Relationships between Accounting Information on the Business Financial Statements and the Stock Price: A Study with LASSO Method

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Abstract

This article examines the relationship between financial statement accounting information and stock prices of companies listed on the Vietnamese stock market. This study conducts a thorough examination of accounting information contained in the company's financial statements and uses the LASSO approach to identify factors affecting stock prices. Between 2008 and 2019, data for 52 indicators were gathered. According to research findings, several characteristics, including book value, firm size, profitability, and rapid solvency ratio, are statistically significant and positively correlate with stock price. The authors present several recommendations for investors, corporations, and policymakers based on their research findings.

Keywords: Accounting information; Stock price; LASSO method

1. Introduction

Transparency and trustworthiness of financial information are the theoretical and practical foundations that are critical for investor protection and stock market stability. When it comes to investing in the stock market, it is critical and desirable for investors to have access to important financial information. Investors rely on their examination of accounting information contained in financial statements to determine the efficiency of a corporation. As a result, investors ultimately decide whether to buy or sell a company's shares. Stock prices are influenced by a variety of factors, including the financial statements' accounting information. Numerous researches on the relationship between stock prices and accounting information have been conducted in industrialized countries (net profit, earnings per share, book value per share, etc.) Ball & Brown (1968) undertook an empirical examination of the relationship between accounting information and New York Stock Exchange stock prices (NYSE). Their findings indicate that the profit reported in financial statements has an effect on stock prices, and they argue that corporate earnings are useful in determining stock prices. Additionally, Lev & Ohlson (1982) and Walker (1997) conducted experimental studies to examine the relationship between publicly available accounting information and stock prices.

Ohlson's (1995) study model extends previous research on the relationship between accounting information and stock prices by include balance sheet ratios as measured by net assets and other financial parameters. The findings of Ohlson's research have significantly affected and reaffirmed the conclusion that accounting information has an effect on stock

prices. As a result, several empirical studies have been done to determine the worth of pertinent financial statement information in various markets. Collins et al. (1997) examined stock price movements in the United States over a 40-year period in relation to profit and equity book value. They developed a regression model using the net profit models as a theoretical foundation to determine the relationship between stock value, book value of equity, and returns. Simultaneously, it demonstrated that financial report information, as described by the Ohlson model, accounts for 54% of the US stock market's value. King & Langli (1998) utilized a regression model to examine earnings and book value per share, and their findings indicated that the UK, Norway, and Germany all had explanatory capacities of 70%, 60%, and 40%, respectively. This finding demonstrates considerable changes in the link between accounting information and stock prices between nations and throughout time.

According to the FASB, the financial statements' goal is to give information about a company's financial situation, performance, and changes in financial position in order to assist various stakeholders in making financial decisions. Financial statements contribute to the provision of meaningful information for loan investment decisions by evaluating the time and uncertainty of cash flows and by disclosing information about economic resources, property rights, and modification. The impact of accounting information on financial statements on stock prices has long attracted scholars' attention, particularly in emerging stock markets such as Vietnam. This study evaluates and enhances earlier research on accounting information on financial statements (52 indicators), including information on the company's size, financial structure, solvency, and asset utilization efficiency, to determine their effect on the

stock price. Additionally, this study employs the LASSO approach, which is similar to the OLS method, to estimate the parameters of the regression model by minimizing the objective function, which is the sum of squares of the residuals. However, LASSO imposes the limitation that the total absolute value of the parameters does not exceed that of a single tuning parameter. The LASSO approach will be implemented in detail in Section 4. Research Methodology.

2. Theoretical Basis

2.1. Representative theory

The representative hypothesis is drawn from Jensen & Meckling's economic theory (1976). This theoretical topic is concerned with the contractual relationship between the principal and the authorized party. Proxy relationships are most prevalent between shareholders and corporate executives, as well as between creditors and corporate shareholders. Contrary to the proxy's expectation of maximization of advantages, the representatives, who are frequently the company's executives, occasionally have their own agendas. They accomplish this by making modifications to the financial statements. Financial statements no longer accurately reflect the financial condition, business operations, and cash flow of the organization. As a result, it provides no helpful information to investors, shareholders, or creditors. Additionally, Jensen & Meckling (1976) suggested that auditing operations could help management and external shareholders avoid conflict. Auditors act as shareholders' supervisors because they identify discrepancies in audited financial accounts. The research employs this idea in the hope that audited accounting data will adequately explain the volatility of listed firms' stock prices. The audited financial statement data is more pertinent to the inquiry.

2.2. Signaling theory

Spence (1973) proposed this idea to explain the labor market's knowledge asymmetry. His idea implies that if parties communicate with one another, asymmetric information problems can be avoided. Additionally, it has been used to clarify disclosures in corporate reports (Ross, 1977). According to signaling theory, regulators are anticipating a signal, and financial statement information is one of the signaling mediums. Companies produce financial statements to demonstrate to traders that they are superior to other companies in the market, with the goal of attracting investment and enhancing their reputation. The signaling theory describes the behavior of two parties: those who hold knowledge and those who signal to the market and use that information. This theory seeks to alleviate the asymmetry of knowledge between the informed and the impoverished. Companies use financial statement data to communicate with the market. A well-prepared financial statement is a reputable source of information, instilling confidence in investors and associated entities by demonstrating that the revealed information is transparent and reliable. Companies can enhance the quality of their financial statements by implementing internal control activities and training accounting employees, as well as adhering to tax and accounting requirements. Thus, the signaling hypothesis helps to explain why investors react appropriately to accounting information received from businesses.

2.3. The efficient market theory

A market that is efficient is one in which investors can obtain the same information at any moment and promptly act in the same homogeneous manner, such that all information is

reflected in the securities market price. Because stock prices are unpredictable in efficient markets, stock returns will likewise be random and largely conform to the normal distribution. The market is classified into three efficiency levels: (i) low form efficiency, (ii) semi-high form efficiency, and (iii) high form efficiency. The weak form efficiency presupposes that the current price is an accurate representation of historical prices. At the semi-strong form efficiency level, the stock price accurately reflects all publicly available information and corporate information, such as profit, dividends, and management announcements. It is hard to implement trade regulations based on internal knowledge with high form efficiency because market prices already reflect such information (Malkiel & Fama, 1970).

If the accounting information released has an effect on the share price, the market is now classed as semi-strong form efficient. According to Ohlson (1995), stock values are integrated from two accounting variables: book value per share and earnings per share.

Thus, the Reference Information Model (RIM) model divides the intrinsic value of a security into two components: the book value and the value derived from the security's present value as determined by the stock's future residual profits. This pricing model permits the investigation of how a business creates value for its owners. If the return on equity exceeds the cost of equity, the intrinsic value of the stock exceeds its book value, and the corporation is perceived to be creating shareholder value. If the cost of equity exceeds the rate of return on equity, the corporation risks destroying its equity value. Discounting residual earnings is a straightforward calculating procedure that is reasonably simple to understand. This strategy, however, is applicable only to corporations with solid future dividend policies. The justification for this strategy is that it should discount future income flows (including dividends and predicted selling prices) to the present and then compare the estimated price to the stock market price. If the estimated price is greater than the market price, investors should purchase; conversely, if the estimated price is less than the market price, investors should sell. As a result, if this strategy is applied to bonds, it will be more acceptable, as the future income streams supplied by bonds are typically steady and predictable, as opposed to stocks' volatility. Ohlson (1995) released his valuation model after describing the theory underlying the stock price model based on the residual return stream. This approach is regarded as one of the most significant advances in capital market research in the 1990s and serves as the foundation for defining research objectives and values. The Ohlson model properly addressed two problems posed by Ball & Brown (1968), the inventors of stock valuation, about the financial statement information to include when constructing a value measurement model (Dung, 2010). Thus, by combining the residual profit model with Ohlson's (1995) information series, Ohlson developed a model that illustrates the relationship between stock price and two direct financial statement items, profit and book value per share.

Aboody et al. (2002) published "Measuring value relevance in a (possibly) inefficient market." The authors defined an ineffective market as one in which the price of securities (especially stocks) does not accurately represent their actual value. This implies that stock prices do not reflect all relevant market information or that the semi-strong form efficiency hypothesis is violated. There may be a correlation between the financial statements' information and the aforementioned inaccuracy. Because stock prices are a function of the accumulation of company-related knowledge, any market weakness can be compounded by additional details to produce perplexing results. However, these effects, in our judgment, will diminish over time and will be reflected in the security's future

returns.

3. Literature Reviews

The research cited above demonstrate that equity information has a beneficial effect on stock price and profit information. They explore the relationship between accounting information and stock prices using Ohlson's (1995) model as the underlying theoretical framework. Barth et al. (1998) investigated the book value of stock and its profit margin in relation to the financial capability of the company. They calculated a company's financial capacity using bonds and two data samples from the United States. For the period 1993–2009 in India, Sharma et al. (2012) evaluated the empirical link between stock prices and explanatory accounting variables such as book value per share, dividend per share, earnings per share, dividend yield, and dividend. Their findings indicated that earnings per share, dividend per share, and book value per share all had a significant impact on the market price of a stock. Stark & Thomas (1998), Lo & Lys (2000), and Akbar & Stark (2003) all demonstrated that stock price is favorably correlated with book value and earnings. The interpretability of the model when both book value and income are included is nearly identical to that of the model when just book value is included. As a result, the dividend, in addition to earnings and book value of equity, has an effect on the stock price. This finding corroborates the findings of prior research conducted by Stark & Thomas (1996), Rees (1997), and Alfaraih & Alanezi (2011).

Collins et al. (1997) examined the impact of earnings and book value information on the stock prices of publicly traded companies in the United States from 1953 to 1993. The study demonstrates that the model's overall explanatory level is 54% and does not decrease over time. However, explainability of returns tends to decline over time, whereas book value increases.

Chen et al. (2001) examined equities in the Chinese stock market from 1991 to 1998 using the Ohlson model (1995). The authors demonstrated that profit and book value are variables that correlate positively with stock price movements. Additionally, the findings of this study indicate that firms with a higher frequency of losses will have a stronger negative correlation between earnings and stock prices (a finding that corroborates Collins et al., 1997); the relationship between accounting information and stock prices is stronger for small firms, and accounting information contributes more to explaining stock price movements for high liquid stocks.

Numerous empirical investigations in developing nations have been conducted using Ohlson's (1995) model, including Shamki (2012) in Jordan, Khanagha (2011) in the United Arab Emirates, Omokhudu & Ibadin (2015) in Nigeria, and Khanna (2014) in India. The preceding research established a correlation between accounting data on a company's financial statement and stock prices with varying degrees of explanation. Along with research focused on book value and earnings per share, a variety of studies link stock prices to other financial statement variables. According to Iqbal et al. (2014), ROA has a favorable effect on stock prices. Apart from that, financial leverage refers to the extent to which a business utilizes fixed-income securities such as debt and equity. The more debt a business incurs, the greater its financial leverage. Financial leverage results in excessive interest payments, which have a detrimental impact on a company's earnings per share. According to Kaundal & Sharma (2010), financial leverage has the reverse effect on stock values. This implies that increased financial leverage will result in lower stock values and vice versa. Collins & Kothari (1989) and Sharma et al. (2012) found that firm size and growth rate have a beneficial effect on stock

prices. King & Langli (1998) used the Ohlson (1995) model to analyze the effect of accounting information on stock prices in three nations with disparate accounting systems, namely the United Kingdom, Germany, and Norway, between 1982 and 1996. According to the research findings, the amount of explanation for price fluctuations in shares in these three stock markets is 70%, 40%, and 60%, respectively. Additionally, profits and book value are understood differently over time and among countries. Book value, in instance, has a bigger impact on the price movements of companies listed on the German and Norwegian stock exchanges than profit, but profit has a greater impact on the UK stock market than book value.

4. Research Methodology

Research models

As a result of the preceding literature analysis, the following concerns arise: Is Ohlson's (1995) model relevant for Vietnam's stock market? Does the model adequately explain the relationship between accounting information and stock prices? Using this model, this study evaluates the effect of accounting information on the stock prices of enterprises listed on the Vietnamese stock market. The study used a linear regression model with the share price as the dependent variable and 52 indicators of financial statement accounting information as the independent variables. We propose an updated model combining the model by Ohlson (1995), Aboody et al. (2002), and study results by Collins et al. (1997), Dechow et al. (1999), Frankel & Lee (1998), Hand & Landsman (2005), King & Langli (1998), Ota (2002), Dang et al. (2018a), Dang et al. (2018b), Ha et al. (2018). To conduct a comprehensive investigation of the impact of accounting information on financial statements on stock prices, we developed the following model:

$$\text{Price}_{it} = \beta_0 + \beta_1 \text{Accounting Information}_{it} + \text{uit}$$

Appendix 1 presents 52 information indicators that we collected from the financial statements.

Research data

Research data is the secondary data collected from companies' financial statements listed on the Vietnamese stock market in 2008–2019. The share price (P) is published on March 31 every year.

Analytical method

When listing variables for linear models, it is typical for studies to consider the P-value. This can be deceptive, as significant factors with a high correlation, but a low P-value can be overlooked. On the other side, irrelevant variables might be incorporated in the model, increasing the model's management complexity. Additionally, an excess problem might occur if the number of observations is smaller than the number of variables in the model. Tibshirani (1996) proposed LASSO as an extension of OLS regression that performs both variable selection and formalization via constraint coefficients. It has the potential to improve the accuracy and interpretability of regression models when compared to standard regression methods (Tibshirani, 1996). The following is the procedure:

To begin, a lambda adjustment parameter (λ) is applied to the model in order to control the intensity of the penalty. With increasing lambda, the many coefficients become zero. When lambda equals 0, we have OLS regression. When lambda increases, deviation increases, and variance reduces. Second, LASSO regression can improve the model's interpretability. Often, in many linear regressions, certain explanatory factors are unrelated to the dependent variable, resulting in an over-

equipped and hard model. The coefficients of unimportant variables are lowered to zero using LASSO.

The process of implementing the LASSO method is below:

Step 1: Normalize the data of the independent variables. Only perform the given transformation for the dependent variable to average 0.

Step 2: Randomly divide the data set into training set and test set at an 80%–20% rate.

Step 3: Since the sample data is panel data, perform model estimation using the two-way estimation technique in the same group to control the effects of time factor and individual factors of each bank. On that basis, using the dimensionality reduction algorithm, the cross-validation procedure to find the best λ and implementing the LASSO estimation method with the best λ on the training set.

The cross-validation procedure is one of the methods used to find the best estimator for λ . In the cross-validation procedure, the data set is randomly divided into K subsets, denoted $C_1, \dots, C_k$. For each value of λ , the cross-validation procedure is performed as follows: Consider C_i as the test set, $(K-1)$ the remaining set as the training set. Applying the LASSO estimation method on this training set to obtain the model, then

using the test set C_i to predict the value of the dependent variable and record the value of MSE_i (Mean Squared Error). Repeat with $i = 1, 2, \dots, K$. Let CVM_λ be the average of the MSE_i :

$$CVM_\lambda = \frac{\sum_{i=1}^K MSE_i}{K}$$

Thus, each i corresponds to one CVM_λ . When i is variable over a given set, the best value of λ is the one corresponding to the smallest CVM_λ .

Step 4: Calculate the MSE of the models corresponding to the LASSO estimation method on the test set.

Step 5: Repeat 100 times from Step 2 to Step 4 to compare the MSE of the corresponding models with the LASSO estimation method on the test set.

5. Results and Discussion

Table 1 describes the average stock prices of listed companies in the period 2008-2019. The lowest prices were in 2008 and the highest peaks in 2017.

Year	Number of observations	Average	Median
2008	254	5,687.40	4,640
2009	357	12,073.25	10,000
2010	479	8,912.56	7,210
2011	505	7,209.52	5,300
2012	523	8,139.54	5,430
2013	533	11,714.20	8,680
2014	557	12,945.57	9,500
2015	601	15,433.11	10,700
2016	630	19,126.54	12,445
2017	669	21,905.99	13,580
2018	688	21,031.00	13,450
2019	705	16,656.48	11,000
Total / Average	6,501	14,392.91	9,180

Table 1: Descriptive statistics of stock prices in the period 2008-2019

Source: Authors' calculation using Stata 16, 2021

According to the descriptive data for the variables in the study model (Table 1), the stock has a high of 249,700 VND per share and a low of 200 VND per share, with a huge standard deviation of 17,763.20 VND. Due to the large disparity between the average and median stock prices, we first algorithmize the stock price before performing scale regression using the LASSO method.

We separated the research sample into two equal groups,

Training and Testing, and then used the LASSO regression method with the CV, adaptive, and plugin variables. Appendix 2 and Appendix 3 include the final results. The results indicate that among 52 indicators, the effect of accounting information on financial statements on stock prices is determined by 16 variables using the CV option, 13 factors using the adaptive option, and 7 factors using the plugin option.

No.	Variables	Code	Coefficient		
			cv	adaptive	plugin
1	Book value per share (BV)	X42	0.1932	0.2072	0.1753
2	Company size (Total revenue)	X2	0.1923	0.2253	0.1718
3	Return on total assets (ROA)	X37	0.1745	0.1803	0.1147
4	Current ratio	X8	0.0792	0.0932	0.0656
5	Earnings per share (EPS)	X40	0.0749	0.0642	0.1006
6	Gross profit margin	X34	0.0732	0.0977	0.0413
7	Company size (Total assets)	X1	0.0273	0.0126	0.0096
8	Fixed assets ratio	X33	-0.0127	-0.0298	
9	Coefficient of periodic interest payment	X17	0.0112	0.0175	

No.	Variables	Code	Coefficient		
			cv	adaptive	plugin
10	Account receivables turnover	X25	0.0105	0.0113	
11	Coefficient of long-term debt solvency	X15	0.0075	0.0087	
12	Revenue growth	X3	0.0069	0.0043	
13	Change in earnings per share (EPS)	X41	-0.0065	-0.0073	
14	Net trade cycle	X30	0.0039		
15	Return on total equity (ROE)	X38	-0.0007		
16	Financial leverage	X50	-0.0003		

Table 2: Summary of variables affecting stock prices
Source: Authors' calculation using Stata 16, 2021

Table 2 lists the accounting information variables that affect stock prices on financial statements. To begin, the book value per share variable has the greatest positive effect on stock price (25.8%), which is consistent with the findings of Ohlson (1995), Khanagha (2011), Omokhudu & Ibadin (2015), and Khanna (2014). Second, the size of the company (as measured by total revenue) has the second-largest positive impact on the stock price (25.3 percent). This study's findings are congruent with those of Sharma et al. (2012).

Profitability is the third category of characteristics that has a positive effect on stock prices. This category includes return on total assets (ROA), earnings per share (EPS), and gross profit margin. This study's findings are consistent with those of Collins et al. (1997), Dechow et al. (1999), Frankel & Lee (1998), Hand & Landsman (2005), King & Langli (1998), and Ota et al. (2002).

Finally, the current ratio is favorably correlated with the stock price, indicating that investors prefer enterprises with a large cash and cash equivalents position.

5. Recommendation and Conclusion

The findings of this study establish empirical evidence regarding the effect of accounting information contained in financial statements on the stock prices of companies listed on the Vietnamese stock market from 2008 to 2019. We used the LASSO approach to conduct a detailed review of 52 indicators on financial statements in order to identify significant factors influencing the stock price. These characteristics include the book value per share, the company's size, the profitability of the business, and the rapid solvency ratio. Contrary to prevalent opinion that accounting information about businesses is irrelevant to investors in the Vietnamese stock market, this study presents empirical evidence that accounting information variables do have an effect on market stock price movements when they are publicized. Due to the difficulty of establishing the efficient market hypothesis in a developing stock market such as Vietnam, the application of Ohlson's (1995) model in conjunction with Aboddy's (2002) approach to price adjustment is critical for establishing a sound theoretical foundation for quantifying this effect.

Based on the above research results, the authors propose some recommendations as follows:

For listed companies

On promptly, provide complete accounting information on financial statements. After three months after the fiscal year closes, the relationship between accounting information and stock price is best described (March 31 every year). Additionally, this is the time period during which businesses must publish their year-end financial results. Thus, timely and complete disclosure of financial statements, audit reports, and

the Board of Directors' report fosters investor confidence in openness and serves as a good signal for attracting investors.

Ascertain timely and correct disclosure of significant facts about the company, such as its financial condition, business performance, ownership structure, and quality management. Financial markets in general, and the stock market in particular, are complicated environments that demand complete disclosure of information. Additionally, information users require assurances regarding the information's dependability. An appropriate method for disclosing information is necessary for recruiting capital and instilling investor confidence. In comparison, an inadequate and opaque disclosure method can result in ethical infractions that harm the business, its shareholders, and the economy.

For investors

When investing in securities, it is critical to pay close attention to accounting information because it has the potential to alter the stock price. However, in addition to the information given in the company's financial statements, it is required to refer to book value per share (BV) provided by other sources.

Investors must understand how to conduct financial statement reviews of parent companies and subsidiaries and be wary of accounting gimmicks used by some corporations. Additionally, investors should analyze the timing of the release of the company's financial statements and cast doubt on organizations that aim to publish their financial information late.

For auditing company

The auditor examines the financial accounts and expresses an opinion on their accuracy, reasonableness, and conformity with accounting and auditing standards and applicable law. The auditor will express exclusion or disapproval of the financial statements data in non-conformities.

Each auditor and accountant must be aware of and adhere to his or her professional and ethical principles in all circumstances. When accountants and auditors are aware of circumstances that jeopardize their ethical behavior, they can take steps to safeguard, remove, or minimize that risk.

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Code	Variables	Measurement
P	Stock price	Stock price on date 31/03/N+1
X1	Company size (Total assets)	Log (Total assets)
X2	Company size (Total revenue)	Log (Total revenue)
X3	Revenue growth	(Revenuet - Revenuet-1) / Revenuet
X4	Assets growth	(Total assetst - Total assetst-1) / Total assetst
X5	Assets to debts ratio	Total assets / Total debts
X6	Coefficient of short-term debt solvency	Total current assets / Total short-term liabilities
X7	Current ratio	(Current assets - Inventory) / Total short-term liabilities
X8	Quick solvency ratio	Cash and cash equivalents / Total short-term liabilities

GENERAL MANAGEMENT

Code	Variables	Measurement
X9	Cash flows / Total short-term liabilities ratio	Net cash flow from operating activities / Average short-term liabilities
X10	Cash flow / Debt-to-maturity ratio	Net cash flow from operating activities / Debt-to-maturity
X11	Debt ratio	Total debt / Total liabilities
X12	Financing factor	Total equity / Total liabilities
X13	Liabilities / Equity ratio	Total liabilities / Total equity
X14	Liabilities / Collateral ratio	Total liabilities / (Total assets - Intangible assets + Land use rights)
X15	Coefficient of long-term debt solvency	Long-term assets / Long-term debt
X16	Coefficient of loan interest solvency	Profit before corporate income tax and interest expenses / Interest expenses
X17	Coefficient of periodic interest payment	Average cash / Average interest payable
X18	Capital mobilization	(Equity + Long-term debt) / Fixed assets
X19	Retained earnings on equity	Retained earnings / Total equity
X20	Assets turnover	Net revenue / Total assets
X21	Current assets turnover	Net revenue / Current assets
X22	Inventory turnover	Net revenue / Average inventory
X23	Inventory turnover	Cost of goods sold / Average inventory
X24	Inventory turnover (days)	Average inventory value x 365 / Cost of goods sold
X25	Account receivables turnover	Net revenue / Account receivables
X26	Account receivables turnover (days)	(Accounts receivable from customers x 365) / Net revenue
X27	Payable turnover	Costs of goods sold / Account payables
X28	Payables turnover (days)	(Account payables x 365) / Cost of goods sold
X29	Cash conversion cycle	Average receivables x 365 / Total revenue + Average inventory x 365 / Cost of goods sold - Average payables x 365 / Cost of goods sold
X30	Net trade cycle	(Average receivables + Average inventory - Average payables) x 365 / Total revenue
X31	Long-term asset cycles	Net revenue / Long term assets
X32	Production capacity of fixed assets	Net revenue / Fixed assets
X33	Fixed assets ratio	Net book value of fixed assets / Total assets
X34	Gross profit margin	(Net revenue - Cost of goods sold) / Net revenue
X35	Profit before tax and interest expense	(Profit before tax + Interest expense) / Net revenue
X36	Profit before tax, interest expense and depreciation	(Profit before tax + Interest expense + Depreciation expense) / Net revenue
X37	Return on total assets (ROA)	Profit after tax / Total assets
X38	Return on total equity (ROE)	Profit after tax / Total equity
X39	Profit after tax to Net revenue (ROS)	Profit after tax / Net revenue
X40	Earnings per share (EPS)	(Profit after tax - Dividends of preferred shares) / Average number of common shares outstanding
X41	Change in earnings per share (EPS)	(Earnings per share (EPS) _t - Earnings per share (EPS) _{t-1}) / Earnings per share (EPS) _{t-1}
X42	Book value per share (BV)	Book value of equity / Number of common shares in circulation
X43	Cash ratio	Cash / Total assets
X44	Short-term debt ratio	Short-term debt / Total assets
X45	Long-term debt ratio	Long-term debt / Total assets
X46	Financial leverage	Total debt / Total assets
X47	Cash ratio (squared)	Squared (Cash / Total assets)
X48	Short-term debt ratio (squared)	Squared (Short-term debt / Total assets)

Code	Variables	Measurement
X49	Long-term debt ratio (squared)	Squared (Long-term debt / Total assets)
X50	Financial leverage (squared)	Squared (Total debt / Total assets)
X51	Cash conversion cycle (squared)	Squared (Average receivables x 365 / Total revenue + Average inventory x 365 / Cost of goods sold - Average payables x 365 / Cost of goods sold)
X52	Net trade cycle (squared)	Squared ((Average receivables + Average inventory - Average payables) x 365 / Total revenue)

Appendix 1: Variables used in the research model

Source: Authors' compilation, 2021

Lasso linear model	No. of obs	=	2,000
	No. of covariates	=	51
Selection: Cross-validation	No. of CV folds	=	10

ID	Description	lambda	No. of nonzero coef.	Out-of- sample R-squared	CV mean prediction error
1	first lambda	.4429704	0	0.0036	.7094107
32	lambda before	.0247656	15	0.4156	.4160931
* 33	selected lambda	.0225655	16	0.4157	.415999
34	lambda after	.0205609	16	0.4153	.4162641
37	last lambda	.0155535	18	0.4116	.418886

* lambda selected by cross-validation.

Appendix 2: Results of lambda and variables selection according to LASSO method

Option cv

Source: Authors' calculation using Stata 16, 2021

Source: Authors' calculation using Stata 16, 2021

Option adaptive

Lasso linear model	No. of obs	=	2,000
	No. of covariates	=	51
Selection: Adaptive	No. of lasso steps	=	2

Final adaptive step results

ID	Description	lambda	No. of nonzero coef.	Out-of- sample R-squared	CV mean prediction error
38	first lambda	26.98218	0	0.0015	.7108721
103	lambda before	.0637991	13	0.4207	.4124281
* 104	selected lambda	.0581313	13	0.4208	.4123537
105	lambda after	.0529671	13	0.4208	.412389
137	last lambda	.0026982	15	0.3983	.4298375

* lambda selected by cross-validation in final adaptive step.

Source: Authors' calculation using Stata 16, 2021

Source: Authors' calculation using Stata 16, 2021

Option a plugin

Lasso linear model	No. of obs	=	2,080
	No. of covariates	=	51
Selection: Plugin heteroskedastic			

ID	Description	lambda	No. of nonzero coef.	In-sample R-squared	BIC
* 1	selected lambda	.0881683	7	0.4059	4174.226

* lambda selected by plugin formula assuming heteroskedastic.

Source: Authors' calculation using Stata 16, 2021

Penalized coefficients

Name	sample	MSE	R-squared	Obs
cv	Training	.4215072	0.4204	2,271
	Testing	.4587657	0.3284	2,313
adaptive	Training	.4238869	0.4172	2,271
	Testing	.4637182	0.3212	2,313
plugin	Training	.4900035	0.3443	3,075
	Testing	.4791921	0.3249	3,102

Appendix 3: Comparison among options according to the LASSO method

Source: Authors' calculation using Stata 16, 2021