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BEHAVIORAL SENTIMENT OF INVESTORS IN IRAQ FROM PRICE GAPS

This research examines investor sentiment in frontier markets where limited data availability prevents the application of traditional sentiment indicators. The Iraq Stock Exchange (ISX), one of the largest frontier markets in the Middle East, has never been studied within the context of behavioral finance, creating a significant empirical gap. The research hypothesizes that price gap patterns derived exclusively from daily closing prices constitute valid proxies for investor sentiment in frontier markets, exhibiting statistically significant relationships with market returns and reflecting identifiable behavioral biases, including overreaction, herding, and sentiment persistence. Four gap-based sentiment indicators are constructed from 122 778 stock-day observations across 57 equities and seven sectors over 2304 trading days (August 2014 – August 2024): the Gap Ratio Indicator (GRI), Gap Intensity Index (GII), Sector Sentiment Dispersion (SSD), and Gap Persistence Indicator (GPI). Validation employs correlation analysis, cross-sectional return dispersion (CSSD) analysis, event study methodology on extreme sentiment days, and rolling 60-day window analysis. The hypothesis is confirmed: GRI demonstrates a statistically significant positive correlation with market returns ($r = 0.269$, $p < 0.001$). Of 122 778 observations, 3965 positive gaps (3.23%) and 3118 negative gaps (2.54%) indicate a moderate optimism bias. Negative gaps exhibit higher reversal rates (36.4%) than positive gaps (32.4%), consistent with loss aversion theory. The herding sub-hypothesis is partially refuted, as cross-sectional

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ОЦІНКА ІНВЕСТИЦІЙНОГО КЛІМАТУ В ІРАКУ НА ОСНОВІ ЦІНОВИХ РОЗРИВІВ

Розглянуто настрої інвесторів на прикордонних ринках, де обмежена доступність даних перешкоджає застосуванню традиційних показників настроїв. Іракська фондова біржа (ISX), один з найбільших прикордонних ринків на Близькому Сході, ніколи не досліджувалася в контексті поведінкових фінансів, що створює значну емпіричну прогалину. Висунуто гіпотезу, що моделі цінових розривів, отримані виключно на основі щоденних цін закриття, є дійсними показниками настроїв інвесторів на прикордонних ринках, демонструючи статистично значущі зв'язки з ринковою прибутковістю та відображаючи ідентифіковані поведінкові упередження, включаючи надмірну реакцію, стадність та стійкість настроїв. Чотири індикатори настроїв на основі розривів побудовані на основі 122 778 спостережень за днями акцій по 57 акціях та семи секторах протягом 2304 торгових днів (серпень 2014 – серпень 2024 рр.): індикатор коефіцієнта розривів (GRI), індекс інтенсивності розривів (GII), дисперсія настроїв секторів (SSD) та індикатор стійкості розривів (GPI). Валідація використовує кореляційний аналіз, аналіз перехресного розриву доходності (CSSD), методологію дослідження подій в екстремальні дні настроїв та аналіз ковзного 60-денного вікна. Гіпотеза підтверджена: GRI демонструє статистично значущу позитивну кореляцію з ринковою дохідністю ($r = 0.269$, $p < 0.001$). Зі 122 778 спостережень 3 965 позитивних розривів (3.23%) та 3118 негативних розривів (2.54%) вказують на помірне упередження оптимізму. Негативні розриви демонструють вищі показники розвороту (36.4%), ніж позитивні розриви (32.4%), що узгоджується з теорією небажання втрат. Підгіпотеза стадності частково спростована,

return dispersion increased rather than decreased under extreme market conditions. The banking sector shows the highest sentiment sensitivity (r = 0.261), with significant heterogeneity across sectors. This study provides the first behavioral finance analysis of the ISX and establishes a replicable framework for sentiment measurement in data-constrained frontier markets.

Keywords: investor sentiment, price gaps, behavioral finance, Iraq stock exchange, frontier markets.

оскільки перехресна дисперсія дохідності збільшилася, а не зменшилася за екстремальних ринкових умов. Банківський сектор демонструє найвищу чутливість до настроїв (r = 0.261) зі значною неоднорідністю між секторами. Це дослідження пропонує перший аналіз поведінкових фінансів ISX та встановлює відтворювану систему для вимірювання настроїв на обмежених даними ринках.

Ключові слова: настрої інвесторів, цінові розриви, поведінкове фінансування, Іракська фондова біржа, прикордонні ринки.

JEL Classification: G14, G15, G40, G41.

Introduction

The efficient-market hypothesis suggests that all information available is reflected in asset prices (Fama, 1970). There has been considerable empirical evidence supporting the existence of anomalies, leading to a major movement in behavioral finance (Shiller, 2003). This theory shows that investors' decision-making processes are skewed by psychological and emotional mechanisms that create discernible, irrational movements in asset prices (Kahneman & Tversky, 1979). The understanding that irrational beliefs and emotions related to future cash flows and risks that are not supported by the evidence can alter price movement has been the basis of many new theories in finance (Baker & Wurgler, 2006).

There are several ways in which stock returns are affected by investor sentiment, regardless of the market context. Baker and Wurgler (2007) focused on the sentiment effect for stocks that are less easily valued and more costly to arbitrage. This has been replicated worldwide, and Wang et al. (2021) reported negative sentiment and return relationships for 50 countries, with a greater speed of sentiment correction in emerging markets compared to developed markets. The behavioral aspect of the markets was highlighted by the COVID-19 pandemic, with fear and uncertainty leading to a dislocation of prices with little (or no) movement in fundamental factors (Vasileiou, 2021). This highlights the need for more sophisticated sentiment indicators that help in understanding how markets behave.

Sentiment research has grounded itself in rigor and substantial scholarship, yet there remain underexplored geographies, notably the frontier markets of the Middle East. The behavioral finance scholarship is yet to be interested in the Iraq Stock Exchange (ISX), one of the region's largest frontier markets, and the first one to be opened in 2004. This is particularly surprising given the frontier market's distinctive features and behavioral finance theorists' preoccupation with differences in market liquidity, the presence of institutional players, and the behavioral finance research information asymmetry (Chang et al., 2000). The recent research interest in the MENA markets has begun to bridge this gap. Negative sentiment on the

stock of 173 MENA banks, including some from the Iraq Stock Exchange, was found by Shah and Albaity (2022) to be associated with the banks' stock returns. However, there is yet to be any research on the sentiment surrounding the Iraq Stock Exchange.

The current study develops and validates behavioral sentiment indicators that fill this research gap through price gap analysis of ten years of daily closing prices for the Iraq Stock Exchange (August 2014 – August 2024). Noted gaps – periods of significant discontinuity of closing prices – are instances of rapid sentiment changes reflecting the market participants' reactions to the information that has been disclosed overnight (Plastun et al., 2020). The study develops four such indicators: the Gap Ratio Indicator (GRI), Gap Intensity Index (GII), Sector Sentiment Dispersion (SSD), and Gap Persistence Indicator (GPI). Since the focus is on markets with limited data availability to only daily closing prices, these indicators contribute to the sentiment analysis of such conditions, expanding the methodology of sentiment analysis in resource-constrained situations.

The research makes three main contributions. First, it offers a thorough behavioral finance perspective analysis on the Iraq Stock Exchange, creating a behavioral finance analysis that has been missing on a major component of frontier market research. Second, it outlines a method for building sentiment indicators, relying exclusively on closing prices, applicable to markets that lack intraday data. Third, it also examines behavioral aspects such as herding, overreaction, and the persistence of sentiment in markets with high political and economic uncertainty.

These findings will be of practical value to both investors interested in understanding the dynamics of sentiment in frontier markets and to regulators concerned about the stability of MENA markets.

This research aims to construct and assess the behavioral sentiment indicators resultant from a price gap analysis of daily closing prices at the Iraq Stock Exchange, and to analyze the ISX investors' behavioral patterns – including herding, overreaction, and sentiment persistence – over the ten years from August 2014 to August 2024.

This research posits that price gaps based solely on daily closing prices are a sufficiently accurate approximation of investor sentiment in frontier markets, offer a statistically relevant relationship to market returns, and are suggestive of behavioral biases, such as overreaction, herding, and sentiment persistence, among investors in the ISX.

To empirically evaluate this hypothesis, four sentiment indicators based on gaps are derived from a dataset of 122 778 stock-day observations for 57 stocks across 7 sectors.

The methodologies employed include:

- the correlation of indicator values to both contemporaneous and subsequent market returns;
- cross-sectional standard deviation (CSSD) as a means of identifying the presence of herding;

- an extreme event approach to evaluate market performance on days of extreme sentiment (greater than +/− 2 standard deviations from the mean);
- a rolling 60-day window to capture and evaluate the presence of sentiment persistence and the dynamic of momentary sentiment.

Several limitations are evident in this research and should be stated upfront. First, the dataset used only includes daily closing prices, and since the ISX does not offer opening price data, the dataset does not allow the use of standard open-to-close gap analysis. Second, the dataset does not provide any trading volume data, which means the use of volume-based sentiment validation, which is a standard robustness check in behavioral finance, cannot be performed. Third, the results apply only to the ISX, and replication studies are needed to assess the findings for other frontier exchanges.

The remainder of this article is structured as follows. Section 1 summarizes the theoretical and empirical literature on investor sentiment, price gaps, herding behavior, and sentiment in emerging and frontier markets. Section 2 outlines the data, methodology for assembling the four gap-based sentiment indicators, and the framework for the analytical validation. Section 3 contains the empirical findings, descriptive statistics, indicators, and analysis of behavioral patterns. Section 4 relates the findings to theory and comparative markets. Section 5, the last one, summarizes the key findings, contributions, and limitations, and outlines the future research directions.

1. Literature review

1.1. Theoretical foundations of investor sentiment

The relevant literature draws upon the fact that market participants consistently fail to adhere to rational expectations. Baker and Wurgler (2006) describe investor sentiment as beliefs regarding future cash flows and the risks associated with investments that are unsubstantiated, given the information that is available. In the case of sentiment effects, the strongest effects are for stocks that are hard to value and are costly to arbitrage. Baker and Wurgler (2006) document the first such case and construct a sentiment index that has been used in almost all subsequent studies. In a follow-up study, Baker & Wurgler (2007) built on their previous work and detailed how trends in sentiment impact individual firms as well as the overall stock market, particularly emphasizing how speculative stocks are more likely to be affected by changes in sentiment.

The study of market sentiment and its behavioral drivers adjusts and applies Prospect Theory (Kahneman & Tversky, 1979) to answer the question of why an investor behaves differently when faced with a gain, compared to a loss, from an investment. With this in mind, and given the evidence of inefficiencies in the capital markets, De Bondt and Thaler (1985) assert that if investors are said to behave irrationally, it is assumed that they will overreact to new information, and therefore, the market will give rise to

predictable reversals in returns. This has become known as the overreaction hypothesis, and numerous studies spanning vast time periods and a range of global markets have illustrated that over the long term, prior loser stocks will outperform prior winner stocks, and this is due to extreme sentiment and mispricing.

1.2. Sentiment measurement and price gaps

Price gaps show breaks in price series that show extremes in sentiment changes across trading intervals. Plastun et al. (2020) performed extensive examinations on U.S. stock market price gap anomalies and concluded that market inefficiency is contradicted, as gap anomalies have patterns with potential profit. Caporale and Plastun (2017) noted that gaps in price occur from overnight information assimilation, whereby opening prices deviate from closing prices. This gap provides evidence of order imbalance caused by uninformed sentiment. These studies demonstrate price gaps as reliable proxies for examining the changes in sentiment of investors and in other market sentiment measurement, devoid of tools.

1.3. Herding behavior in equity markets

Most investors ignore their personal insights and choose to follow the market. This type of behavior is called herding and is an important behavioral phenomenon of how markets function that, from an economics standpoint, could lead to an increase in the stability of markets. Christie and Huang (1995) were the first to apply the herding hypothesis using the methodology of cross-sectional return dispersion and predicted that if investors were to herd towards the market return, then dispersion would achieve a lower value under a condition of market stress. Chang et al. (2000) built on this and internationalized the scope of analysis and, aside from the United States and Hong Kong (which are considered developed markets), reported the most significant herding for the emerging markets of South Korea and Taiwan. This ground-breaking study showed that the microstructure of the market and the information context significantly determine the level of intensity of herding.

Subsequent research conveys differing patterns of heterogeneity in herding across markets. Chiang and Zheng (2010) studied global stock market herding over 18 markets and reported increased herding during market stress and crisis contagion. Bikhchandani and Sharma (2000) show how cascades of rational herding can occur from rational informational cascades in which individual market participants have useful private information. These studies illustrate that despite an overall consistent herding behavior, its presence and degree is dependent on the composition of the particular market and the prevailing economic climate.

1.4. Sentiment in emerging and frontier markets

The last few years have seen significant growth in the study of investor sentiment in frontier and emerging markets. Wang et al. (2021) studied the effects of sentiment on future stock returns in 50 global markets and found that global market sentiment has a negative effect on stock market returns, and that this effect is more pronounced in emerging markets than in developed markets. This implies that lower efficiency markets correct sentiment imbalances faster than their developed counterparts. In major emerging economies like Brazil, India, China, and Pakistan, Andleeb & Hassan (2023) found that investor sentiment and future returns had significant non-linear relationships, along with great variation in cross-country response heterogeneity.

The unique features of sentiment analysis in the Middle East and North African (MENA) region support the study of Shah and Albaity (2022), who studied the impact of trust, sentiment, and uncertainty on the stock returns of 173 banks in MENA and concluded that market sentiment has a positive impact on the returns, while individual sentiment has a negative impact. Shah (2024) studied cultural dimensions and investor sentiment in MENA banking and concluded that cultural biases lead to overreaction of investors. Cevik et al. (2022) studied the dynamics of investors' sentiment during the time of COVID-19 in the G20 countries and concluded that positive sentiment results in returns and negative sentiment results in loss, the magnitude of which varied with the states of the market.

1.5. Research gap and contribution

Even though there is more research about investor sentiment in developing markets, the frontier markets in the Middle East seem to be the most overlooked. The Iraq Stock Exchange, which is one of the most prominent frontier markets in the region, is rarely the subject of research in behavioral finance. This study attempts to draw attention to the Iraq Stock Exchange by pioneering the development of gap-based sentiment indicators tailored to markets where only closing prices can be recorded. This study builds upon and expands the existing techniques for sentiment measurement in under-researched markets by developing four supplementary and complementary sentiment measures, including the Gap Ratio Indicator, Gap Intensity Index, Sector Sentiment Dispersion, and Gap Persistence Indicator, and providing the first extensive behavioral analysis of the Iraq Stock Exchange.

2. Data and methodology

2.1. Data description

The study analyzes daily closing values for stocks included in the ISX60 index at the Iraq Stock Exchange (ISX). *Table 1* presents the detailed breakdown of the sample by sector.

Table 1

Sectoral distribution of sample stocks

Sector	Number of stocks	Percentage (%)
Agriculture	6	10.5
Banks	16	28.1
Hotels	8	14.0
Industry	16	28.1
Insurance	4	7.0
Services	5	8.8
Investments	2	3.5
Total	**57**	**100.0**

Source: Iraq stock exchange.

The data spans from August 3, 2014, to August 1, 2024, totaling 2,304 trading days. The sample comprises 57 equities across all principal sectors of the Iraqi equity markets, as well as the ISX60 index for comparative benchmark analysis. The sample reflects the economic composition of Iraq. Leading is the banking sector with 16 equities (28.1%). This is followed by the industrial sector, also with 16 equities (28.1%). The hotel sector comprises 8 equities (14.0%). This is followed by the agriculture sector with 6 equities (10.5%), the services sector with 5 equities (8.8%), the insurance sector with 4 equities (7.0%), and the investments sector with 2 equities (3.5%).

2.2. Price gap definition

As Bulkowski (2021) noted, conventional gap analysis combines an opening and a closing price to assess overnight price gaps. However, given that the present dataset consists solely of closing prices, the research utilizes a closing price return methodology for gap analysis. This methodology focuses on large price fluctuations over periods that align with intervals associated with changes in investor sentiment between trading days.

The daily return for each stock i on day t is calculated as:

$$Ri,t = \frac{Pi,t - Pi,t-1}{Pi,t-1} \quad , \qquad (1)$$

where: Pi,t represents the closing price of stock *i* on day *t*. Price gaps are then classified based on the magnitude of daily returns relative to a rolling volatility threshold. Specifically, a positive gap (bullish signal) is identified when the return exceeds two standard deviations above zero, while a negative gap (bearish signal) occurs when the return falls below two standard deviations (Baker & Wurgler, 2007).

2.3. Sentiment indicator construction

From price gap patterns, four behavioral sentiment indicators have been developed to examine various aspects of market sentiment.

2.3.1. Gap ratio indicator (GRI)

The Gap Ratio Indicator assesses net directional sentiment across the stock market by analyzing the gaps that occur on a daily basis. Positive gaps are compared with negative gaps, and the result is a stock market sentiment.

$$GIIt = \frac{(Nup,t - Ndown,t)}{Ntotal,t} \quad , \quad (2)$$

where: Nup,t and Ndown,t represent the number of stocks exhibiting positive and negative gaps on day t, respectively, and Ntotal,t is the total number of active stocks. The GRI ranges from −1 to +1, with positive values indicating bullish sentiment dominance.

2.3.2. Gap Intensity Index (GII)

Although the GRI records the frequency of gaps, the Gap Intensity Index accounts for the size of gaps in prices and expresses a weighted gap sentiment measure as:

$$GIIt = \Sigma \frac{|Gapi,t| \cdot Sign(Gapi,t)}{N} \quad . \quad (3)$$

The larger gaps might suggest stronger responses from investors to new information (De Long et al., 1990). Thus, this indicator reflects both the magnitude and the conviction in the directional change of the sentiment.

2.3.3. Sector Sentiment Dispersion (SSD)

The Sector Sentiment Dispersion quantifies the level of sentiment disagreement across the seven sectors using the GRI sector value standard deviation:

$$SSDt = \sigma(Sector\ GRIj,t) \quad . \quad (4)$$

A high SSD score indicates potential sector rotation or separate responses to economic news by the relevant sectors. On the other hand, low SSD values suggest the existence of market-wide sentiment, which may indicate herding (Chang et al., 2000).

2.3.4. Gap Persistence Indicator (GPI)

The Gap Persistence Indicator measures momentum in sentiment by monitoring how many consecutive days there are gaps in one direction. This indicator identifies sentiment regimes with sustained gaps in bullish or bearish sentiment, which may indicate overconfidence or pessimistic sentiment among investors (Daniel et al., 1998).

2.4. Analytical methods

The empirical analysis in this paper consists of four parts. The first part will describe the frequency and distribution of price gaps of stocks and sectors. The second part will focus on correlation analysis with the constructed sentiment indicators and the market returns for the same period. The third part will utilize a rolling window of 60 days to capture the average sentiment for the different periods in the sample. The fourth part will utilize the event study methodology to look at the market in the extreme sentiment of the sentiment indicators at over 2 standard deviations from the mean. The author will conduct all the events with the proper significance and robust standard errors to mitigate the impact of heteroskedasticity and autocorrelation in the time series analysis.

3. Empirical results

3.1. Descriptive statistics of price gaps

The different price gaps on all the 2 154 trading days in the Iraq Stock Exchange can be evaluated to understand how investors at the Iraq Stock Exchange operate. Out of 122 778 stock-day observations, positive gaps, which can be seen as signals to buy stocks, were noted 3 965 times, which is only 3.23% of the observations. On the other side of the scale, negative gaps, which can indicate signals to sell stocks, were detected 3 118 times, which is 2.54% of all observations. On the other 94.23% of trading days, stock returns were shown to be within a 2 standard deviation boundary, which is characterized as a period of neutral sentiment. The positive and negative gap frequency asymmetry suggests that investors at ISX tend to lean to the positive side and that positive gaps can be seen as a validation of the suggested investor overconfidence as seen in most emerging markets (Odean, 1998).

Table 2 outlines how price gaps are distributed across the seven different sectors. The banking sector had the largest frequency of gaps, with positive gaps present in 3.69% and negative gaps in 3.09% of the observations. The banking sector's price gap impact feedback is the strongest, given the importance of the sector in the Iraqi economy and its sensitivity to feedback from the central policy changes and changes in the economic situation. In the services sector, with a positive gap frequency of 3.40% and a notably lower gap of 2.27%, the gap frequency appears to indicate a largely consistent bullish sentiment. The investment sector, on the other hand, signals a price maximum movement and thus, little trading activity, with a positive gap frequency of 0.72% and a negative frequency of 0.81%. The industrial sector had the largest positive net gap bias of 1.14, indicating a strong optimism in the industrial and manufacturing businesses in the given time range.

Table 2

Distribution of price gaps by sector

Sector	Positive gaps (%)	Negative gaps (%)	Net gap bias
Agriculture	2.92	2.42	+0.50
Banks	3.69	3.09	+0.60
Hotels	3.40	2.90	+0.50
Industry	3.28	2.14	+1.14
Insurance	2.36	2.58	−0.22
Services	3.40	2.27	+1.13
Investments	0.72	0.81	−0.09
Overall Market	**3.23**	**2.54**	**+0.69**

Source: author's calculation.

The changes in the frequency of gaps for the given time period show a significant variation from year to year. The year 2023 has the highest overall gap in activities, with a total of 897 gaps. More specifically, there were 524 positive gaps and 373 negative gaps, which may have risen due to the volatility of the markets as a consequence of the advancing/ developing of the investor's confidence due to the stabilization of the revenues from oil. The year 2020 had the lowest gap frequency with a total of 332 positive gaps and 248 negative gaps due to the decline of the trade activities related to the global pandemic and the economic uncertainties that came with that. The years 2022 and 2019 have shown an increase in positive gap frequencies, with 444 and 427, respectively, which were also periods of economic recovery and political stability. The index of the ISX60 market even experienced 63 negative gaps and 65 positive gaps, which suggests that there was a fair equilibrium in the movement.

3.2. Sentiment Indicator analysis

3.2.1. Gap Ratio Indicator results

The Gaps Ratio Indicator (GRI), with a mean value of 0.0069, standard deviation 0.0471, reflects a slight positive sentiment bias during the sample period. The Indicator value ranged between –0.4035 and 0.3860: during 44.4% of the trading days the GRI value was positive (indicative of GRI bullish sentiment dominance), during 33.2% of the days the GRI value was negative (indicative of GRI bearish sentiment dominance) and 22.4% of the days the GRI value was neutral (indicative of balanced sentiment with positive and negative gaps). Notably, the positive gaps sentiment indicator GRI is correlated with positive market returns ($r = 0.269$, $p < 0.001$). This confirms the sentiment indicator calendar days returns correlation. This indicator captures significant shifts in prices. This indicator confirms the sentiment on the gaps approach. This indicator could be valued as the input to gauge the daily price changes in the market (ISX) and gap sentiment market timing strategies.

3.2.2. Gap Intensity Index results

A more in-depth view into the standard deviation shows gross average GII values (Gap Intensity Index) (magnitude and direction of price changes) of 0.129%, quite high at 1.027%. Positive and statistically significant relationships ($r = 0.089$, $p < 0.001$) with market returns were identified for GII; however, lower than the GRI correlation, suggesting that market sentiment in this market is more attributed to gap frequency than gap size. On the other hand, the gap frequency is attributed to cross-sectional variation at the sector level. The highest average GII was recorded at 0.235%, the agriculture sector GII is attributed to larger size price movements and the seasonality of the commodities. Following this, the services sector GII was 0.160%. The insurance and investment sectors recorded average intensity values that were slightly negative (–0.004% and –0.036%, respectively), suggesting more pronounced bearish gaps than bullish gaps in these sectors.

3.2.3. Sector Sentiment Dispersion results

The average SSD was 0.077 with a standard deviation of 0.052, which shows moderate, yet cross-sector sentiment heterogeneity for the entirety of the sample. There was a positive correlation between the SSD and market returns, which was statistically significant ($r = 0.072$, $p < 0.001$). More extreme cases of sentiment divergence between market sectors tended to result in increased levels of market sentiment. In these cases, the average market sentiment was more extreme. These results confirm the hypothesis, as disagreement amongst market participants leads to increased levels of sentiment and price volatility. There was a 1.477% average increase in market volatility in the high dispersion quartile (top quartile), versus a 1.359% average in the low dispersion quartile (bottom quartile). This means there was an 8.7% market volatility increase in the high dispersion quartile versus the low dispersion quartile. This can be a practical proxy for forecasting market volatility, as there is increased cross-sector sentiment disagreement (*Table 3*).

Table 3

Sentiment Indicator Summary Statistics and Correlations

Indicator	Mean	SD	Correlation	p-value
GRI	0.0069	0.0471	0.269	<0.001
GII	0.129%	1.027%	0.089	<0.001
SSD	0.077	0.052	0.072*	<0.001

Source:. Correlation is with absolute market returns (volatility proxy). All correlations are statistically significant at the 0.1% level.

3.3. Behavioral patterns identified

3.3.1. Herding behavior evidence

Cross-sectional standard deviation of returns (CSSD) analysis shows some very minor signs of herding in the ISX. A mean CSSD of 2.66% (SD = 6.34%) shows that there is some significant cross-sectional dispersion of stock returns on average trading days, implying that investors have divergent positionings and trading strategies. Interestingly, CSSD on extreme market days (both positive and negative quintiles) averaged around 2.80%, while on normal trading days, it was 2.64%. This is counterfactual to standard herding theory, which states that CSSD should rise during times of market distress when investors are all coming out to hold the same positions (Christie & Huang, 1995). This shows that ISX investors are still using diverse trading strategies during times of extreme market activity. This illustrates that there may be diverse sets of information, differing levels of risk tolerance, and the existence of institutional traders that are informed contrarian traders during times of market extremes.

3.3.2. Overreaction patterns

The returns after a gap exhibit both evidence for and against investor overreaction in the ISX. We record 102 instances of gaps where at least 5 stocks showed bullish gaps. On average, the market returned +0.282% on the day after the gap ($t = 2.06$, $p = 0.042$), suggesting a continuation of the market momentum. This is contrary to the reversal that overreaction theory suggests. On the contrary, we record lower levels of significant negative gap instances (44 instances) where the market returned on average +0.477% ($t = 0.49$, $p = 0.625$), which suggests a partial reversal that does not reach significance. Of the 102 gaps leading to positive momentum, 32 of them reversed (32.4% reversal rate). In contrast, of the 44 gaps leading to negative momentum, 16 of them reversed (36.4% reversal rate). These tendencies, in collaboration with other pieces of evidence, are attributed to the overreaction of bearish sentiment, leading to the conclusion that there is overreaction towards negative bullish sentiment and underreaction to positive bullish sentiment in the ISX. This is in extension with the theory of Loss Aversion by Kahneman and Tversky (1979). Lastly, the continuation of momentum associated with positive gaps suggests that market participants failed to fully react to the news, a phenomenon observed in many other studies in emerging markets.

3.3.3. Sentiment Persistence

The Gap Persistence Indicator shows moderate positive sentiment momentum for the ISX, which provides the groundwork for the development of trading strategies. The GRI shows first-order autocorrelation of 0.177, which decreases to 0.033 at the five-day lag, which shows that sentiment is short-lived, with the exception of the first few trading days. The pattern of

sentiment short-lived and the pattern of sentiment lateral decay is a sign of the market's gradual assimilation of the information into the price, and the eventual correction of the misalignment of price and sentiment. The longest positive sentiment streak was 14 trading days, and the longest negative sentiment streak was 10 trading days. On average, sentiment streaks reversed on average to positive or negative for 2.8 days before the reversal took place. This pattern of persistence indicates that there is a short-term momentum to belief or sentiment of the investors, which is mean-regressing, with most of the negative sentiment to price alignment likely reversed at longer periods of time, which indicates the efficiency of the market at longer periods of time.

3.4. Sector-Specific Findings

Examining various market segments within the ISX reveals how heterogeneous the sentiment characteristics are within each segment. The banking sector had the most positive and significant correlation with overall market returns (r = 0.261), which signifies that the banking sector is the strongest market sentiment indicator because it is the largest sector by market capitalization. This is important for portfolio construction, and banking sector sentiment provides a positive leading indicator for the market as a whole; it helps in assessing portfolio risk. By comparison, the agriculture sector had the highest return volatility (5.81%) and virtually no correlation with the market returns (r = 0.011), which implies that the sector's price may be due to other market factors, and that industry specific factors, such as the weather, commodity pricing, and governmental policies regarding agriculture, are more important than market psychology. Of all the sectors, the only one to show consistently bearish sentiment bias over the entire sample period was the insurance sector, showing a mean GRI being slightly negative at −0.002.

This situational aspect can be attributed to a lack of structural maturity within the Iraqi insurance sector or ongoing negative investor sentiment towards the sector's growth potential. Sentiments towards services and industry sectors were the strongest, with them having the same mean GRI of 0.011, implying the continuity of positive investor sentiment towards the aforementioned sectors of the economy. Sentiment correlation of cross sectors illustrates a clustered pattern within the ISX, where inter-sector sentiment correlation is the highest for banking and industry sectors, being 0.206, followed by banking-hotels (0.164) and banking-services (0.157). This shows that sentiment spillage exists from the banking sector towards the mentioned sectors, and this phenomenon correlates with the theory of information cascades in financial markets.

Sentiment analysis over the sample period identified 65 days with extreme bullish readings (GRI greater than two standard deviations above the mean) and 57 days with extreme bearish readings. Average market returns on the extreme bullish sentiment days were +1.67% and −0.40% on the

extreme bearish sentiment days, confirming that the constructed sentiment indicators have economic relevance. The greater asymmetry in extreme-day returns (+1.67% versus −0.40% in absolute terms) further reinforces the conclusion that, in the context of the ISX, bullish sentiment signals have greater predictive strength than bearish sentiment.

4. Discussion

4.1. Interpretation of Findings

There is reason to believe that patterns of price gap sentiment correlate with price gap patterns in the Iraq Stock Exchange. The substantial positive relationship with the Gap Ratio Indicator and the market return ($r = 0.269$, $p < 0.001$) indicates that measures of gap-based sentiment, in this case, the gap ratio, positively and significantly predict market movement. The evidence suggests that price gaps in multiple stocks and, therefore, the outpouring of sentiment (behavior) of the people (investors) in the market, are consistent with the overall market sentiment. This is consistent with the market's overall sentiment. The dominance of the banking sector in determining market sentiment is consistent with the banking sector's dominance in the overall market capitalization and the sector's unique position in the provision of macroeconomic information in the Iraqi economy.

The observation of slightly higher positive gaps compared to negative gaps (3.23% vs. 2.54%) shows that there is a small optimistic bias among ISX investors. This is consistent with the overconfidence hypothesis by Odean (1998), which states that investors in markets with lower levels of information efficiency often overestimate positive signals. The differences in the gap characteristics at the sector level suggest that the overall state of investor sentiment varies significantly within the economy. This is particularly so in the insurance and investment sectors, which are bearish compared to the industry and services sectors, which are persistently bullish.

4.2. Behavioral implications

Herding behavior in this instance is further supported by the cross-sectional return dispersion remaining consistent at extreme market conditions, which goes against the orthodox theory of frontier market investors acting in unison. Rather, ISX findings indicate diverging trading patterns, even for instances of market stress, which may be attributed to some investors relying on different patterns of information, differing investment horizons, or other market dynamics. The prediction of asymmetric overreaction in which the bearish gaps suffer from higher reversals (36.4%) as compared to the bullish gaps (32.4%) supports the over-reaction theory as investors suffer from negative information more (Kahneman & Tversky, 1979). This creates an overreaction to the information, which is later reversed.

4.3. Comparison with other markets

The similarities and differences in sentiment characteristics of the ISX when compared to other emerging and frontier markets are clear and definable. Moderate sentiment persistence (first-order autocorrelation of 0.177) places sentiment characteristics between the higher persistence seen more often in developed markets and the more sporadic in less liquid frontier markets. No strong herding is like the U.S. market (Christie & Huang, 1995) and contrasts with South Korea and Taiwan (Chang et al., 2000), which document significant herding. This difference may capture the peculiar market ownership structure of the ISX, particularly the institutional ownership structure, which is very different from East Asian markets.

4.4. Practical applications

The created indicators of sentiment show usable sentiment for investors and regulators. Given its high contemporaneous correlation with returns, Portfolio managers can use the Gap Ratio Indicator as a tactical trigger for timing the market. The Sector Sentiment Dispersion measure can serve as a market uncertainty heuristic and can be incorporated into models of volatility and frameworks of risk control. For investors with a contrarian approach, the extreme sentiment days (65 days bullish, 57 days bearish, and each exceeding 2 standard deviations) can be used for the construction of a mean reversion hypothesis. These indicators can be used by regulators to assess the state of the market and spot the intervals with excessive speculation that can be the subject of closer monitoring.

Conclusions

The behavioral sentiment indicators that were changed and validated using price gap analysis from the Iraq Stock Exchange's (ISX) daily close price compilation spanning a decade. The certain behavioral sentiment indicators for the Iraq Exchange were Gap Ratio. The result shows that the Gap Ratio has a correlation with the local market return ($r = 0.269$, $p < 0.001$), which proves that gap sentiment indicators are predictive. Out of a total of 122 778 stock-day gaps, ISX investors exhibited a slight positive (optimistic) sentiment, with 3965 positive gaps and 3118 negative gaps. The behavioral sentiment study of ISX investors shows little herding, a decline in asymmetric overreaction, a small bearish reversal with over moderate mean and sentiment reversion around one week.

The study confirms its central hypothesis that daily closing price data behavioral sentiment proxies are a valid method of measuring market sentiment in frontier markets. The Gap Ratio Indicator shows a positive correlation with statistically significant ISX market returns ($r = 0.269$, $p < 0.001$), and the frequency of gaps (3.23% positive vs. 2.54% negative) reflects an optimism bias and overconfidence (Odean, 1998). The hypothesis that supports overreaction is also validated: an asymmetric reversal rate (bearish gaps: 36.4% vs. bullish gaps: 32.4%) exemplifies loss aversion

(Kahneman & Tversky, 1979). The herding sub-hypothesis is contrary to classical herding: in extreme market situations, rather than decrease, cross-sectional return dispersion increased, signaling ISX investors employ a variety of divergent trading strategies contrary to a herding mindset. Overall, closing price data gap sentiment indicators provide behavioral framework analytics for frontier markets and extreme data gaps.

This study contributes to science by creating four original sentiment indicators – GRI, GII, SSD, and GPI – derived solely from daily closing prices. This allows for a repeatable analytical framework to be created for frontier markets where intraday and volume data are lacking. As such, this study also provides the first behavioral finance analysis of the Iraq Stock Exchange. This also provides a methodological advancement for the sentiment analysis field when facing data-limited environments. For practitioners, this research provides accessible and evidence-based sentiment analysis tools for frontier equity markets that portfolio managers, risk analysts, and market regulators would benefit from.

Some self-imposed boundaries deserve some merit. The absence of starting prices limits standard methodologies of gap analysis. Consequently, the close-to-close methodology had to be utilized. This approach is just as valid, if not preferred, though it is different. The absence of single-market scope generalizability to other frontier exchanges is clear, though it could be controlled for in future research. Also, in behavioral finance, it is commonplace to measure sentiment signals in volume, often with some standard robustness check. The absence of trading volume data precludes this from being undertaken.

Future research should include, when possible, trading volume data to strengthen the validation of sentiment signals. The sentiment dynamics of the region would be improved by cross-market studies with other Middle Eastern and frontier markets. Furthermore, the precision of the indicators could be improved, and automated trading systems could be developed based on the machine learning tools applied to gap classification and sentiment forecasting in the context of this study.

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