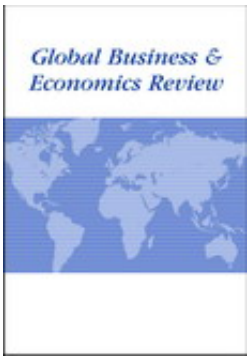

Global Business and Economics Review

ISSN online: 1745-1329 - ISSN print: 1097-4954
https://www.inderscience.com/gber

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DOI: 10.1504/GBER.2025.10059369

Article History:

Received:	01 March 2023
Last revised:	15 April 2023
Accepted:	08 May 2023
Published online:	03 December 2024

Nexus of investors' sentiments and firm value

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Abstract: This study explores how investors' sentiments affected firm value in the non-financial sector of the Pakistan Stock Exchange from 2015 to 2019. Investors' sentiments are measured using a principal component index (PCA), while firm value is assessed through Tobin's Q formula. Control variables include firm size, leverage, and sales growth to enhance internal validity. A generalised method of moments (GMM) is employed for analysis, with Driscoll-Kraay standard error regression for robustness. The findings reveal a statistically significant impact of investors' sentiments on firm value. Consequently, firm managers are advised to actively monitor sentiment, maintain open communication, safeguard their reputation, prioritise financial performance, and engage stakeholders to counteract negative sentiment effects and uphold a positive company outlook.

Keywords: investors' sentiments; firm value; Tobin's Q; PSX; GMM.

Reference to this paper should be made as follows: Shah, S.S.H., Mata, M.N., Dantas, R.M., Javed, W. and Martins, J.N. (2025) 'Nexus of investors' sentiments and firm value', *Global Business and Economics Review*, Vol. 32, No. 1, pp.31–48.

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1 Introduction

Behavioural financial research document sentiments influence an investor's judgment approach in his/her financial decisions. In the first place, sentiments can have an impact on how information is received (Fenton-O'Creevy et al., 2011). Secondly, sentiments can influence decision-making; for instance, fear takes you toward pessimistic risk assessments and risk-averse decisions, whereas anger takes you toward optimistic risk assessments and risk-seeking decisions (Lerner et al., 1998; Tiedens and Linton, 2001). Furthermore, sentiments can influence the value linked with results (Fenton-O'Creevy et al., 2011). For example, strong negative sentiments emphasise short-term results, regardless of the unfavourable long-term effects, whereas positive sentiments encourage optimistic selections (Tiedens and Linton, 2001).

Kahneman and Tversky (1979) explained that individual decision-making may be affected by how information is presented, and people use heuristics or timesaving methods when having inadequate knowledge and while making selections under doubt. Furthermore, Lowenstein (2000) explained that the sentiments one have while making a selection might lead to an approach that is different from what is suggested by assessing the long-term risks and advantages of different options.

The latest research indicates that security returns react to variables linked to elements such as weather conditions, biorhythms, opinions, and societal characteristics. Hirshleifer and Shumway (2003) discovered that day-to-day stock returns are knowingly associated with sunshine. Lucey and Dowling (2005) gave worldwide data that seasonal differences in biorhythms and distractions in sleep affected by shifting to and from daylight saving time disturb stock returns. Eventually, Edmans et al. (2007) examine the effect of international soccer outcomes and discovered a major market downfall after the losses of national soccer teams in international contests. These researches are encouraged by a set of current theories that emphasise the consequences of sentiments and feelings on people's decisions. For instance, Loewenstein et al.'s (2001) 'risk-as-feelings' theory suggests that people's emotions and feelings frequently affect their choices, particularly when such choices include risk and doubt. Consistent with the results that people in decent moods are likely to be more positive in their decisions than those in a bad emotional state Wright and Bower (1992), these studies establish that market costs can be controlled by deviations in investors' feelings even when the basic events are cost-effectively unbiased from a direct cost-benefit viewpoint.

Researchers have since connected shifts in investors' sentiments to firm performance, stock returns, and share rate fluctuations, demonstrating the significance of investors' sentiments in financial markets. To date, most sentiment research concentrates on the association between sentiments and stock returns but there is a grey area of whether

investors' sentiments influence the firm value or not. The present study adds to the literature by investigating the impact of investors' sentiments on firm value.

Pakistan's stock market is one of the most volatile markets in the world. Market instability/uncertainty affects the investors' sentiments that directly affect the stock returns and market value of assets while firm value is the ratio of market to book value of assets. When sentiments affect the market value of assets, they will have an impact on the firm value as well. There exists a potential gap in the literature on whether a change in investors' sentiments affects the firm value. Therefore, this research is bridging the gap in the literature by investigating 'The impact of investors' sentiments on the firm value on the grounded of Tobin's Q theory of investment'.

2 Literature review

This section comprises a review of the literature related to the variables of the study.

2.1 Investors' sentiments

Investor sentiment refers to a person's feelings about future earnings and investment risk, which are often impacted by emotions. Experimental studies examining the impact of sentiment on the financial markets have discovered that, opposite to the efficient market theory's assumptions, sentiment has an impact on the stock market (Brown and Cliff, 2004). For instance, Bandopadhyaya and Jones (2006) demonstrate that instead of the index's price momentum, investor sentiment drives short-term fluctuations in the share market. Furthermore, variations in investor opinion can sometimes illustrate short-term asset price movements very well than other potential reasons. Therefore, Shiller (2014) contends that the development of flawed news media and communication networks (such as Twitter), together with social psychology concepts, plays a critical role in the development of asset pricing bubbles.

The literature's market sentiment indicators centred on five themes (Bandopadhyaya and Jones, 2008). The first is about optimism/pessimism regarding the financial system, like the consumer confidence index. Second, is about optimism/pessimism concerning financial markets, for example, the put/call ratio (PCR). Third, is stock market riskiness, for instance, stock turnover. Fourth is the riskiness of individual stocks, like the risk appetite index and lastly, the fifth one is the riskiness of individual stocks, for example, the risk appetite index. Among these five themes, the put/call ratio and risk appetite index are two of the best market-based emotion indicators (Brown and Cliff, 2004). In the financial media, PCR is generally implemented (Simon and Wiggins, 2001). In a comparison of the ability of the put/call ratio and the risk appetite index to substitute for investor emotions, Bandopadhyaya and Jones (2008) concluded that the put/call ratio is a good explanatory variable than the risk appetite index. Furthermore, when evaluating general market attitude, experts usually relate to the PCR.

Baker and Wurgler (2006, 2007) created a composite index to measure general market sentiment based on the general deviation in six market sentiment variables. They covered trading volume, the closed-end fund discount, the premium for dividend-paying shares, the number and first-day returns of IPOs, and an equity stake in new issues as indicators of investors' inclination to put money into shares. They then utilised their index to see if investor sentiment influences asset pricing when they are optimistic or

pessimistic about market circumstances and discovered that when sentiment was high, the desire for stocks went up, resulting in asset mispricing. Their analysis also showed that the impact of investor sentiment on a company's performance is dependent on the general position of the market, with bull market investors reacting in a very positive manner to information than bear market investors. Finally, their research shows that high investor sentiment causes asset mispricing, which is backed by a time of decline in returns, hence fixing overvalued assets and lowering stock returns. Building on Baker and Wurgler's (2006, 2007) conclusions, Pan (2020) utilises consumer confidence indices as a substitute for investor sentiment and reveals that it is highly associated with the possibility of a stock market bubble formation, and the degree of investor sentiment can influence the bubble size.

De Long et al. (1990) were the first to propose that investor sentiment has a part in financial markets. When unaware market participants make decisions based on sentiment (rather than fundamentals) and risk-averse arbitrageurs run into arbitrage limits, sentiment shifts, resulting in further noise trading, increased level of mispricing, and enhanced volatility, eventually driving asset values away from their actual value. Various researchers have since proven the impact of sentiments on stock returns as well as share price volatility.

2.2 Firm value

Firm value is indeed a fundamental term in finance because of its vast significance for market productivity, capital allotment, and investments. When trading and dealing in securities, an investor takes into account the firm's value. It is a useful measure for investors and managers to determine the accounting value of a business at market price. When making an investment choice, the investors evaluate the firm's worth. Morck et al. (1988) and DeAngelo et al. (2010) suggested that market to book ratio (M/B) or Tobin Q is a suitable proxy to gauge firm performance. The frequency with which investors traded affects the market value of a security. So, excessive trading activities by overexcited investors in a particular stock have a positive impact on the firm's valuation.

Overconfidence bias causes investors to overvalue the accuracy of their knowledge and undervalue the danger connected with assets, resulting in irrational demand for risky stocks. Lacking a balanced arbitrage position, this growing demand mis-predicts the stock (Nikolic and Yan, 2014).

Generally, investors make investments in those shares with which they are satisfied. The research of Huberman (2005) is the most prominent example of this phenomenon. He investigates why employees pay more attention to the security of the companies for which they work or have been guided by their friends. Ha (2007) investigated the effect of herding on share performance and found that herding has a significant effect on stock returns and share returns impact the book-to-market value of companies.

Dow (2011) argued that in the financial market, there is more information generation about good companies rather than bad companies. Individual investors are therefore highly probable to have personal data about good companies, and by combining their data into share price via trading, their dealings should have a significant impact on the value of good companies. Following the information production theory, they observe that the impact of individual investor dealings on a company's value is higher for good companies with greater returns on assets.

The improved stock price information may have a positive impact on the value of the company. Foucault and Gehrig (2008) documented that cross-listed companies acquire accurate data from the stock market and come to good investment choices. Roll et al. (2009) revealed the influence of options trading activity on business valuation is due to its effect on price information quality. Fang et al. (2009) observed stock market liquidity has a significant impact on company value by boosting the information material of market prices and results related to management compensation packages. As a result, pooled trading by individual investors should have a significant influence on firm value by boosting share price accuracy.

2.3 Hypothesis development

Behavioural finance theory is backing the variable 'investors' sentiments' of the research whereas the theory behind the variable 'firm value' is Tobin's Q theory of investment.

Behavioural finance theory is based on the emotions/sentiments of the investors. This theory rejects the assumptions of efficient market theory where investors behave rationally. According to this theory, investors are irrational and use heuristics while taking decisions. Their decisions are biased because they follow their emotions. This irrational behaviour of the investors affects the market value of the securities. Tobin's Q theory of investment tells us that firm value is the ratio of market to book value of assets (Maury and Pajuste, 2005). If investors affect the market value through their sentiments, they will also affect the firm value. This is the rationale behind this research, as the study wants to know if is there any impact of investors' sentiments on firm value. From the review of the literature, it is concluded that investors' sentiments significantly affect the stock returns and the market price of the shares of a company (either positively or negatively). From all these discussions, this study develops a hypothesis that investors' sentiments have significantly impacted the firm value.

H1 Investors' sentiments have significantly impacted the firm value.

According to Cheng and Tzeng (2011), if bankruptcy risk is ignored, the values of a leveraged firm are higher than those of an unleveraged firm. Moreover, before obtaining the ideal capital structure for the company, leverage is considerably positively correlated with the firm value if we concurrently consider the financial advantage and cost of debt. Similarly, an improved firm's financial quality tends to have a stronger positive impact on leverage's ability to boost firm value. Therefore, the study develops a hypothesis that leverage has significantly impacted the firm value.

H2 Leverage has significantly impacted the firm value.

The causal relationship between firm size and firm value is complex and can depend on various factors, such as industry dynamics, market conditions, management practices, and competitive strategies. It is important for investors and analysts to carefully evaluate both firm size and firm value when assessing the potential risks and returns of a company's stock or investment opportunities. Maury and Pajuste (2005) investigated a significant but negative causal relationship between firm size and firm value. Following this research, the present study develops a hypothesis that firm size has significantly impacted firm value.

H3 Firm size has significantly impacted the firm value.

The impact of sales growth on firm value can be significant, as higher sales growth is often seen as a positive signal of a company's prospects for revenue, profit, and market share growth. Maury and Pajuste (2005) also suggested a positive significant causal relationship between sales growth and firm value. So, the study develops a hypothesis that sales growth significantly impacted the firm value.

H4 Sales growth has significantly impacted the firm value.

3 Methodological approach

3.1 Data source and sampling technique

The study is based on epistemological assumptions and the research philosophy is positivism. This research employs a deductive approach. Secondary data is used in the research. The research involves only numerical data; therefore, the nature of the data is quantitative. The research employed one regression model, i.e., the GMM. Therefore, the methodological choice is a mono method. The time horizon in the research is a longitudinal one as the research uses panel data. The sampling technique used in the research is non-probability sampling. Therefore, the strategy for making the sample is convenience sampling. Data is obtained from the annual reports of the companies and for that purpose, the websites of PSX, SBP and Open Doors are used. The population targeted in the research is the non-financial sectors of the Pakistan Stock Market. Only those firms from the non-financial sector of the Pakistan Stock Exchange are taken for a sample whose data is conveniently available. The total population of non-financial firms registered at PSX is 410 but due to the unavailability of data, only 370 firms are taken as a sample, whose data is used to conduct the research. Data from five years starting from 2015 to 2019 is used. In the process of data collection, missing observations are excluded from the overall data. The sample size is determined with the remaining observations.

3.2 Explanation of variables

3.2.1 Investors' sentiments

Investors' sentiments refer to a person's feelings about future earnings and investment risk, which are often impacted by emotions. To measure investors' sentiments, an index of four proxies is made following the work of Baker and Wurgler (2006). The description of the proxies is as follows:

- Closed-end fund discount (CEFD): CEFDs are joined investment funds that obtain a specific quantity of capital through an initial public offering (IPO). CEFD shares are based on market prices instead of the fund's net asset value (NAV). That implies they can be freely traded at any time throughout the day, regardless of the fund's price. Stock prices are driven by demand. As CEFD prices are determined by market demand, shares often trade at a premium or a discount to NAV. It is the average difference between the net asset value of CEFD shares and their market prices. Sentimental investors are probably to be responsible for the disparity between CEFD prices and their NAV (Lee et al., 1991). It is inversely proportional to investors'

emotions, meaning that when the discount rises because of a fall in share value, the investor will develop a negative sentiment (Khan and Ahmad, 2019).

Calculation:

$$CEFD = Net\ Asset\ Value - Share\ Price$$

- Share turnover: Baker and Stein (2004) recommend that turnover, or more commonly liquidity, can aid as a sentiment index. In a market with fewer sales restrictions, illogical financiers contribute, and therefore enhance liquidity, merely when they are hopeful; therefore, great liquidity is an indication of overvaluation. Keeping up with this, Jones (2002) discovered that great turnover estimates fewer market profits.

  Calculation:

$$TURN = \frac{Number\ of\ Shares\ Traded}{Outstanding\ Shares}$$

- Dividend premium: Baker and Wurgler (2004) use this variable to assess investor demand for dividend-paying stocks. When investors place a share price premium on dividend-paying stocks, managers respond to them by paying dividends. Considering that dividend payers are typically larger, more successful companies with limited growth prospects Fama and French (2002), the dividend premium may serve as a substitute for relative demand for this associated set of attributes. It is calculated by dividing the dividend per share price by the market price per share (Rahman and Shah, 2017).

  Calculation:

$$DP = \frac{Dividend\ perShare}{Price}$$

- Equity shares: the share of equity issues is a new method of financing activity that might catch sentiment. Since it comprises a portion of a company's financing, the percentage of equity in long-term finances, which is described as a mixture of long-term debts and owner's equity, might anticipate several market sentiment effects. Baker and Wurgler (2000) discover that great prices of the equity share forecast fewer market profits.

  Calculation:

$$EQShares = \frac{Gross\ Equity}{Gross\ Equity + Long\ term\ Debt}$$

3.2.2 Sentiment index

To make an investors' sentiments index, the study applied principal component analysis (PCA) on the above-mentioned four variables following the work of Rahman and Shah (2017).

$$Sentiment\ Index = 0.4254\ EQShares + 0.3894\ DP + 0.3154\ TURN - 0.2605\ CEFD$$

3.2.3 Firm value

The firm value indicates the worth of a company. In theory, it is the sum of money required to purchase or acquire a business. When trading and dealing in securities, an investor takes into account the firm's value. It is a useful measure for investors and managers to determine the accounting value of a business at market price. Morck et al. (1988) and DeAngelo et al. (2010) suggest that Tobin's Q ratio is the suitable proxy to measure the value of the firm. The Q ratio is the average of a company's physical assets market value to its replacement value. Tobin's Q measurement method differs depending on the study goal. This research is based on the market-to-book value of assets ratio. It is calculated following the work of Fosu et al. (2016).

Calculation:

$$FV = \frac{Market\ Value\ of\ Assets}{Book\ Value\ of\ Assets}$$

The Q ratio indicates that if its value is greater than 1, it means that the stock of the company has more value than the cost to replace its assets. It means the stock of a company is overvalued and has a high firm value. On the other hand, if the ratio is less than 1, it means that the value of a stock is less than its replacement cost. This shows that the stock of a company is undervalued and has a low firm value.

3.2.4 Leverage

The ratio of the book value of long-term liabilities to total assets is used to calculate leverage. Leverage can be used to enforce discipline by limiting available free cash flow and thereby reducing profit diversion. Leverage, on the other hand, can be harmful if it increases the danger of financial trouble and insolvency. Cheng and Tzeng (2011) suggest that leverage is strongly positively connected to business value before approaching the optimal capital structure. When a company's financial health is stronger, leverage has a higher positive impact on its value. It is calculated following the work of (Mulyadi and Anwar, 2012).

Calculation:

$$LEV = \frac{Total\ Liabilities}{Total\ Shareholders'\ Equity}$$

3.2.5 Firm size

The natural logarithm of the book value of total assets is used to calculate firm size. Larger companies are expected to be mature companies with low corporate valuations (Maury and Pajuste, 2005). As a result, the study anticipates a negative correlation between firm size and firm value. It is calculated following the work of Fosu et al. (2016).

Calculation:

$$SIZE = \ln Total\ Assets$$

3.2.6 Sales growth

The annual growth rate of a company's sales is known as the sales growth rate. The percentage change in sales from year to year is used to determine sales growth. The study hopes for a positive relationship between sales growth and firm value because faster-expanding organisations generally have greater valuations (Maury and Pajuste, 2005). It is calculated following the work of Fosu et al. (2016).

Calculation:

$$SGROWTH = \frac{Current\ Year\ Sales - Previous\ Year\ Sales}{Previous\ Year\ Sales} * 100$$

3.3 Mathematical equation

To check the impact of investors' sentiments on firm value, the theoretical relationship between these variables can be expressed as follows:

$$FV_{i,t} = f\left(SENT_{i,t}, SIZE_{i,t}, LEV_{i,t}, SGROWTH_{i,t}\right)$$

The study transformed this equation into a mathematical expression:

$$FV_{i,t} = \beta_o + \beta_1\ SENT_{i,t} + \beta_2\ SIZE_{i,t} + \beta_3\ LEV_{it} + \beta_4\ SGROWTH_{it} + \varepsilon_{it}$$

In the above equation, *FV* denotes firm value as the dependent variable, *SENT* denotes investors' sentiments as an independent variable. Whereas *SIZE* denotes the firm size, *LEV* denotes leverage and *SGROWTH* denotes sales growth as control variables. $\varepsilon_{i,t}$ denotes the error term where *i* is the number of firms at a certain time *t*.

4 Results and discussion

4.1 Descriptive statistics

Table 1 shows the descriptive statistics section, which involves structuring, and summarising data in a form that is easy to comprehend. The dependent variable of the study is firm value; as per Table 1, firm value has the highest mean value of 649.939 among other variables. It has also the highest standard deviation of 1,250.721 with a minimum of –0.457 and a maximum of 4,484.312 value.

Among the four proxies of investors' sentiments, share turnover has the highest average value of 14.161, and dividend premium has the lowest value of 0.028. In the case of volatility, the study observes the same results as share turnover has the highest volatility and dividend premium has the lowest volatility level i.e., 5.247 and 0.082.

Table 1 Descriptive statistics

Variable	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
FV w	1,830	649.939	1,250.721	–0.457	4,484.312
LnCEFD	1,830	2.147	3.87	–7.761	12.422
LnTURN	1,830	14.161	5.247	0	22.158
EQShares	1,830	0.781	1.108	–22.172	18.445
DP	1,830	0.028	0.082	0	1.839
SIZE w	1,830	19.871	2.891	14.683	24.038
LEV w	1,830	1.19	1.877	–2.621	6.288
SGROWTH w	1,830	4.424	28.238	–60.236	65.948

Firm size, leverage, and sales growth are the control variables. The mean value of firm size is 19.871. The mean value of sales growth i.e., 4.424 shows the average annual sales growth of firms. The average leverage of selected firms is 1.19, it shows the percentage of a firm's capital funded by loans or debts. Among these control variables, sales growth has the highest volatility level.

This table also shows the minimum and maximum values of the variables. No minimum values are above the zero value except the minimum value of firm size which is 14.683. The minimum values of share turnover and dividend premium are at zero, while all the other variables are negative. In the case of maximum values, the firm value has the highest maximum value then comes the sales growth. Generally, the difference between the minimum and maximum values is small in all cases except in the firm value case.

4.2 Correlation matrix

Pairwise correlation results are shown in Table 2. The correlation matrix is used to examine Multicollinearity, and it is considered that Multicollinearity is not an issue when the correlation among independent variables is low Haniffa and Hudaib (2006), which it is in this case, so it is not an issue.

Table 2 Pairwise correlations

Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
(1) FV_w	1.000				
(2) SENT_w	0.166*	1.000			
	(0.000)				
(3) SIZE_w	–0.595*	0.018	1.000		
	(0.000)	(0.449)			
(4) LEV_w	0.145*	0.134*	0.108*	1.000	
	(0.000)	(0.000)	(0.000)		
(5) SGROWTH_w	0.102*	0.084*	0.027	0.119*	1.000
	(0.000)	(0.000)	(0.240)	(0.000)	

Notes: ***p < 0.01, **p < 0.05, *p < 0.1

4.3 Regression analysis

The study starts the analysis with OLS regression. By applying the Hausman specification test, the study found that the fixed-effects model is good for this research. After the post-estimation tests, the study found that diseases of heteroscedasticity, autocorrelation, cross-sectional dependency, and endogeneity are present in the data. Therefore, the study has to change the econometric model for analysis. So, this study moves towards the GMM model.

4.4 Generalised method of moments

This research utilises the model GMM suggested in 1982 by Lars Peter Hansen. The model is beneficial for various factors: firstly, it eliminates the issue of endogeneity and heteroscedasticity in panel data; secondly, it addresses the issue of instrumental variables by practicing a lagged approach for the predictor variable; and thirdly, it introduces the estimator to manage the correlation between the independent variables. As a result, the currently projected outcomes will be non-biased, consistent, and highly appropriate (Nguyen, 2021). Differential GMM and system GMM estimation are two different techniques of GMM estimation.

The study uses the System GMM model following the work of Nguyen (2021). The System GMM is quite more effective than the first-differenced GMM in resolving undetected country heterogeneity, missing variable bias, estimate error, and endogeneity issues. As a result, the System-GMM with two steps estimators are used in the research because it is fairly efficient and resilient to heteroscedasticity and autocorrelation.

Arellano-Bond and Hansen's tests are essential for estimating GMM findings. GMM estimation requires that the remainder have no quadratic autocorrelation. Therefore, the study must do an autocorrelation test in the composition of error using the Arellano-Bond test suggested by Arellano and Bond (1991). Therefore, when evaluating GMM, AR (1) i.e., first-order autocorrelation is considered necessary, and AR (2) i.e., second-order autocorrelation of residuals is not required. According to the null hypothesis of AR (1) and AR (2), there is no first or second-order serial correlation of residuals. As a result, the study must reject the null hypothesis when evaluating AR (1); however, the study should accept it while evaluating AR (2).

The Sargan/Hansen test is used to check whether the instrumental variables are suitable in the GMM model. The null hypothesis of this test states that instrumental variables are exogenous, meaning they do not associate with model error. Therefore, following the theory, the study will accept the null hypothesis with a probability value higher than 5%.

According to Table 3, the p-value of AR1 is less than 0.05, which demonstrates that there is first-order autocorrelation, hence rejecting the null hypothesis. The p-value of AR-2 is greater than 0.05, which shows that there is no autocorrelation, hence accepting the null hypothesis. It also confirms the differenced equation terms are serially correlated at AR1 and AR2. The probability values of Sargan and Hansen tests greater than 5%, suggest that all estimates fit the criteria of accepting the null hypothesis, indicating that the instrumental variables chosen in the model are exogenous and suitable.

Table 3 GMM and Driscoll-Kraay Standard Errors

	GMM	*Driscoll-Kraay standard errors*
	(1)	*(2)*
Variables	*FV_w*	*FV_w*
L.FV_w	0.303***	
	(0.057)	
SENT_w	0.447**	0.159***
	(0.181)	(11.95)
SGROWTH_w	–0.086	0.019
	(0.059)	(2.04)
LEV_w	0.585***	0.567***
	(0.140)	(56.07)
SIZE_w	–15.272***	–17.571***
	(1.354)	(–37.33)
2016bn. year	0.501	
	(0.386)	
2017. year	0.117	0.076**
	(0.143)	(3.07)
2019. year	0.214	0.087
	(0.182)	(1.55)
2016. year		0.383***
		(18.00)
2018. year		–0.238***
		(–10.75)
Constant	48.193***	55.907***
	(4.202)	(40.00)
Observations	270	658
Number of ids	160	
No. of instruments	17.000	
AR1 p-value	0.038	
AR2 p-value	0.088	
Sargan p-value	0.284	
Hansen p-value	0.539	
Number of groups		299
F		807.7

Notes: Standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

4.4.1 Investors' sentiments and firm value

Investors' sentiments have a significant causal relationship with the dependent variable i.e., firm value at a 5% level of significance. The association between both these variables

is positive. It shows that investors' sentiments positively influence the firm value. A significant causal relationship between these variables indicating towards accepting the first hypothesis of the research i.e., investors' sentiments significantly impacted the firm value. This is the novelty of this research as no one checks the impact of investors' sentiments on firm value in the previous literature to the best of our knowledge. As the results of the study show that investors' sentiments have significantly impacted the firm value, so now, managers should consider the sentiments of the investors while deciding on the firm.

4.4.2 Leverage and firm value

Leverage has a highly significant causal relationship with firm value at a 1% level of significance. It is positively associated with firm value. It means an increase in leverage ratio increases the value of the firm. Cheng and Tzeng (2011) observe that leverage is strongly positively connected to business value before approaching the optimal capital structure. When a company's financial health is stronger, leverage has a higher positive impact on its value. Here the study is accepting the second hypothesis of the research i.e., Leverage has significantly impacted the firm value.

4.4.3 Firm size and firm value

Firm size is significantly causally related to firm value at a 1% level of significance but the association between these two variables is negative. It means an increase in firm size decreases the firm value and vice versa. Larger companies are expected to be mature companies with low corporate valuations (Maury and Pajuste, 2005). As a result, the study anticipates a negative correlation between firm size and firm value. Here the study is accepting the third hypothesis of the research i.e., firm size has significantly impacted the firm value.

4.4.4 Sales growth and firm value

Sales growth has an insignificant causal relation with firm value. The association among these variables is negative, which shows that an increase in sales growth decreases the firm value. Generally, sales growth has a positive impact on firm value. The results of this research are contradicting the literature. So, the study is rejecting the fourth hypothesis of the research i.e., sales growth has significantly impacted the firm value.

4.5 Driscoll-Kraay standard errors regression

As per Driscoll and Kraay (1998), the DK regression standard errors technique rectifies the issues of heteroscedasticity, cross-sectional dependency, and autocorrelation. It is a non-parametric approach with a covariance matrix indicator.

The research uses Driscoll-Kraay standard errors regression to check the robustness of the GMM model. Table 3 shows the findings of the robust tests while using Driscoll-Kraay's standard error regression. In DK regression, the findings of the research are validated. This technique minimises errors and gives more efficient results. As you can see in the table, the investors' sentiments variable is significantly causally related to firm value at a 5% level of significance in the GMM model but now in DK regression

results, it is significantly related at a 1% level of significance. Coefficients also decrease from 0.447 to 0.159. Leverage and firm size remain significant at a 1% level of significance. Sales growth still has an insignificant relation with firm value but now in DK regression, its association with firm value moves from negative to positive. Coefficients of sales growth and leverage decrease but the coefficients of firm size increase by 2%. Overall, the findings confirm and recommend the decision to examine endogeneity biases, missing variables, over-identifying limitations, measurement errors, and managing autocorrelation in a panel dataset using a two-step system GMM.

5 Conclusions

Research on investors' sentiments has mainly concentrated on determining the impact of sentiments on stock market returns. The present study adds to the literature by investigating the impact of investors' sentiments on firm value, using the sample of 370 firms listed on the Pakistan Stock Exchange by applying the GMM.

The results of the study indicate that investors' sentiments have a significant causal relationship with firm value and the association between these variables is positive. Therefore, it can be said that investors' sentiments positively influence the value of a firm. The results accept hypothesis H1 of this research. The results also demonstrate that leverage and firm size are significantly causally related to firm value, accepting H2 and H3, but sales growth has an insignificant causal relation, so, rejecting H4. However, leverage and sales growth are positively related to the firm value which shows that an increase in leverage and sales growth also increases the value of the firm; Whereas, firm size is negatively related to the firm value. It means an increase in firm size will decrease the firm value and vice versa. Hence, it is proved from the results that investors' sentiments not only influence the market of value stock returns but also have an impact on the firm value.

From the results of the research, it is recommended to the firm's managers that they should continuously monitor investors' sentiments and analyses how they impact the company's stock price. By understanding the factors that drive investors' sentiments, firms can anticipate potential changes in the stock price and develop strategies to mitigate negative impacts. Secondly, firms should focus on maintaining open communication channels with investors to help them better understand the company's strategies and goals. By keeping investors informed and engaged, firms can help to mitigate negative sentiment and encourage positive sentiment towards the company. Thirdly, building and maintaining a strong reputation is critical to sustaining positive investor sentiments. Firms should prioritise building a positive reputation through ethical business practices, transparent communication, and delivering on their promises. Fourthly, the financial performance of a firm is the primary driver of investor sentiment. Firms should prioritise maintaining financial stability and profitability to maintain positive investor sentiment. Last but not least, besides investors, firms should focus on engaging with all stakeholders, including customers, employees, suppliers, and the community. By maintaining positive relationships with all stakeholders, firms can build a strong foundation of support and loyalty that can help to offset negative sentiment in the event of market volatility.

Whenever policies are designed, they should generate positive waves in the investors so that they perceive that the project will increase the financial performance or value of

the company. These positive waves will help in increasing the trading activity of the shares in the market and the bond between market value and firm value will become strong.

For future research purposes, add any moderating or mediating variable like managers' sentiments or market news in the same study and then check the impact. Secondly, increase the time duration of the research. Thirdly, do a comparative study (by adding different cultures and behaviours) and check the impact in the developed and developing world.

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