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Unlocking the puzzle: Corporate hedging's ripple effect on investor sentiments amid asymmetries

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Abstract: Pakistan is a leading emerging market as per the recent classification of the International Monetary Fund (MF), and hedging is used as a considerable apparatus for minimizing a firm's risk in this market. In these markets, investors are customarily unaware about the hedging activities in firms, due to the occupancy of asymmetric environment prevailing in firms. This research paper adds a new insight and vision to the existing literature in the field of behavioral finance by examining the impact of hedging on investors' sentiments in the presence of asymmetric information. For organizing this research, 366 non-financial firms are taken up as the size sample; all these firms are registered in the Pakistan Stock Exchange. A two-step system of generalized method of moments (GMM) model is implemented for regulating the study. The findings of empirical evidence exhibit that there is a positive relationship between investors' sentiments and hedging. Investors' sentiments are negative in relationship with asymmetric information. Due to the moderate presence of asymmetric information, hedging is positively related to investors' sentiments although this relation is non-significant.

Keywords: hedging; asymmetric information; investors' sentiments; a two-step GMM model

1. Introduction

In this modernized age, due to the presence of abnormal incremental in foreign trade in foreign markets, all firms are facing high risk (Seng and Thaker, 2018). Hedging is also used for risk mitigation, through which investments can be made in risky financial assets by investors (Massa and Simonov, 2006). In the vernacular of finance, the term hedging is known as a measure by which investors or firms can eradicate or minimize the risk in decisions of different investments (Stulz, 2013). Now to wipe out this risk, different financial assets are taken up by investors (Massa and Simonov, 2006). Different ways are used by firms for managing risk. Risk management is comprised of policies that help managers minimize the undiversified risk that is faced by managers (Petersen and Thiagarajan, 2000). In the prior literature on risk management, the purpose of derivatives is just hedging. Substitute channels are being used by firms for hedging other than derivatives (Petersen and Thiagarajan, 2000). The convenience of derivatives is visible in their results as minimizing flaws of the market, for instance: taxes and bankruptcy agency costs and undiversified

stakeholders (DeMarzo and Duffie, 1995; Froot et al., 1993; Mello and Parsons, 2000; Smith and Stulz, 1985; Stulz, 1984). Derivatives are the first choice for hedging, which are further classified into two, options and forward. Besides these derivatives, stand-by LCs, diversification of portfolio, and fixed-rate instruments are also employed for hedging.

As stated by classic scholars of finance, basic principles of price equilibrium are the core requirement behind stock price. There is no relationship between investor's sentiments and stock price (Fama, 1965). Keeping in view the hypothesis of an efficient market, financial instruments are always sold and purchased at a fair value from the stock market which enables investors efficient enough to buy those instruments that are undervalued and dispose of those stocks which are overrated. A contrary theory of an efficient market hypothesis is the "arbitrage theory" that demonstrates price equilibrium can be also achieved through irrational investors since they affect as a market constraint (Friedman, 1953; Fama, 1965; Ghosh et al., 2020). There is no specific and advanced knowledge in these uninformed traders. The behavior of all non-informed and informed traders works like a prime factor in their decisions of investment (Glaser and Weber, 2009). Investors' sentiments also furnish information on inflated returns (Lux, 2012). All these components move forward in playing a prime role in firms' decisions. As per previous literature, there is a positive effect between hedging and investors' sentiments (Smith et al., 2016; Yang et al., 2016). One of the leading features in the Pakistan stock market is excessive trading which highlights more liquidity needs and the crucial involvement of traders. These investors are on the whole noisy, concerned about market emotions, and ignorant (Kuzmina, 2010).

Information asymmetric is the prime factor of the emerging market that also governs the emotions of investors (Manos et al., 2012). Concerning the context of hedging and asymmetric information; hedging associates firms in minimizing noise concerning managers and shareholders. This aids in eradicating asymmetric information (Breeden and Viswanathan, 1998; DaDalt et al., 2002; DeMarzo and Duffie, 1995; Shao, 2003).

The immense impact of hedging comes from the scenarios of information that get around in the firm. Assessment of forecasting and volatility are prime features of hedging. Thus, by lessening the outcomes of noise in information through hedging, managers can present shareholders with an actual view of firm revenue and the working capacity of managers (DaDalt et al., 2002). Myers and Majluf (1984) clarify the directions through asymmetric information effects the decisions of financing in the firm. Literature also enlightens the bond between asymmetric information and investors' sentiments. Findings mostly show that the availability of asymmetric information will negatively impact investors' sentiments (De Wet, 2004; Grossman and Stiglitz, 1976; Stiglitz and Weiss, 1981). That is the ground behind taking up this study to inspect the moderating effect of asymmetric information on the relationship between hedging and investors' sentiments. This paper is managed in the context of Pakistan's emerging market. Pakistan is a bank-based economy. From the recent two decennaries, different developing nations are making efforts to gain sustainable growth to strengthen their financial markets. In this competition, Pakistan is also making hard efforts. After 9 years, Pakistan was again recognized as an emerging

market in 2017 by Morgan Stanley Capital International. Pakistan Stock Exchange is comprised of financial firms and non-financial firms. These are the basic and major elements of financial markets in Pakistan (Seng and Thaker, 2018). However, this study takes non-financial hedge firms because banks are themselves money makers and they have different meanings of derivatives and hedging as compared to non-financial firms.

The author has found rare evidence that hedging and investor sentiments are inspected under one umbrella with the presence of asymmetric information as a moderator. Previous literature revealed hedging and investor sentiments are positively correlated. The variable asymmetric information belongs to the lemon theory which proves, that the presence of this variable will manipulate the price. NM theory of hedging has S-shaped curve and the prospect theory of hedging shows a concave-shaped curve. The S-shaped curve has a large volume of challenges in making hedging decisions. Presence of asymmetric information moves the hedging curve into S-shape. Behavioral finance theories prove that the prices of stocks are connected with investors' emotions. The authors of this study want to examine if two variables; hedging and asymmetric information come together which are also opposite in nature then how they perform with investors' sentiments. The novelty of the study would add a new vision to the hedging and investor sentiment relationship. The results of this research will help in understanding the following matters:

1) The impact of hedging on investor sentiments.

2) How asymmetric information moderates the relationship between investor sentiments and hedging.

2. Literature review and construction of hypothesis

It is stated in classical finance theory, that financial hedging is extraneous to firm value in a perfect capital market (Modigliani and Miller, 1958). On the whole, extravagant firms do not undertake hedging activities (Culp et al., 1998). The reasons behind firms opt for hedging, are to lessen the financial distress expenses, that arise from bankruptcy (Graham and Rogers, 2002; Smith and Stulz, 1985), to shrink the expenses of those opportunities relevant to investment (Froot et al., 1993; Gay and Nam, 1998; Géczy et al., 1997; Knopf et al., 2002), and to cut back the proposed tax liability (Graham and Rogers, 2002; Nance et al., 1993). Sajjad et al. (2013) explained the risk of the financial sector of Pakistan and the role of derivatives in declining the risk. Results explained that hedging is a considerable tool for boosting liquidity, declining capital congregation, and combating risk in the economy. The hedging money is positively related to market competition and conditions and has an inverse relationship with investors' sentiments and style performance (Ma et al., 2022). Agarwal and Ren (2023) studied hedge funds in the asset market. They concluded that hedged money carries powerful benefits, fewer constraints, and moderate in trading like other institutional investments. The capacity of hedged funds to strengthen liquidity or to arbitrage relates to the market environment and funding background of funds.

Baker and Wurgler (2007), Brown and Cliff (2005), Kumar and Lee (2006) explored that collectively, stock market return is forecasted by investors' sentiments.

High and low investors' reactions, which do not according to the typical postulations of finance, are investor's sentiments (Baker et al., 2007). Prices are not only affected by investors' sentiments. These sentiments also induce market risk (Shleifer and Summers, 1990). Investors who reside in the same region or area can drive unusual returns (Ivković and Weisbenner, 2005). Variations in sentiments strongly affect those securities that are complex for arbitrage (Smales, 2017). These sentiments' impact on the gain of stock markets is visible whether the market is working well or bad (Ur Rehman, 2013). Due to investors' reactions, the Pakistan stock market is mercurial. The reason for this behavior is incompetent expertise and unprocurable statistical tools to estimate variations in the stock market (Raza et al., 2019). If investors' sentiments are positive and inflated, then stock returns also go upward. On the contrary, if investors' sentiments are negative and deflated, then stock return also moves downwards (Cevik et al., 2022).

The phenomenon of information asymmetric took birth from the theory of "The market for lemons" by George Akerlof (1970). Customarily purchasers have bad tips as compared to producers or sellers about the characteristics of the object they acquire. Specifically, asymmetric information gives rise to adverse selection prices, and enduring debt financing that will capture priority over other financing modes (Myers and Majluf, 1984). Over-investment happens due to asymmetric information between shareholders and management. While, the under-investment problem arises due to asymmetric information among receivables and shareholders (Morgado and Pindado, 2003). Bharath et al. (2009) formulate a model of asymmetric information. The results explicitly that asymmetric information governs the choice of a firm's capital structure. Qu et al. (2018) also built an index of asymmetric information. It has shown that compelling asymmetric information generates compelling leverage levels. Ahmed et al. (2020) examined the relationship between asymmetric information and capital structure. They employ data from the Pakistan Stock Exchange for 10 years, from year 2006 to 2015. The observations are reconcilable with the packing order theory. The empirical results show an evident increase in leverage, which happens due to asymmetric information. The severity of asymmetric information moves towards an adverse selection problem, therefore only inferior goods producers remain in the market, and producers of good quality products have to quit (Macedoni, 2022).

Ahmad et al. (2014) investigated that there is a positive relationship exists between future market and stock return, realized volatility, and stock volatility. Emerging markets' individuals do not generate sentiments. These individuals have an exclusive part in irrational trading (Bello et al., 2017). Yang et al. (2016) established a research work to investigate the sentiments of investors in the options market. Doukas and Mandal (2018) explained managerial sentiments and hedging relationships. Wang et al. (2021) discovered the impact of the sentiments of investors on firms' decisions that have funds from hedging. They finalized their paper with these results; injection of funds, neither in cold nor hot markets, is non-favorable for investors due to inflated investors' sentiments. Su et al. (2023) observed that fear sentiments' can be hedged by gold prices. A pessimistic influence on fear sentiments through gold prices pointed to the diversified assets that can be employed as substitutes for gold. Taking this into consideration, the following hypothesis is derived:

H1: Hedging has a significant impact on investor sentiments.

Nath and Mukherjee (2012) explored that relational bonds have a buffering impact on a firm's creativity for building consumer links. This relationship is moderated by asymmetric information. Sofia and Murwaningsari (2019) also examined the moderate relationship of asymmetric information on capital structure, institutional ownership, and diversification in order to influence earnings management. The moderate impact of asymmetric information makes the relationship between capital structure and institutional ownership structure dominate earnings management. Although does not help diversification in influencing earnings management.

Su et al. (2023) employed asymmetric information as a moderator to study the relationship between voluntary disclosure and financial reporting quality. The findings depicted that asymmetric information minimizes the quality of financial reporting; also, voluntary disclosure reduces asymmetric information. Pernamasari (2022) explored that excessive information asymmetry causes high bid-ask to spread, in this scenario, the disclosure of earnings (ROA) is anticipated to minimize the information asymmetry, consequently, the bid-ask spread also minimizes that increases the stock prices. By taking the moderate impact following hypothesis is formulated.

H2: In the presence of a moderate effect, hedging has a positive impact on investor sentiments.

3. Materials and methods

Data collection

Primarily, 410 firms from the Pakistan Stock Exchange were selected as a sample size. After sample generalization, from the sample of 410 non-financial firms, only 366 firms are finalized for the data essentials of hedging, asymmetric information, and investors' sentiments. 5-year data is collected from the years 2015–2019. During the process of data collection, the missing observations are not included in the final observations. Data is collected from the yearly financial statements of the firms and for this purpose, the websites of Open Doors, SBP, and PSX are used. The Study moves around the three prime variables that are integrated together for investigation in this study: 1) investor sentiments (dependent variable), 2) hedging (independent variable), and 3) asymmetric information (moderate variable).

Afza and Alam (2011), Bashir et al. (2013) also took dummy variables for calculating data of hedging. Those non-financial firms that employ interest rate derivatives (IRD) and foreign exchange derivatives (FXD) are measured as Hedgers and all those firms that are not employing any of these derivatives are considered as non-hedger. A value of 1 is allocated to hedgers and a 0 value is allocated to non-hedgers. For measuring investors' sentiments, an Index is built by employing four proxies: 1) equity shares, 2) dividend premium, 3) share turnover, 4) close-end fund discount (Baker and Wurgler, 2006). This investor sentiments index is built by running Principal Component Analysis (PCA) on proxies. PCA examines a data table which presents observations described by several dependent variables, that are inter-correlated. Its objective is to pull out considerable information from the data table and to indicate this information as a combination of new orthogonal variables which is called principal components. Where P is the $I \times L$ matrix of left singular vectors, Q is

the $J \times L$ matrix of right singular vectors, and Δ is the diagonal matrix of singular values (Abdi and Williams, 2010).

$$X = P\Delta Q^t$$

Following is the investors' sentiment index calculated through PCA.

$$\text{Sentiments index} = (0.4254\text{EQSHARES} + 0.3894\text{DP} + 0.3154\text{INTURN} - 0.2605\text{CEFD})$$

where: EQSHARES = Equity shares; DP = Dividend premium; INTURN = Share turnover; CFED = Closed end fund discount.

Another type of mutual fund is well-known as a closed-end fund discount. On the initial level of funds raising, IPOs are common practice. These specific kinds of securities are being used for issuing fixed numbers of shares through IPOs. The CFED is measured by taking the difference of net asset value of the fund's holdings and the fund's trading price in the market (Baker and Wurgler, 2006; Lee et al., 1991; Neal and Wheatley, 1998). Here, net asset value is measured by taking the difference between the liabilities and assets of the firm and then dividing it by the value of outstanding shares of the firm (Khan and Ahmad, 2018).

$$\text{CEFD} = \left(\frac{\text{Share price}}{\text{NAV}}\right) - 1$$

Share turnover is a touchstone for the calculation of stock liquidity. It also serves for the forecasting of investors' sentiments and market responses. It acts in the market like a trading indicator (Baker et al., 2012; Campbell et al., 1993; Heflin et al., 2001). High turnover demonstrates the trading pattern of irrational individuals and also opens the over response of the Baker and Wurgler (2006). It is measured by dividing the dividend price per share by outstanding shares.

$$\text{TURN} = \frac{\text{Number of shares traded}}{\text{Outstanding shares}}$$

Equity shares point out dissimilar sentiments of markets. It is calculated by dividing the gross equity by the total gross equity and long-term debt. Baker and Wurgler (2000) find that a high value of shares forecasts the minimum return of stocks.

$$\text{EQShares} = \frac{\text{Gross equity}}{\text{Gross equity} + \text{Long term debt}}$$

Baker and Wurgler (2006) evident prime method which is also price-based is dividend premium. It admits the prime former trends of the firm's culture of paying a dividend. Firms show more eagerness to premiums on dividends (Fama and French, 2001). This proxy is positively associated with investor sentiments (Rahman, 2017).

$$\text{DP} = \frac{\text{Dividend pershare}}{\text{Price}}$$

Asymmetric information points towards the condition, in which during performing any business deal any party either seller or buyer is much aware in contrast to another. A higher level of volatility in share returns demonstrates higher asymmetric information (Wang, 1993).

$$\text{Daily stock return volitality} = \text{Stdev.s}\left(\frac{\text{Closing share price}}{\text{Opening share price}} - 1\right) \times \sqrt{252}$$

Estimations of control variables are as follows:

Firm size estimation is done by applying the natural logarithm of total assets' book value.

$$\text{Size} = \ln \text{total assets}$$

Firms' yearly growth rate of sales is estimated for sales growth (Shah et al., 2024, 2019, 2018).

$$\text{Sales growth} = \frac{\text{Current year sales} - \text{Previous year sales}}{\text{Previous year sales}} \times 100$$

Leverage is calculated by taking all long-term liabilities' book value divided by the total assets. Leverage performs a disciplinary action by reducing the free flow of cash at hand. Hence, minimize the profit diversion.

$$\text{LEV} = \frac{\text{Total liabilities}}{\text{Total shareholders' equity}}$$

A regression model for multivariate is built to estimate the relationship of hedging on investor sentiments. In the model dependent variable is investors' sentiments. Hedging is taken as an independent variable. The moderate variable is asymmetric information. While three control variables: Firm size, Sales growth, and Leverage are also part of the model. The relationship nature is moderate.

The *p*-value explains the validity of the findings. The β_0 represents the constant term. ε represents to error term that accomplished the equation. β_1 β_2 β_3 demonstrates the parameter of change. β_4 β_5 β_6 are the control variables parameters that influence on findings and maximize the model validity.

$$\text{IS} = \beta_0 + \beta_1 \text{hedging} + \beta_2 \text{AS} + \beta_3 \text{H} \times \text{AS} + \beta_4 \text{Size} + \beta_5 \text{growth} + \beta_6 \text{Lev} + \varepsilon \quad (1)$$

4. Results

Table 1 contains a list of variables along with their explanations and references.

Table 1. Variables and proxy measurement.

Variable	Proxy	Measurement	References
Dependent variable			
	Dividend premium	Dividend per share/price	(Baker and Wurgler, 2006)
	Equity shares	Gross equity/gross equity + Gross long-term debt	(Baker and Wurgler, 2006)
Investors sentiments	Closed-end fund discount	(Share price/NAV) − 1	(Baker and Wurgler, 2006)
	Share turnover	Number of shares traded/outstanding shares	(Baker and Wurgler, 2006)
Independent variable			
Hedging	Discrete measurement	Dummy 1 if firm is doing hedging and 0 if firm is not hedging	(Afza and Alam, 2011)
Moderate variable			
Asymmetric information	Return volatility	The annual average of daily stock return volatility	(Elbadry et al., 2015)
	Firm size	Natural logarithm of total assets	(Fosu et al., 2016)
Control variables	Leverage	Debt/equity ratio	(Mulyadi and Anwar, 2012)
	Sales growth	(Current year sales − Previous year sales/previous year sales) × 100	(Elbadry et al., 2015)

Table 2 presents the descriptive statistics. It demonstrates a static description of the above 1800 observations. It presents the standard deviation, minimum, and maximum value of each variable. The sample size is 366 non-financial firms for the time period of 5 years from 2015–2019. IS represents the estimations of investor

sentiments taken up from the PCA. The hedging proxy is a discrete variable. Asymmetric information measures through daily stock return volatility. Moderation impact adds by multiplying asymmetric information and hedging. Lnsgrowth is the log of the yearly growth rate of sales of a firm. Lev is calculated through debt-to-equity ratio. Size is the log of total assets of firms.

Table 2. Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
IS	1830	0.03	0.89	−0.902	1.474
Hedging	1830	0.597	0.491	0	1
Asymmetric information	1830	0.514	0.297	0	1.261
Moderator	1830	0.268	0.255	0	0.651
Lnsgrowth	1830	2.437	1.278	0	4.144
Lev	1830	1.118	1.175	−0.878	3.375
Size	1830	19.881	2.734	15.495	23.436

Note: IS has lowest average value.

IS has a low value of mean and high volatility in contrast to an independent and moderate variable. The standard deviation and mean value of IS are 0.89 and 0.03, respectively. All variables' mean values are more than zero.

Table 3. Pairwise correlation.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) IS	1.000	-	-	-	-	-	-
(2) Hedging	0.125*	1.000	-	-	-	-	-
(3) Asymmetric information	−0.258*	−0.066*	1.000	-	-	-	-
(4) Moderator	−0.006	0.862*	0.241*	1.000	-	-	-
(5) Lnsgrowth	−0.007	0.025	0.096*	0.055*	1.000	-	-
(6) Lev	0.117*	0.017	0.042	0.060*	0.110*	1.000	-
(7) Size	−0.722*	0.111*	0.139*	0.165*	0.124*	0.144*	1.000

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Hedging and investor sentiments is positively correlated at 90% significance level. Asymmetric information is negatively correlated with hedging and investor sentiments at 90% significance level.

Table 3 depicts pairwise correlation coefficient of variables. Independent variable is hedging and investors' sentiments is a dependent variable. Moderate variable is asymmetric information. Firm size, leverage and growth all are control variables. The independent variable hedging is 90% significant and has positive relationship with dependent variable IS. The relationship among investors' sentiments and asymmetric information is negative and significance level is 90%. The moderator effect (hedging × AS) is negative with investors' sentiments and has no significant relationship. It demonstrates on the availability of asymmetric information; hedging has no impact on investor sentiments. Size and sales growth have negative relationship with investors' sentiments. Leverage and firm size have 90% significant relationship with IS. Sales growth has no significant relationship with IS. All these variables are

not having value more than 0.7, which demonstrate there is no multicollinearity in variables.

In order to check the relationship among investors' sentiments and hedging, first panel data regression models are run. Panel data associate researchers to insert variables for analyzing on various levels which would appropriate for hierarchical or multilevel modeling. After panel OLS, pooled OLS is tested in regression model. This model performs estimations by ignoring the time series and cross-section data nature, supposing that all entities are equal overall period time. Pooled OLS model is used for heterogeneity. Heterogeneity works in panel fixed model. These models used values of intercept. These values of intercepts do not change across time.

Standard equation of pooled OLS model:

$$y_{it} = a + x_{it}\beta + u_{it} \tag{2}$$

Standard equation of panel fixed OLS model. Where y = dependent variable, i = firms, t = time period, x = independent variable, β = parameter for risk level and u = error term.

$$y_{it} = a_{it} + x_{it}\beta + u_{it} \tag{3}$$

Table 4 shows the estimations of pooled OLS and panel fixed OLS. Pooled OLS estimations are exits in column 2. Panel fixed OLS results are available in column 3. Hedging is positive at 100% significant level (Smith et al., 2016; Szu and Yang, 2015). So, hypothesis is accepted. Asymmetric information has negative correlation at 100% significant level in impacting investor sentiments (De Wet, 2004; Grossman and Stiglitz, 1976; Stiglitz and Weiss, 1981). By adding the moderate impact of asymmetric information (Hedging × Asymmetric information), hedging is 100% significant level with investors' sentiments but has negative impact.

Table 4. Estimations of pooled OLS and panel fixed OLS.

	(1) Pooled OLS	**(2) Panel fixed OLS**
Variables	**IS**	**IS**
Hedging	0.615***	0.376***
	(10.18)	(6.36)
Asymmetric information	−0.319***	−0.142***
	(−6.10)	(−2.82)
Moderator	−0.576***	−0.195*
	(−4.81)	(−1.72)
Lnsgrowth	0.051***	0.037***
	(5.20)	(4.05)
Lev	0.172***	0.140***
	(15.98)	(13.99)
Size	−0.247***	−0.190***
	(−52.65)	(−30.74)
2016 year	-	0.018
	-	(0.56)
2017 year	-	0.045
	-	(1.42)

Table 4. (*Continued*).

Variables	(1) Pooled OLS IS	(2) Panel fixed OLS IS
2018 year	-	0.031
	-	(0.98)
2019 year	-	0.031
	-	(0.99)
Constant	4.581***	3.437***
	(48.10)	(27.27)
Observations	1830	1830
R-squared	0.645	0.434
r_{2a}	0.644	0.288
F	552.2	111.3
Number of IDS	-	366

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; with the moderating effect of asymmetric information, hedging and investor sentiments are negative at 90% significance level.

With the moderation impact of asymmetric information, hedging impacts negatively on investor sentiments which reject our hypothesis 2. From control variables, sales growth and leverage are significant and positive related with investors' sentiment. Firm size has negative relationship and 100% significant with investors' sentiments. The observations are 1830. The value of *R*-square defines, in percentage, how much model's dependent variable is described by the independent variable. **Table 4** demonstrates that the *R*-squared value of pooled OLS is 0.645 and panel fixed OLS is. 434. *R*-squared of Pooled OLS is higher than 0.5 and *R*-squared value of panel fixed OLS is 0.434 is low than 0.5.

Pooled OLS model demonstrates that the independent variable is competent enough to narrate the dependent variable.

The pooled OLS and panel fixed OLS estimations do not develop accurate results. Five post estimation tests are run for the confirmation of data validity: 1) Pearson test, 2) endogeneity test, 3) multicollinearity, 4) autocorrelation, 5) modified wald test for group wise heteroskedasticity. Endogeneity test shows *p* value occurs less than 0.05. Auto correlation test reveals first order autocorrelation at 1% significance level. Wald test also exhibits heteroskedasticity as *p*-value is at 1% significance level. Therefore, it is essential to adopt such an econometric model which can resist all these diseases and also abolish fixed panel effects. In 1982, Lars Peter Hansen has proposed GMM model. The GMM model has two divergent types which are differential-GMM and system-GMM. As per Arellano and Bond (1991), differential-GMM is appropriate for small sample and system-GMM is appropriate for large sample (Nguyen, 2021). Bond (2001), Klomp and Hoogezand (2018), Lefort and Esquivel (1996) and Tinta et al. (2018), all these intellectuals adopted system GMM model in their study. This model is highly effective in contrast of two-stage least square and first difference GMM. It rectifies imperceptible Heteroskedasticity, omitted variable biases, estimation errors problems and endogeneity which are continuously emerging in calculations (Baum, 2006).

Following are the reasons by which researchers have adopted it. First, it abolishes diseases of heteroskedasticity and endogeneity. Secondly, through applying the legged approach it abolishes instrumental problems, third, it demonstrates estimators by which correlation among independent variables could be eliminated. Many prior studies have used it and explain beneficial results.

The standard equation is:

$$y_{i,t} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2 X_{i,t} + \beta_3 Z_{i,t} + \varepsilon \tag{4}$$

Equation with moderate effect:

$$y_{i,t} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2 X_{i,t} + \beta_3^{"} X_{i,t} + \beta_4 Z_{i,t} + \varepsilon \tag{5}$$

In this model, $y_{i,t}$ is the lagged variable of dependent variable which represents investors' sentiments. X is a predictor variable which shows hedging. $\beta_3^{"} X_{i,t}$, it represents asymmetric information moderation effect. Z represents control variables.

$$IS_{i,t} = \beta_0 IS_{t-1} + \beta_1 Hedging_{i,t-1} + \beta_2 Asymmetric\ information_{i,t} + \beta_3 Insgrowth_{i,t} + \beta_4 Size_{i,t} + \beta_5 Lev_{i,t} + \varepsilon \tag{6}$$

$$\begin{aligned} IS_{i,t} = {}& \beta_0 IS_{t-1} + \beta_1 Hedging_{i,t-1} + \beta_2 Asymmetric\ information_{i,t} + \beta_3^{"} Hedgimg \times Asymmetric\ information_{i,t} \\ & + \beta_4 Insgrowth_{i,t} + \beta_5 Size_{i,t} + \beta_6 Lev_{i,t} + \varepsilon \end{aligned} \tag{7}$$

In GMM, same assumptions and low information are required. It develops better results as compared to OLS. Bond et al. (2001); Caselli et al. (1996); Klomp and Hoogezand (2018), Tinta (2022), all these scholars applied System GMM model in their papers.

Table 5 is the estimations of two-step system GMM. For acquiring results from GMM, Arellano-Bond and Sargan/Hansen tests are needed. These are post estimation tests. There is an assumption of GMM results which requires no quadratic auto correlation in data. Thus, we are bound to conduct the test of auto correlation with the compositions of errors which were designed in the Arellano-Bond's (1991) study. AR1 is abbreviation of first-order correlation that relates with consecutive errors correlation. AR2 is second order-correlation that relates with those errors that effect data two periods prior. The test of AR-1 and AR-2 is conducted for auto correlation. The null hypothesis of AR1 and AR2 demands that there should be not first and second order serial correlation.

Table 5. Estimations of two-step system GMM.

	(1)
Variables	**IS**
IS	0.161***
	(0.061)
Hedging	0.281**
	(0.133)
Asymmetric Information	−0.476***
	(0.102)
Moderator	0.121
	(0.256)
Lnsgrowth	0.261**
	(0.104)

Table 5. (*Continued*).

Variables	(1) IS
Lev	−0.101
	(0.126)
Size	−0.230***
	(0.027)
2016 year	0.021
	(0.051)
2017 year	0.033
	(0.051)
2018 year	0.005
	(0.041)
Constant	4.099***
	(0.498)
Observations	1464
Number of ID	366
Number of instruments	19
AR1p	3.01×10^{-6}
AR2p	0.0673
Hansenp	0.350
Sarganp	0.240

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; In moderating impact of asymmetric information, Heding and investor sentiments have no impact.

For GMM estimations, Estimations should be according to following order, which result of AR1 should reject null hypothesis and result of AR2 must be according to the Null hypothesis. Sargan and Hansen test certain the wellness of instrumental variables. H0 hypothesis of this test is instrumental are exogenous. As per grounded theory null hypothesis will be acceptable when *p*-value is 5% or above. The results of AR1 demonstrate that *p*-value is less than 5% it means there is a first order autocorrelation. The results of AR-2 show that *p*-value is above 5% which accepts null hypothesis. It also proves the difference of equation terms are serially correlated at AR1 and AR2. Hansen/Sargan results *p*-values are also more than 5%. It also accepts null hypothesis and proves instrumental variables are exogenous.

In **Table 5**, Hedging is at 5% significant level relates positive with dependent variable (investors' sentiments) These findings are in accordance with previous literature and validate that on the availability of hedging, investor's sentiments escalate and provide positive signaling for investment (Smith et al., 2016; Szu and Yang, 2015). H1 is accepted.

Asymmetric information has negative correlated with investors' sentiments at 100% significant level with the dependent variable (De Wet, 2004; Grossman and Stiglitz, 1976; Stiglitz and Weiss, 1981). Hence, it proves asymmetric information has negative impact on investors' sentiments and in presence of asymmetric information, investor will gain negative signals. These signals motivate irrational trading and also

ultimately lead towards unusual losses or gains.

After applying moderator (Hedging × AS) in estimations, the results show that due to the presence of asymmetric information, hedging has positive correlation with investors sentiment, as results demonstrate this relationship is not significant which might be due to sample size or data problem. Hence, H2 is partially accepted which demonstrates in the presence of asymmetric information, hedging is positively related to investors' sentiments (Shao, 2003). In Pakistan, activities of hedging are not performed in the same manners likewise different developed countries. This problem minimizes the impact of hedging and do not provide its ripe fruits. This might be the reason behind hedging has no effect in the presence of asymmetric information. Modigliani and Miller (1958) stated that in the presence of asymmetric information, the effect of hedging is insignificant. Sales growth is 5% significant and has a positive correlation with investors' sentiments. Leverage has negative correlation with investors' sentiments. This relationship is also not significant (Ryu et al., 2020). Firm size has negative correlation at 100% significant level with investors' sentiments (Koshoev, 2020).

Table 6 presents the result of model robustness. Various scholars from different fields exercised Driscoll and Kraay's, model. As per finance scholars, this model is highly functional while evaluating large panels of data (Baloch et al., 2019). Baloch et al. (2019) corroborate that the model generates unbiased findings and fits panel data well. In heteroscedasticity and serial dependence difficulties, different researchers considered that Driscoll Kraay's model is effectual techniques (Özokcu and Özdemir, 2017). In this study, author employ Driscoll Kraay standard errors regression to examine the robustness of the GMM model. **Table 6** shows the results of the robust tests while using Driscoll Kraay's standard error regression. By employing DK regression, our estimations are validated. This method reduced errors and provides proficient results. In the table, hedging variable is significantly related to investors' sentiments at 5% level of significance in GMM model but now in DK regression results, it is significantly related at 1% level of significance. Asymmetric information is now positively correlated with investors' sentiments at 1% significance level. By adding the moderating impact of asymmetric information, the result is still positive with no relationship between hedging and investors' sentiments. Coefficients also decrease from 0.12 to 0.02. Firm size remains significant at a 1% level of significance negatively. Sales growth also has positive relation at 5% significant level. Leverage still has no significance. In conclusion, the result verifies and endorses the decision to inspect endogeneity biases, heteroskedasticity, and managing autocorrelation in a panel dataset using a two-step system GMM.

Table 6. Model robustness Driscoll-Kraay.

	GMM	Driscoll-Kraay standard errors
	(1)	(2)
Variables	IS	IS
IS	0.161***	-
	(0.06)	-

Table 6. (*Continued*).

	GMM	Driscoll-Kraay standard errors
	(1)	**(2)**
Variables	**IS**	**IS**
Hedging	0.281**	0.059***
	(0.13)	(11.95)
Asymmetric information	−0.476***	0.267***
	(0.10)	(56.07)
Moderator	0.12	0.02
	(0.26)	(2.04)
Lnsgrowth	0.261**	0.441**
	(0.10)	(0.18)
Lev	(0.10)	(0.22)
	(0.13)	(0.14)
Size	−0.230***	−17.571***
	(0.03)	(37.33)
2016 year	0.02	0.12
	(0.05)	(0.08)
2017 year	0.03	0.21
	(0.05)	(0.06)
2018 year	0.01	0.09
	(0.04)	(0.07)
Constant	4.099***	5.907***
	(0.50)	(0.57)
Observations	1464.00	-
Number of ID	366.00	-
Number of instruments	19.00	-
AR1p	0.00	-
AR2p	0.07	-
Hansenp	0.35	-
Sarganp	0.24	-
Number of groups	-	299.00
F	-	807.70

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

5. Conclusion

The research paper has extended behavioral finance literature by investigating the impact of hedging on investors' sentiments in asymmetric environment. In this study; researchers have taken up investors' sentiments as a dependent variable. Independent variables are hedging, and asymmetric information is used as a moderator. The independent and moderator variables have dissimilar dimensions. As hedging is considered as a positive factor for investor's sentiments, on the contrary asymmetric information has negative impact on investors' sentiments After

identification of gray area in the literature, study's problem statement states that with the moderating role of asymmetric information, what will be the relationship between investor's sentiments and hedging.

The empirical results have revealed that there is a positive relationship between investors' sentiments and hedging. Hedging affairs dispense positive signals about firm's good conduct to investors that assist them in making rational decisions. On the availability of asymmetric information, investors will never be able to acknowledge the true picture of firm. This situation creates noise. There is also the possibility of irrational trading by investors. Asymmetric information also negatively upon hedging. The findings of moderating impact demonstrate that the availability of a positive correlation among hedging and investors' sentiments, but this relationship is not significant. These results are not significant, maybe due to sampling size and might be the presence of asymmetric information is reason of insignificant results as asymmetric information has negatively correlated with hedging and investors sentiments. Leverage also has insignificant impact and negative correlation with investors' sentiments. Sales growth has a significant impact and positively related to investors' sentiments. Firm size has no significant relationship and negative impact on investors' sentiments.

This study is beneficial for managers, researchers, policymakers and more specifically investors. Hedging activities reduce risk, reduce financial distress and bankruptcy cost. Hedging also reduces asymmetric information. therefore, it is worthy for the economy by all prospects. Asymmetric information has gloomy effects either it associates to firm or associates to a transaction. It creates problems. Therefore, it is considerable for managers to enhance hedging activities which not only minimize risk for firms but also welcome investors. This study recommends policy makers to induce those policies that provide aid in lowering asymmetric information and give raise to hedging activities in Pakistan. The theory also recommends investors should always get information about firm risk management and financing activities from the financial reports of firms before making any investment decisions.

The first limitation of this study is availability of data. This problem decreases the study's sample size. Different dimensions are present for testing in future. This study would welcome various studies that could uplift the hedging activities and also establish different measures for the reduction of asymmetric information. Different studies should conduct to find ways of hedging that do not contradicts Islamic laws as some types of hedging like options, are currently not practicing in Pakistan because their conditions are contradicting with Islamic laws. Another future direction can be a comparison of hedging impact on investors' sentiments before COVID-19 or after COVID-19. Moreover, by applying qualitative proxies for asymmetric information could add valuable findings in current literature. Besides that, analyst forecast could use for the measurement of asymmetric information. This estimation would impact on estimations in another way. Also, researchers could employ market sentiments as a dependent variable for getting insights of hedging impact upon these sentiments by taking asymmetric information as a moderator.

This study would help finance managers, policymakers, brokers, investors, and financial analysts in their fields. Hedging is a financial decision for risk management, if a finance manager and financial analyst know which hurdles interrupt taking full

benefits of hedging then they will try their best for their elimination. The investor wants to gain high advantages from their investments, but the asymmetric environment hides the benefits of the firm's true picture. Investors should be aware of the role of hedging and asymmetric information in the firm. Policymakers could develop policies that help in the reduction of asymmetric information. So, the hedging's benefits also come in front of the eyes of investors. The findings of this study motivate brokers to play their role in giving true signaling to investors to avoid asymmetric information.

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