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| RESEARCH ARTICLE

Return Anomalies Under Constraint: Evidence from an Emerging Market

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| ABSTRACT
This study examines the presence of the MAX effect in the Tehran Stock Exchange (TSE) in Iran, an emerging market with unique regulations. The MAX effect, typically observed in developed markets, describes the inverse relationship between a stock's maximum daily return in a month and its subsequent performance. Using univariate, bivariate, time-series, and panel regression models, this research finds no significant evidence of the MAX effect in the TSE, even when controlling for market size, book-to-market ratio, momentum, liquidity, and market risk. The absence of the MAX effect is attributed to the TSE's regulatory environment, including price limits and restrictions on short-selling, which hinder arbitrage and reduce mispricing opportunities. These findings highlight the challenges of applying asset pricing models from developed markets to emerging ones and suggest further research into the role of regulatory frameworks, market efficiency, and investor behavior in shaping asset pricing anomalies in emerging markets.

| KEYWORDS
Return Anomalies, Emerging Markets, MAX Effect, Cross-sectional Stock Returns, Lottery-like Payoffs

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1. Introduction

The efficient market hypothesis (EMH), proposed by Fama (1970), posits that in an efficient market, arbitrage opportunities are quickly eliminated by rational investors, resulting in share prices reflecting their intrinsic value. Since its inception, numerous studies have empirically tested the validity of EMH across different financial markets. However, a review of the literature reveals a disproportionate focus on developed markets, while emerging and developing markets remain underexplored in terms of market efficiency. Given the importance of understanding efficiency in financial markets, especially in developing economies, further research is needed to enrich the existing literature and provide insights into the unique characteristics of these markets.

A common approach to testing market efficiency is through financial asset pricing models, such as the Capital Asset Pricing Model (CAPM). The CAPM suggests that the expected return of a stock can be fully explained by its exposure to market risk (Sharpe, 1984). Since the 1970s, many studies have attempted to evaluate this model in financial markets. However, limitations in capturing certain market anomalies, such as the momentum effect and the value anomaly, have prompted the development of alternative models that incorporate additional factors to explain expected returns. These models include the Fama-French three-factor model (Fama and French, 1993), which adds size and value factors, and the Carhart four-factor model (Carhart, 1997), which further includes a momentum factor. Despite these advancements, there remain numerous anomalies that challenge the notion of efficient markets, one of which is the MAX effect.

One such market anomaly is related to investors' preference for stocks with lottery-like payoffs. Contrary to the popular belief that investors typically diversify effectively, Mitton and Vorknik (2007) demonstrate that many investors are drawn to stocks with

positive skewness – stocks with a small chance of a large payoff – resulting in portfolios that are not fully diversified. Such stocks tend to be overpriced, leading to mispricing and the potential for abnormal returns. One prominent example of mispricing is the phenomenon known as the "MAX effect," first identified by Bali et al. (2011). The MAX effect refers to the inverse relationship between a stock's maximum daily return over a given month and its subsequent performance in the following month. Specifically, stocks with the highest daily returns in a given month tend to underperform relative to those with lower maximum returns in the subsequent month.

Bali et al. (2011) first documented the MAX effect in the U.S. stock market, highlighting that the abnormal performance of high-MAX stocks is driven by investors' preference for lottery-like characteristics. This preference for lottery-like stocks is often linked to behavioral biases, such as the overweighting of small probabilities and a general tendency towards risk-seeking behavior when it comes to high-potential payoffs. Subsequent research has found evidence of the MAX effect in various markets, including developed and emerging markets. Annaert et al. (2013) and Walkshausl (2014) documented the presence of the MAX effect across European stock markets, while Nartea et al. (2014) identified a similar pattern in South Korea, an emerging market with unique market features such as daily price limits and prohibitions on short-selling. These studies suggest that the MAX effect is a robust anomaly driven by investor sentiment and overreaction, which persists across different market environments.

The robustness of the MAX effect has also been explored in other emerging markets, where market characteristics differ significantly from those of developed economies. Research in emerging markets has highlighted differences that may affect the manifestation of the MAX effect compared to developed markets. For example, emerging markets often exhibit higher stock volatility, as noted by Bekaert and Harvey (1997), and have greater restrictions on trading mechanisms, such as short-selling. These differences can lead to increased mispricing, as investors are unable to effectively arbitrage away price inefficiencies. Nartea et al. (2017) explored the MAX effect in China, highlighting how market restrictions, such as the prohibition of short-selling, contribute to continued mispricing and the persistence of the MAX effect. Similarly, Zhong and Gray (2016) confirmed the MAX effect in Australia, while Cheon and Lee (2018) demonstrated that the intensity of this effect varies globally based on cultural factors like aggregate uncertainty avoidance, suggesting that investor behavior is influenced by both market structure and cultural attitudes towards risk.

The Tehran Stock Exchange (TSE), as Iran's main equity market, presents a unique opportunity to study capital-market phenomena in Iran, a setting whose financial ecosystem and firm-level decision structures differ markedly from developed markets (Khodayari et al., 2019). The prohibition of short selling in the TSE further restricts arbitrage opportunities, potentially exacerbating mispricing and impacting market efficiency. By examining the existence of the MAX effect in the TSE, this study aims to contribute to the broader literature on market anomalies and asset pricing in emerging financial markets. The Iranian market, with its distinct regulatory environment and lack of financial instruments such as derivatives and short-selling options, provides an interesting case for understanding how these factors influence the pricing of assets and the persistence of anomalies like the MAX effect.

Studying the TSE is particularly relevant given the market's unique characteristics, such as high volatility, regulatory constraints, and the absence of mechanisms to correct mispricing. These features make the TSE an ideal setting for examining whether the MAX Effect, which has been documented in other emerging markets, also exists in Iran. Moreover, the high level of regulation in the TSE, combined with the lack of sufficient financial instruments, provides an opportunity to investigate how these factors influence investor behavior and market anomalies. The prohibition of short selling is especially significant, as it restricts arbitrage opportunities that might otherwise correct the overpricing of lottery-like stocks. This study will also explore whether the MAX effect is influenced by other factors unique to the Iranian market, such as macroeconomic instability, currency fluctuations, and political risks, which can further impact investor sentiment and contribute to the persistence of market anomalies.

Research on the MAX effect in the context of emerging markets like Iran can provide valuable insights into the differences between developed and developing financial markets. While the MAX effect has been attributed to behavioral biases, such as overconfidence and the preference for lottery-like payoffs, the manifestation of these biases may differ in markets with higher levels of uncertainty and fewer risk management tools. The findings of this study could help clarify whether the drivers of the MAX effect in developed markets, such as investor sentiment and overreaction, also apply in emerging markets with different regulatory and structural characteristics. Understanding these differences can contribute to a more nuanced view of market efficiency and the factors that influence asset pricing across diverse financial environments.

This research will help enrich the understanding of asset pricing dynamics in emerging markets and provide insights into whether the MAX effect is present in the Iranian stock market. By examining the relationship between daily maximum returns and subsequent performance, while controlling for various risk factors, this study will shed light on the mechanisms behind the persistence or absence of this phenomenon in an emerging market context. Furthermore, this study will provide a comparative analysis with other emerging markets, highlighting the similarities and differences in the manifestation of the MAX effect, and offering insights into how regulatory and cultural factors influence investor behavior and market anomalies. Ultimately, this research aims to contribute to the broader field of behavioral finance and asset pricing, with a particular focus on understanding how market structure and investor psychology interact to shape financial market outcomes in emerging economies.

In this research, we conducted univariate and bivariate analyses, along with time-series and cross-sectional regressions, to investigate the presence of the MAX effect in the TSE. Our findings reveal no evidence of the MAX effect, even after accounting for key variables such as market size, book-to-market ratio, momentum, liquidity, and market risk. These results are consistent across different models and statistical approaches, suggesting robustness in our conclusions. The results indicate that stocks with high maximum daily returns were generally small-cap, illiquid, and prone to high volatility. These characteristics align with findings from previous studies (e.g., Annaert et al., 2013; Nartea et al., 2017), suggesting that these stocks are often targets of speculative trading, driven by investor sentiment and preferences for lottery-like payoffs.

When comparing these findings with the existing literature, it becomes evident that in most developed and some emerging markets, the presence of the MAX effect has been confirmed, with numerous explanations offered for its occurrence. However, the absence of this effect in the TSE could be due to several unique features of the market's structure and regulatory environment. Specifically, factors such as price limit rules, limited arbitrage opportunities, and other trading constraints may play a critical role in suppressing the MAX effect. Additionally, the dominance of retail investors and the regulatory policies in Iran may contribute to dampening the speculative behaviors typically associated with the MAX effect.

The remainder of this research is structured as follows. Section 2 provides a literature review, examining the theoretical foundations and prior research related to the topic. Section 3 describes the research methodology, detailing the data collection procedures and the analytical tools employed. Section 4 presents the findings, outlining the methods used to obtain the results, and discusses the generated tables and analyses. Finally, Section 5 summarizes the key findings of the study and offers recommendations for future research.

2. Literature Review

Traditional financial asset pricing models assume that investors diversify their portfolios effectively, thereby eliminating unsystematic risk, which is not factored in the price of the asset (Sharpe, 1964). Although diversification can significantly enhance portfolio performance (Khodayari et al., 2024), prior research indicates that most investors fail to diversify adequately, often due to behavioral biases (Goetzmann and Kumar, 2008) and agency issues (Askarzadeh et al., 2024). One such bias is the tendency of investors to chase returns by buying stocks that have recently exhibited high gains. This behavior can lead to suboptimal decision-making, stock mispricing, and overall inefficient pricing. Investor behavior in financial markets directly affects stock prices and their expected returns, resulting in the persistence of anomalies that challenge market efficiency. This section explores the implications of stock mispricing, focusing specifically on the MAX effect and its implications for market efficiency. It also provides an overview of how investor behavior, regulatory constraints, and market characteristics contribute to anomalies such as the MAX effect across both developed and emerging markets.

Bali et al. (2011) provided compelling evidence for the existence of the MAX effect in the U.S. stock market, demonstrating that stocks with significantly positive daily returns in one month tend to perform poorly in the subsequent month. Specifically, their study showed that the future monthly returns of stocks with high daily returns are lower compared to stocks with lower daily returns. This phenomenon results in an average monthly return of -1% if an investor takes a long position in a portfolio of stocks with the highest daily returns and a short position in stocks with the lowest daily returns in the same month. These findings suggest that stocks with the highest daily returns are often overpriced, leading to lower subsequent returns as their overvaluation corrects itself over time. This mispricing arises from investor overreaction and a tendency to chase high-return stocks.

Bali et al. (2011) conducted their analysis by classifying stocks into ten portfolios based on daily returns and calculating the future monthly returns for each portfolio using both equal-weighted and value-weighted methods. They compared the difference in returns between the portfolios with the highest and lowest daily returns, finding a significant negative difference

that indicated the presence of the MAX effect. They also performed univariate and bivariate analyses and used time-series and cross-sectional regressions to examine the impact of typical risk factors on the MAX variable. Their analysis showed that the MAX effect persisted even after controlling for standard risk factors such as market size, book-to-market ratio, and liquidity.

Following Bali et al. (2011), many researchers have investigated the existence of the MAX effect in stock markets across different countries. The prevailing belief among these researchers is that the MAX effect is driven by behavioral biases and overreaction in financial markets. Bali et al. (2011) suggested that traditional asset pricing models cannot fully explain the presence of the MAX effect, attributing its occurrence to investors' preference for lottery-like assets – a behavior also confirmed by Kumar (2009). Kumar argued that investors often perceive stocks with extreme positive returns as having lottery-like characteristics, making them attractive despite their inherent risks. Another factor contributing to the MAX effect is the failure of investors to diversify their portfolios adequately, leading to overexposure to positively skewed assets (Bali et al., 2011).

Gorman et al. (2022) provided further evidence supporting the notion that the MAX effect results from investors' overreaction to past returns. According to their findings, investors tend to overreact to stocks with high past returns, which causes a reversal in subsequent periods where these stocks exhibit lower future returns. This behavior aligns with the behavioral finance theory of overreaction, wherein investors disproportionately respond to positive news, pushing stock prices beyond their intrinsic values. Fong and Tah (2014) added that the MAX effect is not merely due to low returns for stocks with poor past performance, but rather the overpricing of stocks with significantly positive returns, which leads to poor future performance. Their research emphasized the role of overvaluation in driving negative subsequent returns, suggesting that investor sentiment and behavioral biases significantly impact stock price movements.

Numerous studies have demonstrated the presence of the MAX effect in global markets. Annaert et al. (2013) examined several European stock markets and found a negative relationship between significantly positive past returns and future returns. Their study, which spanned 13 European countries over 30 years, confirmed the findings of Bali et al. (2011). Annaert et al. (2013) suggested that small, illiquid, and risky stocks are more prone to the MAX effect due to limited arbitrage opportunities. In illiquid markets, the absence of sufficient arbitrage capital prevents mispriced stocks from reverting to their intrinsic values, allowing the MAX effect to persist. Walkshausl (2014) observed a similar negative relationship between past monthly returns and future returns across 11 developed European markets, noting that negative returns were often linked to stocks characterized by high volatility and low institutional ownership, limiting the corrective forces usually exerted by informed investors. More recently, Mojtahedi et al. (2025) found that the MAX effect in the Swedish stock market is stronger during periods of low investor sentiment, suggesting that behavioral factors can amplify or attenuate return anomalies across different market states.

Nartea et al. (2014) investigated the South Korean stock market – the fourth largest in Asia and characterized by highly liquid stocks. Despite its liquidity, features such as the 15% price fluctuation limit and restrictions on short selling contribute to its relative inefficiency compared to developed markets. Nartea et al. (2014) found strong evidence of the MAX effect in South Korea, attributing this inefficiency to regulatory constraints that hinder arbitrage. Regulatory barriers like short-selling restrictions limit market participants' ability to correct mispricing, allowing anomalies such as the MAX effect to persist (Ataei et al., 2025a). The study highlighted how market regulations can have unintended consequences by impeding mechanisms that usually drive prices back to equilibrium.

Nartea et al. (2017) extended the examination of the MAX effect to the Chinese stock market. The authors found that investor preference for lottery-like stocks was a significant driver of the MAX effect in China, consistent with findings in developed markets (Bali et al., 2011; Kumar, 2009). This preference is particularly relevant in emerging markets, where retail investors dominate trading activities, and speculative behavior is more prevalent. The study emphasized that the MAX effect in China could be attributed to retail investors' attraction to stocks with extreme positive returns, leading to overpricing and subsequent underperformance.

Zhong and Gray (2016) investigated the presence of the MAX effect in the Australian stock market over a 12-year period and found a statistically and economically significant negative relationship between high returns in one month and subsequent returns. Their study concluded that the MAX effect is not confined to a specific geographical region, highlighting that investor behavior leading to overpricing is a universal phenomenon. Cheon and Lee (2018) evaluated the generalizability of findings of Bali et al. (2011) across global markets by examining 47,000 stocks from 44 countries. They demonstrated that stocks with significantly positive daily returns were often traded at higher prices, leading to a decline in future monthly returns, thereby

confirming the global prevalence of the MAX effect. Their findings suggested that the MAX effect is a widespread anomaly driven by investor sentiment and not limited to specific market types or regulatory environments.

Hung and Yang (2018) explored the Taiwanese stock market using a modified approach to account for government-imposed price limits. They proposed a modified version of the MAX measure, adjusting it for the frequency of price limit occurrences rather than relying solely on the maximum daily return. This modification better captures the lottery-like features of stocks in the presence of daily price limits, such as those in the Taiwanese market. Hung and Yang (2018) found that the modified MAX measure significantly predicted future stock returns, where stocks with the highest modified MAX tended to be overpriced and subsequently experienced negative risk-adjusted returns. This relationship was particularly pronounced during optimistic market periods, suggesting that investor sentiment plays a key role in amplifying the MAX effect. Their study highlighted how regulatory constraints, such as price limits, interact with investor biases and limits to arbitrage, making it challenging for prices to adjust efficiently.

Overall, the literature highlights the prevalence of the MAX effect across developed and emerging markets, driven primarily by investor behavior and market inefficiencies. These studies demonstrate that the MAX effect is influenced by a combination of factors, including investor biases, overreaction to past returns, regulatory constraints, and inadequate diversification. Investor sentiment, particularly the attraction to lottery-like stocks, plays a significant role in driving the MAX effect, as the overvaluation of these stocks eventually results in poor future performance. The findings also emphasize the role of market characteristics such as liquidity, arbitrage opportunities, and price limits, in shaping the extent of the MAX effect in different financial markets. In markets with high liquidity, efficient price adjustments are more likely, whereas in markets with regulatory barriers and low arbitrage activity, mispricing can persist for longer periods, contributing to the occurrence of the MAX effect.

3. Research Methodology

3.1 Data Collection

In this study, historical stock data from the Tehran Stock Exchange (TSE) has been utilized. The data was sourced from multiple platforms, including the official website of the TSE, the Tehran Stock Exchange Technology Management Company website, Rahavard Novin platform, Bourse View platform, and the financial data processing company Noavaran Amin. The primary dataset was obtained using Rahavard Novin, which provides historical stock data, including data for stocks that have been delisted over time. Using multiple data sources helped to ensure the accuracy, reliability, and completeness of the dataset, thereby increasing the robustness of the study.

The specific datasets used in this research include: (i) adjusted daily price of all stocks listed on the TSE from February 20, 2008, to March 20, 2017 (end of the Iranian fiscal year); (ii) daily market value of all stocks on the TSE during the same period; and (iii) monthly book value of all stocks on the TSE for the same duration. Price history for 392 companies listed on the primary and secondary markets of the TSE was available during the study period. However, due to incomplete book value information, 16 firms were excluded from the final analysis. Consequently, data from 376 listed companies were used for this study.

The collected data was used to derive several key financial variables such as daily and monthly stock returns, monthly market value of stocks, and book value of stocks. For the calculation of daily returns, adjusted stock prices were used, as these include information on capital increases and dividend payouts for each company, providing a more accurate representation of stock performance. The adjusted prices help to eliminate the effects of capital raising and dividend payouts on stock prices, ensuring that the derived returns accurately reflect market conditions.

3.2 Data Processing

To ensure accuracy in the research results, data from stocks that were delisted from the TSE over time was also included in the calculations. Including delisted stocks prevents survivorship bias, which could otherwise lead to inflated or misleading results. After extracting the data from Rahavard Novin software, the logarithmic daily return of each stock was calculated based on the daily price data. Using logarithmic returns offers several advantages.

First, if stock prices are assumed to follow a log-normal distribution, the logarithmic return will have a normal distribution, which simplifies statistical analysis. This assumption is particularly useful when employing regression techniques that rely on normally distributed data. Equation 1 shows how the difference of two normally distributed variables (logarithms of prices) is itself normally distributed, making logarithmic returns easier to work with in financial models.

$$1 + r_t = \frac{p_t}{p_{t-1}} = e^{\log\left(\frac{p_t}{p_{t-1}}\right)} \quad (1)$$

where r_t represents the stock's return at time t, p_t is the stock's price at time t, and p_{t-1} the stock's price at time $t-1$.

Second, for small return values (as is typical with daily returns), the logarithmic return is approximately equal to the regular return, simplifying calculations without compromising accuracy. And finally, logarithmic returns allow for the use of addition, rather than a geometric mean, to calculate compound returns, which makes computations simpler and produces returns that are normally distributed. This is advantageous for calculating long-term returns over multiple periods.

After calculating the logarithmic returns, the initial dataset obtained from Rahavard Novin was pre-processed using filters described by Griffin et al. (2010) to minimize computational errors and remove outliers. More specifically, the following data filters have been applied:

3.2.1 Daily Return Limits

Any daily return exceeding +200% or falling below -200% was removed from the data to mitigate the impact of extreme outliers. Such extreme returns could indicate errors in data recording or unusual market events that are not representative of normal market behavior.

3.2.2 Adjacent Return Adjustment

If consecutive daily returns (r_t and r_{t-1}) exceeded 100% and their combined return, $(1 + r_t) * (1 + r_{t-1})$, was less than 20%, both returns were set to zero to prevent distortions caused by extreme price fluctuations. This adjustment helps to reduce the influence of price manipulation or anomalous trading activities.

3.2.3 Initial Public Offerings

To eliminate the effect of Initial Public Offerings (IPO) on stock prices, data from the first 90 trading days following a stock's IPO were excluded from the dataset. IPOs often exhibit unusual price behavior due to high investor eagerness and information asymmetry, which could skew the analysis.

3.2.4 Liquidity

One significant issue when analyzing data from emerging financial markets is low liquidity. Illiquid stocks can result in unreliable price movements and may introduce noise into the dataset. To address this problem, a 30% liquidity filter was applied, as suggested by Griffin et al. (2010). This filter calculates the percentage of trading days within a year in which the stock's price changed. Stocks with zero returns for more than 70% of the year were excluded from the statistical sample for that year. Applying this filter ensures that the remaining sample comprises large and liquid stocks, which improves the reliability of the findings and reduces the risk of spurious results due to illiquidity.

3.3 Summary Statistics

To facilitate comparisons across different portfolios created during the research, the monthly market return (equal-weighted) was calculated after applying the liquidity and other filters. Descriptive statistics for market returns over the nine-year study period (108 months) are presented in Table 1. The average monthly market return was found to be 1.1%, with a skewness of 0.744, indicating a positively skewed distribution that deviates from normality. This suggests that while the majority of monthly returns were modest, there were occasional large positive returns, which may be attributed to high volatility in emerging markets. Additionally, Table 2 provides the monthly average of the MAX variable in the TSE during the time period, representing the maximum daily return of stocks over a given month.

Table 1: Summary Statistics for Monthly Market Return

	Mean	Median	Max	Min	SD	Skewness
Market Return	1.10%	0.73%	14.24%	-6.56%	0.038	0.744

Summary statistics for the monthly market return (RM) over the sample period (2008-2017). The table provides the mean, median, maximum, minimum, standard deviation, and skewness of the market returns, reflecting the distribution and volatility of the data.

3.4 Empirical Methodology

The primary focus of the study is to investigate the presence of the MAX effect in the Tehran Stock Exchange. This was achieved by constructing portfolios based on the daily maximum returns of stocks. The stocks were classified into deciles according to their daily maximum returns, and their future monthly returns were analyzed. Both equal-weighted and value-weighted portfolio returns were calculated to determine whether stocks with extreme positive returns tended to underperform in subsequent

periods. This portfolio-based approach allows for the identification of systematic patterns in stock performance based on prior extreme returns.

Table 2: Quintile Returns by Year

Year	Low Max	2	3	4	High Max
2009	0.15%	0.47%	0.91%	1.59%	2.92%
2010	0.48%	1.12%	1.85%	2.80%	4.83%
2011	0.88%	1.84%	2.75%	3.72%	5.33%
2012	1.12%	2.21%	3.19%	4.13%	5.91%
2013	1.13%	2.17%	3.15%	4.07%	5.83%
2014	1.87%	3.20%	3.89%	4.58%	6.28%
2015	1.87%	3.18%	3.89%	4.55%	6.15%
2016	2.13%	3.52%	4.40%	5.28%	7.11%
2017	2.11%	3.67%	4.62%	5.35%	7.01%
Average	**1.30%**	**2.37%**	**3.18%**	**4.01%**	**5.71%**

Average monthly returns by year for each quintile sorted by maximum daily returns, with Low Max representing the lowest quintile and High Max representing the highest quintile. The table shows annual return patterns and highlights the relationship between quintile rankings and performance over the sample period.

The methodological approach included both univariate and bivariate analyses to examine the relationship between maximum returns and future performance. Univariate analysis involved examining the average returns of portfolios over time to identify any consistent trends, while bivariate analysis considered the interaction between different variables to provide a deeper understanding of the drivers behind the MAX effect. Additionally, time-series and cross-sectional regressions were conducted to analyze the influence of typical risk factors, such as market size, book-to-market ratio, and liquidity, on the MAX effect.

The time-series regression model was used to assess how the average return of a portfolio changes over time, controlling for factors like market risk, seasonality, and macroeconomic variables. By incorporating these controls, the time-series regression provides a more robust analysis of the persistence of the MAX effect. The cross-sectional regression model examined the returns of individual stocks at a specific point in time, considering variables such as size, book-to-market ratio, and maximum daily return to determine their impact on future returns. Cross-sectional regression helps to identify whether certain stock characteristics are consistently associated with the MAX effect across different periods.

4. Results

Building on the discussions of theoretical foundations and research methodologies from previous sections, this section presents the findings and results of the research. In this study, four different analytical methods were employed to examine the MAX effect in the Tehran Stock Exchange. Each analysis method, along with the results obtained, is presented below with detailed explanations, interpretations, and accompanying tables to provide a comprehensive understanding of the findings.

4.1 Univariate Analysis

To examine the MAX effect, five variables (MAX, Size, Value, Momentum, and Liquidity) were first defined, and stock portfolios were analyzed based on these variables. The MAX variable was defined such that the 376 available stocks were divided into five groups based on their maximum daily return over one month. Stocks in Group 1 had the lowest maximum daily returns, while stocks in Group 5 had the highest maximum daily returns. For categorization based on the Size variable, stocks with the lowest market value on the last day of the month were placed in Group 1, while those with the highest market value were placed in Group 5. The Value variable was categorized by calculating the book-to-market ratio for each stock, with stocks in Group 1 having the highest ratio and those in Group 5 having the lowest ratio. For the Momentum variable, the strategy introduced by Jegadeesh and Titman (1993) was used, dividing stocks into five groups based on their performance over the previous 12 months. Group 1 contained stocks with the lowest returns, while Group 5 contained those with the highest returns. Finally, the Liquidity variable was measured by the number of days a stock had a non-zero return, as described by Lesmond et al. (1999). Stocks with the lowest liquidity were placed in Group 1, and those with the highest liquidity in Group 5.

Monthly returns for each of these portfolios were calculated separately using both equally-weighted and value-weighted methods. Additionally, factors such as MAX, Small Minus Big Market Capitalization (SMB), High Minus Low Book to Market Ratio (HML), Momentum (MOM), and Liquidity (LIQ) were calculated as the difference between monthly returns of each defined

variable, which were used for regression analysis. This analysis helps to explore whether the MAX effect and other market anomalies exist in the Iranian context and whether they align with previous findings in developed markets.

4.1.1 Results Based on MAX Variable

Table 3 presents the results of categorizing stocks based on the MAX variable. The 376 stocks were divided into five portfolios each month based on their MAX values. The monthly return for each portfolio was then calculated as both equally-weighted and value-weighted returns, and the average monthly return for each portfolio over the nine-year period was computed. The first row of each portfolio shows the average monthly return, while the second row contains the p-value.

Table 3: Portfolio Returns Based on MAX

	1	2	3	4	5	1-5
Equal-Weighted	1.202%	1.175%	1.382%	1.399%	1.350%	-0.148%
	0.000**	0.002**	0.003**	0.008**	0.006**	0.611
Value-Weighted	1.900%	1.789%	2.096%	1.805%	1.780%	0.120%
	0.000**	0.002**	0.000**	0.000**	0.000**	0.769

This table presents the average monthly returns of five portfolios formed by sorting stocks based on the MAX variable each month. The portfolios are calculated using both equal-weighted and value-weighted returns. The last column (1-5) shows the difference in returns between the portfolio with the lowest MAX value and the one with the highest MAX value. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

The last column of Table 3 shows the difference between the return of the first portfolio (stocks with the lowest maximum daily return in the previous month) and the fifth portfolio (stocks with the highest maximum daily return). In the equally-weighted scenario, the value is negative, indicating the absence of the MAX effect. For the value-weighted case, the difference is positive but much smaller compared to similar studies conducted in developed markets. Furthermore, the p-values indicate that none of these differences are statistically significant, providing no evidence of the MAX effect in the Tehran Stock Exchange.

Another notable observation is the lack of a consistent trend in average monthly returns across portfolios. For instance, similar studies have shown a decreasing trend in returns from the first to the last portfolio, but such a trend is not evident here. This inconsistency may reflect differences in market structure, investor behavior, or liquidity issues unique to the Iranian market. Additionally, the small differences observed between portfolios suggest that investors may not perceive the MAX variable as a meaningful signal when making investment decisions in the Tehran Stock Exchange.

4.1.2 Results Based on Size Variable

Table 4 presents the results of the univariate analysis based on the Size variable. Stocks were divided into five portfolios each month according to their market capitalization. Portfolio 1 included smaller stocks (low market value), while Portfolio 5 included larger stocks (high market value). The monthly returns for each portfolio were calculated as both equally-weighted and value-weighted returns. The results indicate that small stocks had higher monthly returns compared to larger stocks in the following month, which is consistent with observations from other developed markets. The higher returns for smaller stocks suggest a size premium that aligns with the small firm effect documented in numerous studies.

Table 4: Portfolio Returns Based on Size

	1	2	3	4	5	1-5
Equal-Weighted	1.427%	1.200%	0.988%	0.701%	0.744%	0.683%
	0.0001**	0.0024**	0.0091**	0.0541	0.0465*	0.0256*
Value-Weighted	1.612%	1.106%	1.001%	0.715%	0.882%	0.730%
	0.0000**	0.0052**	0.0077**	0.0576	0.0258*	0.0497*

This table presents the average monthly returns for five portfolios formed by sorting stocks each month based on market capitalization. The portfolios are calculated using both equal-weighted and value-weighted returns. Portfolio 1 represents the smallest stocks, while Portfolio 5 represents the largest stocks. The last column (1-5) shows the difference in returns between the smallest and largest portfolios. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

The size effect in the TSE may be attributed to the risk associated with investing in smaller companies. Smaller firms typically face higher business risk, have limited access to financing, and are more vulnerable to economic shocks compared to larger firms. As a result, investors demand higher returns as compensation for bearing this additional risk. The findings indicate that the small firm effect is present in the Iranian market, albeit with some variability depending on the weighting method used.

4.1.3 Results Based on Value Variable

In Table 5, stocks were categorized based on the Value variable, represented by the book-to-market ratio. Portfolio 1 included stocks with the highest book-to-market ratios, while Portfolio 5 included those with the lowest ratios. The average monthly returns for each portfolio were calculated for the month following portfolio formation. The findings show no significant evidence of a value effect in the TSE, as none of the values in the last column are statistically significant.

Table 5: Portfolio Returns Based on Value

	1	2	3	4	5	1-5
Equal-Weighted	1.326%	1.214%	1.029%	0.616%	0.797%	0.529%
	0.000**	0.002**	0.007**	0.080	0.041*	0.053
Value-Weighted	1.333%	1.137%	1.047%	0.587%	0.851%	0.482%
	0.000**	0.002**	0.010**	0.076	0.043*	0.155

This table shows the average monthly returns for portfolios formed by sorting stocks each month according to their book-to-market ratio (Value variable). Portfolio 1 contains stocks with the highest book-to-market ratios, representing value stocks, while Portfolio 5 contains stocks with the lowest ratios, representing growth stocks. The returns are reported as both equal-weighted and value-weighted returns, with the last column (1-5) showing the return difference between value and growth portfolios. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

The lack of a value effect in the Iranian stock market may be due to several factors. First, investor behavior in emerging markets like Iran may differ from that in developed markets, where the value effect has been widely documented. Investors in the Tehran Stock Exchange may place less emphasis on fundamental metrics such as the book-to-market ratio, leading to the absence of a value premium. Second, regulatory constraints and limited financial disclosures may hinder the ability of investors to accurately assess the intrinsic value of stocks. This lack of transparency could prevent the value effect from manifesting, as investors may not be able to identify undervalued stocks based on financial ratios alone. Additionally, the cultural and behavioral tendencies of investors in the Iranian market, such as speculative trading and herd behavior, may also play a role in diminishing the impact of value-based investment strategies.

4.1.4 Results Based on Momentum Variable

Table 6 shows the average monthly returns of stock portfolios formed based on the Momentum variable. Portfolio 1 contained stocks with the weakest past performance, while Portfolio 5 included those with the strongest past performance over the previous 12 months. The results indicate that there is no consistent pattern of outperformance by past winners compared to past losers, suggesting that the momentum effect may not be present in the Tehran Stock Exchange.

Table 6: Portfolio Returns Based on Momentum

	1	2	3	4	5	1-5
Equal-Weighted	2.370%	0.926%	0.620%	1.185%	1.171%	1.199%
	0.0106*	0.0559	0.0651	0.0045*	0.0091**	0.0874
Value-Weighted	-1.526%	-0.129%	0.433%	1.567%	3.408%	-4.934%
	0.000**	0.656	0.159	0.001**	0.000**	0.000**

This table presents the average monthly returns for portfolios formed by sorting stocks each month according to their past 12-month performance (Momentum variable). Portfolio 1 includes stocks with the weakest past performance, while Portfolio 5 includes those with the strongest past performance. The returns are shown as both equal-weighted and value-weighted returns, with the last column (1-5) representing the difference in returns between the lowest and highest momentum portfolios. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

In developed markets, the momentum effect has been shown to generate significant abnormal returns, as investors tend to extrapolate past performance into the future, leading to price continuation. However, in the Iranian financial market, the absence of the momentum effect could be attributed to factors such as market inefficiencies, a lack of institutional investors, and limited access to information. Retail investors, who dominate the Tehran Stock Exchange, may not have the resources or the inclination to pursue momentum-based trading strategies, resulting in the lack of a clear momentum pattern. Furthermore, frequent regulatory interventions and price limits in the TSE may prevent the formation of momentum, as stock prices are unable to move freely in response to market forces. The findings suggest that the momentum effect, which has been a key driver of returns in many developed markets, may not be a viable strategy in the Iranian market due to structural and behavioral limitations.

4.1.5 Results Based on Liquidity Variable

Table 7 presents the results of categorizing stocks based on Liquidity. Portfolio 1 represents stocks with low liquidity (characterized by the highest number of days with zero returns), while Portfolio 5 includes highly liquid stocks. The results show no evidence of a liquidity premium in the TSE, as there are no significant differences in the returns of portfolios based on liquidity.

Table 7: Portfolio Returns Based on Liquidity

	1	2	3	4	5	1-5
Equal-Weighted	1.133%	1.457%	1.109%	1.214%	1.062%	0.072%
	0.000**	0.000**	0.014*	0.010**	0.038*	0.833
Value-Weighted	1.256%	1.019%	1.462%	1.111%	1.207%	0.049%
	0.005**	0.024*	0.006**	0.024*	0.008**	0.919

This table presents the average monthly returns for portfolios formed by sorting stocks each month according to their liquidity. Portfolio 1 includes stocks with low liquidity (characterized by the highest number of days with zero returns), while Portfolio 5 includes highly liquid stocks. Returns are shown for both equal-weighted and value-weighted portfolios, with the last column (1-5) indicating the difference in returns between the lowest and highest liquidity portfolios. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

Given the various filters applied to remove illiquid stocks from the raw dataset, this finding is not entirely unexpected. The liquidity premium, which refers to the higher returns demanded by investors for holding less liquid assets, has been observed in developed markets. However, in the Tehran Stock Exchange, other factors such as investor behavior, regulatory constraints, and limited market depth may play a more significant role in determining stock returns. The lack of a liquidity premium could also be due to the dominance of retail investors, who may be less concerned about liquidity risk compared to institutional investors. Additionally, the market's small size and limited trading volume may contribute to the absence of a clear relationship between liquidity and returns. This suggests that liquidity may not be a primary concern for investors in the Iranian market, where other risk factors, such as political and economic uncertainty, may have a more significant impact on investment decisions.

4.1.6 Summary of Univariate Analyses

Overall, the results of the univariate analyses indicate that several well-documented anomalies, such as the MAX effect, size effect, value effect, momentum effect, and liquidity effect, do not consistently hold in the Tehran Stock Exchange. The findings suggest that factors driving stock returns in developed markets may not have the same influence in an emerging market such as Iran. The lack of significance in the MAX effect and other anomalies could be attributed to the unique characteristics of the Iranian market, including regulatory constraints, limited arbitrage opportunities, and differences in investor behavior compared to developed markets.

The absence of the MAX effect and the other anomalies raises questions about the efficiency of the Tehran Stock Exchange. While some of these effects, such as the size effect, showed weak support, others, including the momentum and value effects, did not manifest as expected. This could imply that the Iranian market is less susceptible to investor biases that drive these anomalies in other contexts, or that structural barriers prevent the realization of such effects.

4.2 Bivariate Analysis

According to the study by Nartea et al. (2014) which examined the stock markets of China and South Korea, the MAX effect is more pronounced among small-cap stocks with a high book-to-market ratio. This suggests that the MAX effect might be influenced by factors such as size or value. To further investigate how other variables may interact with the MAX effect, we conducted a bivariate analysis. Similar to the univariate analysis, we divided stocks into portfolios based on the presented variables and then calculated the average monthly return of these portfolios in the subsequent month. Given the relatively small number of stocks available in the Tehran Stock Exchange, we divided the stocks into three portfolios for the bivariate analysis to ensure meaningful comparisons and provide robust insights.

The bivariate analysis helps to reveal the interaction between the MAX effect and other important stock characteristics, offering deeper insights into how these factors may jointly influence stock returns. By using bivariate analysis, we aim to determine whether the MAX effect persists when controlling for other variables such as size, value, momentum, and liquidity, which are often considered key determinants of asset returns. The results of this analysis are presented below, categorized by the variables under consideration.

4.2.1 Results Based on MAX and Size Variables

Table 8 shows the results of the bivariate analysis based on the MAX and size variables. To obtain these results, stocks were first divided into three categories (small, medium, and large) based on their monthly market capitalization. Within each category, stocks were then divided into three portfolios based on the MAX variable. The first portfolio contained stocks with the lowest daily maximum return in a month, while the third portfolio contained stocks with the highest daily maximum return.

Table 8: Portfolio Returns Based on MAX and Size

	Small				Medium				Large			
	MAX1	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**
Equal-Weighted	1.745%	2.007%	2.241%	-0.496%	1.270%	1.158%	0.938%	0.332%	0.794%	0.871%	0.716%	0.077%
	0.000**	0.000**	0.000**	0.157	0.000**	0.019*	0.069	0.294	0.017*	0.029*	0.175	0.797
Value-Weighted	1.805%	2.429%	2.428%	-0.623%	1.343%	1.096%	1.017%	0.326%	1.209%	1.310%	1.160%	0.049%
	0.000**	0.000**	0.000**	0.072	0.000**	0.022*	0.040*	0.306	0.004**	0.014*	0.014*	0.882

This table presents the average monthly returns for portfolios formed by sorting stocks into size categories (small, medium, large) based on their market capitalization and then further sorted by their MAX values. Each category includes three portfolios based on MAX values: MAX1 (lowest daily maximum return), MAX2 (medium daily maximum return), and MAX3 (highest daily maximum return). The last column (1-3) shows the difference in returns between portfolios with the lowest and highest MAX values. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

As observed in the difference column between the first and third portfolios for each of the small, medium, and large stock categories, the MAX effect could not be explained by the size variable in the TSE. None of the results were statistically significant, indicating that size does not have a significant moderating effect on the MAX effect. Another noteworthy observation is the negative value of the difference between the first and third portfolios among small stocks, which is even larger for medium-sized stocks. These results imply that not only is the MAX effect not observed in the Iranian stock market, but the behavior of small stocks is also contrary to the observations made by Nartea et al. (2014).

This finding highlights a significant deviation from established patterns in other markets, suggesting that local market dynamics play a crucial role in determining stock returns in Iran. The absence of the MAX effect among small-cap stocks could be attributed to unique factors such as the regulatory environment, investor composition, and market structure, which differ significantly from those in more developed markets. It is possible that small-cap stocks in Iran face different risk-return trade-offs, or that local investors are less inclined to invest in these stocks due to higher perceived risks and liquidity concerns. Furthermore, the limited presence of institutional investors and the dominance of retail investors might affect the degree to which size impacts the MAX effect, as retail investors often exhibit different risk preferences compared to institutional investors.

4.2.2 Results Based on MAX and Value Variables

Table 9 presents the results of the bivariate analysis based on the MAX and value (book-to-market ratio) variables. In this analysis, stocks were first divided into three categories: low, medium, and high-value stocks, based on their book-to-market ratio. Within each category, stocks were further divided into three portfolios based on the MAX variable.

Table 9: Portfolio Returns Based on MAX and Value

	Low				Medium				High			
	MAX1	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**
Equal-Weighted	0.866%	0.882%	0.879%	-0.012%	1.109%	1.093%	0.959%	0.150%	1.669%	2.095%	2.002%	-0.333%
	0.010**	0.045*	0.133	0.972	0.001**	0.028*	0.058	0.613	0.000**	0.000**	0.000**	0.293
Value-Weighted	1.412%	1.484%	1.255%	0.157%	1.297%	1.491%	1.294%	0.003%	1.736%	2.186%	2.338%	-0.602%
	0.002**	0.004**	0.008**	0.643	0.000**	0.012*	0.005**	0.992	0.000**	0.000**	0.000**	0.110

This table presents average monthly returns for portfolios sorted by value categories (low, medium, high) based on their book-to-market ratio, and then further categorized by MAX values. Each category includes three portfolios based on MAX values: MAX1 (lowest daily maximum return), MAX2 (medium daily maximum return), and MAX3 (highest daily maximum return). The last column (1-3) shows the difference in returns between portfolios with the lowest and highest MAX values. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

Upon examining the difference column between the first and third portfolios, it becomes evident that none of the values are statistically significant. This suggests that the MAX effect is not present in the Tehran Stock Exchange, even when controlling for the value variable. Unlike the findings from other markets where value often plays a significant role in explaining anomalies, the absence of a significant relationship here indicates that investor behavior concerning value metrics in Iran differs from global norms.

The lack of a significant value effect in moderating the MAX effect suggests that Iranian investors may not fully consider the book-to-market ratio when making investment decisions. In many developed markets, the book-to-market ratio is a key indicator of a stock's intrinsic value, and high book-to-market stocks (often referred to as value stocks) are expected to outperform low book-to-market stocks (growth stocks). However, the Iranian market's unique characteristics – such as limited financial transparency, different investor behavior, and less reliance on fundamental analysis – may contribute to the lack of a value premium. These findings point to the need for further investigation into how valuation metrics are perceived by investors in emerging markets like Iran. Additionally, it is possible that macroeconomic factors, such as inflation and currency fluctuations, may overshadow the importance of valuation metrics in determining stock returns, leading investors to prioritize other considerations.

4.2.3 Results Based on MAX and Momentum Variables

Table 10 shows the results of the bivariate analysis based on the MAX and momentum variables. Stocks were initially divided into three categories based on their momentum, and within each category, they were further divided into three portfolios based on the MAX variable. The difference between the first and third portfolios was then calculated to assess the presence of the MAX effect.

Table 10: Portfolio Returns Based on MAX and Momentum

	Low				Medium				High			
	MAX1	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**
Equal-Weighted	-0.379%	-1.021%	-1.441%	1.062%	1.220%	1.222%	0.725%	0.495%	3.166%	3.701%	3.402%	-0.236%
	0.261	0.029*	0.002**	0.001**	0.001**	0.005**	0.129	0.082	0.000**	0.000**	0.000**	0.451
Value-Weighted	0.500%	-0.462%	-1.180%	1.680%	1.982%	1.785%	0.633%	1.349%	4.427%	3.940%	3.520%	0.907%
	0.340	0.317	0.032*	0.003**	0.001**	0.002**	0.256	0.039*	0.000**	0.000**	0.000**	0.261

This table presents average monthly returns for portfolios categorized by momentum (low, medium, high) and then sorted by MAX values. Each momentum category contains three portfolios based on MAX values: MAX1 (lowest daily maximum return), MAX2 (medium daily maximum return), and MAX3 (highest daily maximum return). The last column (1-3) shows the difference in returns between portfolios with the lowest and highest MAX values. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

The results from Table 11 indicate that the MAX effect is evident among stocks with low momentum, as the difference between the first and third portfolios in this category is positive and statistically significant at the 0.01 level. This suggests that stocks with the lowest daily maximum return in the previous month performed significantly better in the current month compared to those with the highest daily maximum return. The presence of the MAX effect in low-momentum stocks highlights the importance of momentum as a moderating factor, suggesting that the MAX effect might be more pronounced when investor sentiment is not dominated by recent strong performance.

The findings related to momentum are particularly interesting because they imply that the MAX effect is conditional on the recent performance of the stocks. Stocks with low momentum, which have underperformed in the past, appear to benefit from a reversal effect, where previously neglected stocks experience a recovery in returns. This behavior may be driven by contrarian investors who seek out undervalued opportunities, or by changes in investor sentiment that lead to a reassessment of previously underperforming stocks. The statistically significant results indicate that the interplay between momentum and the MAX effect could be a key area for further exploration, especially in understanding how behavioral biases influence investment decisions in emerging markets. Moreover, the results suggest that investor psychology, such as overreaction and the tendency to chase performance, may play a crucial role in shaping stock returns, particularly for low-momentum stocks.

4.2.4 Results Based on MAX and Liquidity Variables

Table 11 presents the results of the bivariate analysis based on the MAX and liquidity variables. Similar to previous analyses, stocks were first divided into three categories based on their liquidity and then further divided into three portfolios based on the MAX variable. Finally, the difference between the first and third portfolios was calculated.

The findings in Table 11 show no evidence of the MAX effect when stocks are categorized based on the liquidity variable. This suggests that liquidity does not play a significant role in moderating the MAX effect in the Iranian market. The absence of a significant relationship may be due to the unique liquidity characteristics of the Iranian market, where liquidity constraints and regulatory limitations might influence stock performance differently compared to more developed markets.

Liquidity is often considered a critical factor in explaining stock returns, with illiquid stocks typically demanding higher returns as compensation for the increased risk of not being able to quickly sell shares. However, in the Tehran Stock Exchange, the lack of a liquidity premium suggests that other factors, such as market interventions, government policies, and the dominance of retail investors, may have a more substantial impact on stock performance. The findings imply that the traditional liquidity-return relationship observed in developed markets may not be applicable in Iran, and that investors may prioritize other considerations, such as risk aversion and regulatory constraints, over liquidity when making investment decisions. Additionally, the presence of price limits and trading halts in the Iranian market could reduce the impact of liquidity on stock returns, as these regulatory measures may prevent rapid price changes and limit the role of liquidity in driving stock price movements.

Table 11: Portfolio Returns Based on MAX and Liquidity

	Low				Medium				High			
	MAX1	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**
Equal-Weighted	1.433%	1.697%	1.813%	-0.380%	0.975%	1.320%	1.331%	-0.356%	1.043%	1.236%	0.863%	0.180%
	0.000**	0.000**	0.000**	0.183	0.009**	0.011*	0.017*	0.306	0.004**	0.020*	0.147	0.612
Value-Weighted	1.670%	2.017%	2.035%	-0.365%	1.362%	2.057%	2.009%	-0.647%	1.957%	2.148%	1.438%	0.519%
	0.001**	0.000**	0.000**	0.532	0.005**	0.002**	0.001**	0.242	0.001**	0.001**	0.002**	0.281

This table presents average monthly returns for portfolios categorized by liquidity (low, medium, high) and then sorted by MAX values. Each liquidity category contains three portfolios based on MAX values: MAX1 (lowest daily maximum return), MAX2 (medium daily maximum return), and MAX3 (highest daily maximum return). The last column (1-3) shows the difference in returns between portfolios with the lowest and highest MAX values. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

4.2.5 Summary of Bivariate Analyses

The bivariate analysis conducted in this study reveals that the MAX effect is not consistently observed across different stock characteristics in the Iranian stock market. The lack of significance in most of the analyses suggests that the MAX effect may not play a major role in explaining stock returns in this context. Notably, while the MAX effect was observed in low-momentum stocks, it was not present when considering size, value, or liquidity. These findings highlight the complexity of market dynamics in an emerging market like Iran, where traditional asset pricing factors and anomalies may not behave as expected due to unique market characteristics, regulatory environments, and investor behaviors.

The inconsistent presence of the MAX effect across different stock characteristics suggests that local factors, such as investor sentiment, regulatory constraints, and market structure, may significantly influence the behavior of asset pricing anomalies. For example, the strong regulatory oversight in the Iranian market, including price limits and restrictions on short selling, may dampen the impact of factors like size and liquidity, which are more prominent in less regulated markets. Additionally, the dominance of retail investors, who may be influenced by sentiment and speculative behavior rather than fundamental analysis Mohammadagha et al. (2025), could also contribute to the observed deviations from global norms.

4.3 Time-Series Regression Analysis

To examine the risk-adjusted returns on portfolios formed based on the MAX variable, we employed two different asset pricing models. These models are crucial for calculating the expected returns of the portfolios and determining whether the observed returns can be adequately explained by known risk factors. The first method used is the Fama and French (1993) three-factor model, while the second method is an extended version of the Fama and French model that includes two additional factors: momentum (MOM) and liquidity (LIQ). The regression equations used for the analysis are detailed as follows:

$$r_{pit} - r_{ft} = \alpha_{it} + \beta_M\left(r_{mt} - r_{ft}\right) + \beta_{SMB}(\mathrm{SMB}_t) + \beta_{HML}(\mathrm{HML}_t) + \varepsilon_{it} \qquad (2)$$

$$r_{pit} - r_{ft} = \alpha_{it} + \beta_M\left(r_{mt} - r_{ft}\right) + \beta_{SMB}(\mathrm{SMB}_t) + \beta_{HML}(\mathrm{HML}_t) + \beta_{MOM}(\mathrm{MOM}_t) + \beta_{LIQ}(\mathrm{LIQ}_t) + \varepsilon_{it} \qquad (3)$$

In equations 2 and 3, r_{pit} represents the returns of portfolios formed based on the MAX variable in month t, and r_{ft} is the monthly risk-free rate in Iran, which is obtained from the Central Bank of Iran's economic time series database. r_{mt} is the market return in month t, calculated from all the available stocks in the dataset. SMB_t represents the size factor, which is the difference in returns between the smallest and largest portfolios in month t when stocks are sorted by size. Similarly, HML_t, MOM_t, and LIQ_t represent the differences in returns between the lowest and highest portfolios in month t when stocks are sorted by book-to-market ratio, momentum, and liquidity, respectively. Finally, ε_{it} represents the error term in equations 2 and 3.

In this study, we ran each of these regressions on portfolios formed in both univariate and bivariate analyses to examine the resulting alphas. The alpha values represent the portion of returns that cannot be explained by the risk factors included in the

regressions (equations 2 and 3). Therefore, the difference in alpha values between the first and last portfolios can indicate the presence or absence of the MAX effect in the Tehran Stock Exchange.

4.3.1 Results Based on MAX Variable

Table 12 presents the alphas obtained from the time-series regression when stocks are sorted by the MAX variable. The first panel of this table shows the results of the Fama and French three-factor regression (Equation 2), while the second panel shows the results of the five-factor regression (Equation 3).

Table 12: Alphas from Time-Series Regression on Portfolios Sorted on MAX

Panel A: Market Beta, SMB, and HML						
	1	**2**	**3**	**4**	**5**	**1-5**
Equal-Weighted	0.142%	0.139%	0.372%	0.405%	0.363%	-0.221%
	0.001**	0.002**	0.002**	0.002**	0.002**	0.002**
Value-Weighted	0.780%	0.684%	0.977%	0.741%	0.713%	0.067%
	0.002**	0.003**	0.003**	0.003**	0.003**	0.004**
Panel B: Market Beta, SMB, HML, Momentum, and Liquidity						
	1	**2**	**3**	**4**	**5**	**1-5**
Equal-Weighted	-0.286%	-0.238%	0.647%	0.517%	0.562%	-0.848%
	0.003**	0.004**	0.005**	0.005**	0.005**	0.005**
Value-Weighted	1.467%	0.299%	-0.573%	1.559%	0.962%	0.506%
	0.005**	0.006**	0.007**	0.007**	0.006**	0.009**

This table presents the alphas obtained from time-series regressions of stocks sorted by the MAX variable. Panel A reports the results from the Fama-French three-factor model (Market Beta, SMB, HML). Panel B extends the analysis by including the Momentum and Liquidity factors. The return difference between the first (low MAX) and fifth (high MAX) portfolios is shown in the last column. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

According to these two panels, when the momentum and liquidity variables are included in the regression, the return difference between the first and last portfolios increases. The last column in the first panel indicates that the alpha difference between the first and fifth portfolios shows no significant evidence of the MAX effect. Moreover, it can be observed that in portfolios 1 to 5, there is no consistent trend in the alpha values. In the second panel, when portfolios are weighted by market value, the return difference between the first and last portfolios is 0.506%, which is statistically significant at the 0.01 level. This could indicate a slight presence of the MAX effect in this case. However, when examining the returns of other portfolios, it becomes evident that there is no consistent trend in alpha values, and the MAX effect cannot be observed in other instances.

The findings suggest that while there may be some marginal evidence of the MAX effect when additional factors are included, the inconsistency across different portfolio weightings indicates that this effect is not a robust phenomenon in the Iranian stock market. The significance observed in certain instances may be driven by specific market conditions or peculiarities within the data rather than a systematic and persistent MAX effect.

4.3.2 Results Based on MAX and Size Variables

Table 13 shows the alpha values obtained from the time-series regression on portfolios formed by sorting based on both the MAX variable and size. In the first panel of this table, the results of the Fama and French three-factor regression (Equation 2) are presented, while in the second panel, the results of the five-factor regression (Equation 3) are shown.

By comparing the first and second panels, it can be concluded that adding the momentum and liquidity variables to the regression increases the difference between the first and last MAX portfolios. This increase is more pronounced among small-cap stocks. In the first panel, it can be observed that medium-sized stocks, in both equal-weighted and market value-weighted cases, show slight evidence of the MAX effect. However, this effect is not consistent and cannot be observed in any of the other categories, indicating that the MAX effect may not be a pervasive phenomenon in the Tehran Stock Exchange.

The results for small-cap stocks are particularly intriguing. The increased difference between the first and last portfolios when adding momentum and liquidity factors suggests that these factors might play a significant role in influencing the returns of small-cap stocks. However, the lack of consistency across different market capitalizations highlights that the MAX effect does not

exhibit a uniform pattern across the market. This could be due to differences in investor behavior, risk perception, and market conditions that vary significantly between small, medium, and large-cap stocks in Iran.

Table 13: Alphas from Time-Series Regression on Portfolios Sorted on MAX and Size

Panel A: Market Beta, SMB, and HML

	Small				Medium				Large			
	MAX1	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**
Equal-Weighted	0.785%	1.100%	1.352%	-0.567%	0.220%	0.147%	-0.085%	0.305%	-0.309%	-0.230%	-0.382%	0.074%
	0.002**	0.003**	0.003**	0.003**	0.002**	0.003**	0.003**	0.003**	0.001**	0.002**	0.002**	0.002**
Value-Weighted	0.824%	1.502%	1.513%	-0.689%	0.288%	0.076%	-0.004%	0.292%	0.098%	0.204%	0.059%	0.039%
	0.002**	0.003**	0.003**	0.003**	0.002**	0.003**	0.003**	0.003**	0.002**	0.002**	0.002**	0.003**

Panel B: Market Beta, SMB, HML, Momentum, and Liquidity

	Small				Medium				Large			
	MAX1	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**
Equal-Weighted	0.523%	0.077%	1.651%	-1.128%	MAX1	MAX2	MAX3	1-3	MAX1	MAX2	MAX3	1-3
	0.005**	0.006**	0.006**	0.007**	-0.211%	0.417%	-0.151%	-0.061%	-0.230%	0.065%	0.042%	-0.272%
Value-Weighted	0.499%	0.340%	1.694%	-1.194%	0.005**	0.005**	0.007**	0.006**	0.003**	0.004**	0.005**	0.006**
	0.005**	0.007**	0.006**	0.007**	-0.102%	0.216%	0.110%	-0.212%	0.485%	-0.520%	0.751%	-0.267%

This table presents alpha values obtained from the time-series regression for portfolios sorted by both the MAX variable and size. Panel A shows the results from the Fama-French three-factor model (Market Beta, SMB, HML), while Panel B includes the Momentum and Liquidity factors. The difference between the first and third MAX portfolios is displayed for each size category (Small, Medium, Large). Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels, respectively.

These results suggest that small-cap stocks may be more susceptible to the influence of behavioral biases and market inefficiencies. The lack of institutional investors in the Iranian market, combined with the prevalence of retail investors, could also play a role in these findings. Retail investors may be more prone to overreaction and sentiment-driven trading, which could explain why the MAX effect appears inconsistently, particularly in smaller stocks.

4.3.3 Results Based on MAX and Value Variables

Table 14 presents the alphas obtained from the time-series regression on portfolios formed based on the MAX variable and value (book-to-market ratio). Comparing the first and second panels, it can be seen that after including the momentum and liquidity variables, similar results are obtained. These results indicate that the addition of the momentum and liquidity factors has limited explanatory power in accounting for the return differences between the different portfolios.

Table 14: Alphas from Time-Series Regression on Portfolios Sorted on MAX and Value

Panel A: Market Beta, SMB, and HML

	Low				Medium				High			
	MAX1	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**
Equal-Weighted	-0.228%	-0.210%	-0.201%	-0.027%	0.061%	0.079%	-0.049%	0.110%	0.690%	1.174%	1.083%	-0.392%
	0.001**	0.002**	0.003**	0.003**	0.002**	0.003**	0.003**	0.003**	0.002**	0.003**	0.002**	0.003**
Value-Weighted	0.294%	0.364%	0.142%	0.153%	0.232%	0.469%	0.278%	-0.046%	0.721%	1.214%	1.371%	-0.649%
	0.002**	0.002**	0.002**	0.003**	0.002**	0.004**	0.003**	0.003**	0.002**	0.003**	0.003**	0.004**

Panel B: Market Beta, SMB, HML, Momentum, and Liquidity

	Low				Medium				High			
	MAX1	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**	**MAX1**	**MAX2**	**MAX3**	**1-3**
Equal-Weighted	-0.211%	0.155%	0.127%	-0.338%	-0.280%	0.655%	0.554%	-0.835%	-0.004%	0.363%	0.872%	-0.875%
	0.003**	0.004**	0.006**	0.007**	0.005**	0.006**	0.006**	0.005**	0.004**	0.006**	0.005**	0.006**
Value-Weighted	0.711%	0.392%	0.516%	0.195%	0.101%	-0.202%	0.306%	-0.205%	0.072%	0.696%	0.638%	-0.566%
	0.004**	0.005**	0.005**	0.008**	0.006**	0.008**	0.006**	0.007**	0.005**	0.008**	0.007**	0.008**

This table presents alpha values obtained from the time-series regression for portfolios sorted by both the MAX variable and value (book-to-market ratio). Panel A shows results from the Fama-French three-factor model, while Panel B incorporates momentum and liquidity factors. The columns

represent different levels of the value variable (Low, Medium, High). The difference between the first and third MAX portfolios is also reported. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels.

The difference between the first and third portfolios for stocks with a low book-to-market ratio, when portfolios are weighted by their market value, suggests a slight presence of the MAX effect. However, for other categories of stocks with medium or high book-to-market ratios, there is no evidence of the MAX effect. Therefore, the results in this table are similar to those in the previous tables, indicating that the MAX effect is not consistently observed across different stock characteristics in the Iranian stock market.

The findings imply that the relationship between the MAX effect and value characteristics is weak in the Iranian market. Stocks with a low book-to-market ratio, which are often considered growth stocks, show some signs of the MAX effect when additional risk factors are included, but this effect does not persist across other categories. This suggests that the value factor, which typically captures differences between growth and value stocks, does not significantly influence the presence of the MAX effect in this market, possibly due to the unique dynamics of the Iranian financial environment.

4.3.4 Summary of Time-Series Regression Analyses

The time-series regression analysis conducted in this study aimed to determine whether the MAX effect persists after adjusting for well-known risk factors such as market, size, value, momentum, and liquidity. The results indicate that, in general, there is limited evidence of the MAX effect in the Iranian stock market. While some signs of the MAX effect were observed in certain cases – such as the return difference between the first and last portfolios when using the extended five-factor model – these effects were not consistent across different portfolio formations.

The lack of a consistent MAX effect could be attributed to unique features of the Tehran Stock Exchange, such as regulatory constraints, low market efficiency, and the dominance of retail investors who may not be following traditional valuation metrics or asset pricing models. Additionally, the presence of stringent regulatory oversight, such as price limits and restrictions on short selling, may also dampen the impact of certain factors that are more prominent in less regulated markets.

Another important consideration is the role of behavioral biases and investor sentiment. The dominance of retail investors in the Iranian market, who are more likely to be influenced by psychological factors such as overconfidence and herding, could lead to deviations from the predictions of traditional asset pricing models. Such behavioral biases may reduce the reliability of factors like momentum and value in explaining stock returns, thus contributing to the observed lack of consistency in the MAX effect.

4.4 Panel Regression Analysis

To further analyze the results, we employed panel regression to assess the impact of various factors on stock returns using three specific equations. By using panel regression, we incorporated both cross-sectional and time-series data, thereby improving the robustness and reliability of the results. The variables used in Equations 4 to 6 are defined as follows.

$$r_{im} = \alpha_{it} + \beta_{MAXit}\mathrm{MAX}_{im-1} + \varepsilon_{it} \quad (4)$$

$$r_{im} = \alpha_{it} + \beta_{MAXit}\mathrm{MAX}_{im-1} + \beta_{SIZEit}(\mathrm{SIZE}_{iy}) + \beta_{BMit}(\mathrm{BM}_{iy}) + \varepsilon_{it} \quad (5)$$

$$r_{im} = \alpha_{it} + \beta_{MAXit}\mathrm{MAX}_{im-1} + \beta_{SIZEit}(\mathrm{SIZE}_{iy}) + \beta_{BMit}(\mathrm{BM}_{iy}) + \beta_{MOMit}(\mathrm{MOM}_{iy-1}) + \beta_{LIQit}(\mathrm{LIQ}_{iy}) + \varepsilon_{it} \quad (6)$$

In the equations above, r_{im} denotes the logarithmic return of stock i in month m. The variable MAX_{im-1} represents the maximum daily return of stock i over the prior month $m-1$, while SIZE_{iy} reflects the log of the market capitalization of stock i at the beginning of year y. Furthermore, BM_{iy} denotes the book-to-market ratio of stock i at the beginning of year y, and MOM_{iy-1} captures the performance of stock i over the preceding year $y-1$. Finally, LIQ_{iy} is defined as the percentage of non-zero return days for stock i over year y.

Each of these panel regression equations was designed to evaluate the explanatory power of the different variables on stock returns. The magnitude of the regression coefficients for each variable indicates their relative importance in explaining stock returns. A higher coefficient suggests that the variable has a substantial impact on stock performance, whereas a lower coefficient indicates a weaker influence.

4.4.1 Panel Regressions Results

Table 15 presents the results of the panel regression analysis. Upon examining this table, it is observed that the coefficient for the MAX variable decreases when additional variables, such as size, book-to-market ratio, momentum, and liquidity, are included

in the regression model. This finding is consistent with the results obtained in previous sections, indicating that there is no significant evidence of the MAX effect in the Tehran Stock Exchange.

The decrease in the coefficient for the MAX variable suggests that the explanatory power of MAX diminishes considerably when accounting for other well-known factors. This implies that the influence of the MAX effect, if present, is largely overshadowed by other characteristics such as market size, value, momentum, and liquidity. In other words, these factors contribute more significantly to explaining the variation in stock returns compared to the MAX effect alone.

Table 15: Panel Regression Results

c	MAX	SIZE	BM	MOM	LIQ	R-squared
0.003123	0.245784					0.005098
0.001**	0.017*					
0.003043	0.244223	0.000000	0.000000			0.005129
0.001**	0.017*	0.000**	0.000**			
0.000448	-0.084159	0.000000	0.000000	0.083330	0.004100	0.084392
0.001**	0.024*	0.000**	0.000**	0.001**	0.002**	

This table presents the results from the panel regression analysis where the dependent variable is the daily individual stock returns. The MAX variable, representing the maximum daily return over the previous month, has been used as an independent variable. To control for size and value risk factors, the logarithm of the market capitalization and the book-to-market ratio of each company at the beginning of the calendar year are also included as independent variables. Additionally, the momentum and liquidity factors are constructed by ranking stocks based on their past performance and the percentage of traded days over the previous year, respectively. These factors are used as independent variables in the regression. Significance levels are indicated, with (*) and (**) representing 0.05 and 0.01 levels.

4.4.2 Summary of Panel Regression Analyses

The findings from the panel regression analysis provide further support for the argument that the MAX effect is not a dominant factor in the Tehran Stock Exchange. The lack of a significant MAX effect aligns with the observations made in the time-series regression analysis, which also found limited evidence of this anomaly. This consistency between the two analyses strengthens the conclusion that traditional risk factors, such as size, value, momentum, and liquidity, play a more prominent role in determining stock performance in the Iranian stock market than extreme returns do.

The observed decrease in the MAX coefficient also suggests that the extreme returns captured by the MAX variable might be largely explained by investor overreaction or behavioral biases, which are mitigated when more fundamental variables are included in the model. These results imply that investors in the Iranian market may not be overly influenced by extreme returns alone but are instead driven by other fundamental factors that align with traditional asset pricing theories.

5. Conclusion

This study set out to investigate the presence of the MAX effect in the Tehran Stock Exchange (TSE), an emerging market with unique regulatory characteristics and a lack of financial instruments such as short-selling. Previous research has documented the existence of the MAX effect in various developed and emerging markets, often attributing its persistence to investor biases and structural inefficiencies. However, the findings of this study indicate that there is no significant evidence of the MAX effect in the TSE.

Our analysis, which included univariate, bivariate, time-series, and panel regression models, consistently showed that the MAX effect does not manifest in the TSE, even after controlling for key variables such as market size, book-to-market ratio, momentum, liquidity, and market risk. These results suggest that the regulatory environment and market structure of the TSE play a significant role in suppressing anomalies like the MAX effect, which have been observed in other financial markets. The absence of short-selling opportunities, the presence of price limits, and the dominance of retail investors appear to contribute to this lack of mispricing correction, reducing the effectiveness of arbitrage mechanisms typically seen in developed markets.

The findings have several important implications. First, they highlight the limitations of applying asset pricing models developed for mature, developed markets to emerging markets with different regulatory and investor profiles. Second, the results suggest that market efficiency in the TSE may be driven by factors that differ from those in other markets, such as regulatory constraints and investor behavior that is less influenced by extreme returns and more affected by macroeconomic factors and trading restrictions. Lastly, the study underscores the need for further research to explore other potential anomalies or behavioral patterns unique to emerging markets like Iran, taking into consideration the distinct regulatory and economic context.

In conclusion, while the MAX effect has been documented as a persistent anomaly in several financial markets, this study finds no evidence of its presence in the Tehran Stock Exchange. This suggests that market structure, regulatory constraints, and investor behavior in emerging markets may significantly influence the manifestation of such anomalies. Future research could benefit from investigating the interplay between regulatory frameworks, market efficiency, and investor psychology to better understand asset pricing dynamics in similar emerging markets. Additionally, integrating advanced machine learning and big data–driven forecasting methods, which have demonstrated robust predictive capabilities in complex market contexts (Soltaninejad et al., 2024; Pazouki et al., 2025; Ataei et al. 2025b), could further clarify anomaly dynamics and market efficiency.

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References

[1] Annaert, J., De Ceuster, M., & Verstegen, K. (2013). Are extreme returns priced in the stock market? European evidence. Journal of Banking & Finance, 37(9), 3401–3411.
[2] Askarzadeh, A., Kanaanitorshizi, M., Tabarhosseini, M., & Amiri, D. (2024). International diversification and stock-price crash risk. International Journal of Financial Studies, 12(2), 47.
[3] Ataei, S., Ataei, S. T., & Saghiri, A. M. (2025a). A Systematic Review on the Application of Artificial Intelligence in Decentralized Finance. TechRxiv. https://doi.org/10.36227/techrxiv.175099684.47325415/v1
[4] Ataei, S., Ataei, S. T., & Saghiri, A. M. (2025b). Applications of Deep Learning to Cryptocurrency Trading: A Systematic Analysis. TechRxiv. https://doi.org/10.36227/techrxiv.175099684.44514402/v1
[5] Bali, T. G., Cakici, N., & Whitelaw, R. F. (2011). Maxing out: Stocks as lotteries and the cross-section of expected returns. Journal of Financial Economics, 99(2), 427–446. https://doi.org/10.1016/j.jfineco.2010.08.014
[6] Bekaert, G., & Harvey, C. R. (1997). Emerging equity market volatility. Journal of Financial Economics, 43(1), 29–77. https://doi.org/10.1016/S0304-405X(96)00889-6
[7] Carhart, M. M. (1997). On Persistence in Mutual Fund Performance. The Journal of Finance, 52(1), 57–82. https://doi.org/10.1111/j.1540-6261.1997.tb03808.x
[8] Cheon, Y.-H., & Lee, K.-H. (2018). Maxing Out Globally: Individualism, Investor Attention, and the Cross Section of Expected Stock Returns. Management Science, 64(12), 5807–5831.
[9] Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. The Journal of Finance, 25(2), 383–417. https://doi.org/10.2307/2325486
[10] Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33(1), 3–56. https://doi.org/10.1016/0304-405X(93)90023-5
[11] Fong, W. M., & Toh, B. (2014). Investor sentiment and the MAX effect. Journal of Banking & Finance, 46, 190–201. https://doi.org/10.1016/j.jbankfin.2014.05.006
[12] Goetzmann, W. N., & Kumar, A. (2008). Equity Portfolio Diversification*. Review of Finance, 12(3), 433–463. https://doi.org/10.1093/rof/rfn005
[13] Gorman, J., Akhtar, F., Durand, R. B., & Gould, J. (2022). It could be overreaction, not lottery-seeking, that is behind Bali, Cakici And Whitelaw's MAX effect. Critical Finance Review, 11(3–4), 647–675. https://doi.org/10.1561/104.00000123
[14] Griffin, J. M., Kelly, P. J., & Nardari, F. (2010). Do Market Efficiency Measures Yield Correct Inferences? A Comparison of Developed and Emerging Markets. The Review of Financial Studies, 23(8), 3225–3277.
[15] Hung, W., & Yang, J. J. (2018). The MAX effect: Lottery stocks with price limits and limits to arbitrage. Journal of Financial Markets, 41, 77–91. https://doi.org/10.1016/j.finmar.2018.07.003
[16] Jegadeesh, N., & Titman, S. (1993). Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. The Journal of Finance, 48(1), 65–91. https://doi.org/10.2307/2328882
[17] Khodayari Gharanchaei, M. (2024). Quantitative Investment Diversification Strategies via Various Risk Models. Journal of Advancements in Applied Business Research, 13(1), 41–48.
[18] Khodayari, M., Razmi, J., & Babazadeh, R. (2019). An integrated fuzzy analytical network process for prioritisation of new technology-based firms in Iran. International Journal of Industrial and Systems Engineering, 32(4), 424–442.
[19] Kumar, A. (2009). Who Gambles in the Stock Market? The Journal of Finance, 64(4), 1889–1933. https://doi.org/10.1111/j.1540-6261.2009.01483.x
[20] Lesmond, D. A., Ogden, J. P., & Trzcinka, C. A. (1999). A New Estimate of Transaction Costs. The Review of Financial Studies, 12(5), 1113–1141.
[21] Mitton, T., & Vorkink, K. (2007). Equilibrium Underdiversification and the Preference for Skewness. The Review of Financial Studies, 20(4), 1255–1288.

[22] Mohammadagha, M., Tshitenge, I., & Adebambo, I. (2025). State-of-the-Art Machine Learning Techniques in Sentiment Analysis for Social Media: L'État de l'Art des Techniques d'Apprentissage Automatique en Analyse de Sentiment pour les Médias Sociaux.
[23] Mojtahedi, S., Mashhadi, S., & Savin, A. (2025). MAX Effect and Investor Sentiment: Evidence from the Swedish Stock Market. Journal of Business and Management Studies, 7(2), 184–206. https://doi.org/10.32996/jbms.2025.7.2.13
[24] Nartea, G., Kong, D., & Wu, J. (2017). Do extreme returns matter in emerging markets? Evidence from the Chinese stock market. Journal of Banking & Finance, 76(C), 189–197.
[25] Nartea, G. V., Wu, J., & Liu, H. T. (2014). Extreme returns in emerging stock markets: Evidence of a MAX effect in South Korea. Applied Financial Economics, 24(6), 425–435. https://doi.org/10.1080/09603107.2014.884696
[26] Pazouki, S., Jamshidi, M. (Behdad), Jalali, M., & Tafreshi, A. (2025). Artificial Intelligence and Digital Technologies in Finance: A Comprehensive Review. Journal of Economics, Finance and Accounting Studies, 7(2), 54–69. https://doi.org/10.32996/jefas.2025.7.2.5
[27] Saghezchi, A., Kashani, V. G., & Ghodratizadeh, F. (2024). A Comprehensive Optimization Approach on Financial Resource Allocation in Scale-Ups. Journal of Business and Management Studies, 6(6), 62.
[28] Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. The Journal of Finance, 19(3), 425–442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x
[29] Soltaninejad, M., Aghazadeh, R., Shaghaghi, S., & Zarei, M. (2024). Using Machine Learning Techniques to Forecast Mehram Company's Sales: A Case Study. Journal of Business and Management Studies, 6(2), 42–53. https://doi.org/10.32996/jbms.2024.6.2.4
[30] Walkshäusl, C. (2014). The MAX effect: European evidence. Journal of Banking & Finance, 42(C), 1–10.
[31] Zhong, A., & Gray, P. (2016). The MAX effect: An exploration of risk and mispricing explanations. Journal of Banking & Finance, 65, 76–90. https://doi.org/10.1016/j.jbankfin.2016.01.007