correlation with similar variables.

5. Conclusion

We conducted this study to evaluate the effectiveness of traditional accounting-based measures in determining shareholder value added using financial data from Dow Jones companies spanning 2001 to 2020. Previous studies have indicated that although theory advocates for a value-based approach, empirical evidence favours traditional measures. However, our main concern was that previous research often utilised a limited set of variables when evaluating both approaches using econometric models. We sought to address this by solely incorporating traditional measures in our analysis. By conducting a semantic analysis of the earnings announcements, we were able to gather the necessary data for the stock market measurements and comply with the restrictions outlined by the Securities and Exchange Commission (SEC) Regulation G on Nov. 2, 2002, regarding the use of non-GAAP financial information.

In our analysis, we utilised a framework of stationarity, cointegration, and causality. Through this approach, we determined that the independent variables can be assessed as integrated of order one I(1). We also tested for cointegration to confirm the presence of a cointegration equation and found that the variables are indeed cointegrated, indicating a non-spurious relationship.

To gain further insights, we employed an error-correction model to analyse short-term dynamics of adjustment towards equilibrium. Additionally, we estimated a cointegration regression to examine the long-run relationship between the independent variables and shareholder value (SVA). Finally, after conducting tests, we determined that the appropriate panel data estimator was fixed effects. The resulting estimates were comparable to those of the cointegration regression. However, diluted earnings per share did not show significance in the cointegration equation. This suggests that the influence is primarily short-run and does not contribute to the long-run relationship.

The study concluded that diluted earnings per share (EPS), the change in free cash flow (ΔFCF), return on assets (ROA), the change in total debt (ΔDEBT), and investment (INV) are positively associated with shareholder value added (SVA) and significantly related to it.

All in all, this study provides new perspectives into the shareholder value added (SVA) literature, examining the use of accounting-based measures and quarterly earnings announcements. It brings forth valuable insights for investors, academics, and corporate leaders in two areas: 1) assessing the feasibility of decisions aimed at maximising shareholder value added by estimating annual budgets for various relevant measures. All related to the significant variables of this study, with emphasis on the main components of investing activities: capital expenditures, acquisition of businesses, purchase of investments, etc, and 2) gaining a better understanding of a company´s position and behaviour at the sector level by estimating coefficients specific to itself and competitors in the model of our study.

6. Recommendations

Further research may entail increasing the sample size, examining sustainable ESG scores, assessing entrepreneurial and managerial abilities, analysing traits and behaviours, evaluating innovation capabilities, and conducting sector-specific analyses. Certain variables will be collected through direct surveys and primary research methods.

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Notes

Note 1. Data Availability Statement: The data used in this study were obtained from LSEG-Eikon Workspace. Due to licensing restrictions, the authors cannot share the data. Researchers with access to LSEG Eikon Workspace can replicate the dataset following the variable descriptions described in the academic paper.

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