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Effect of the Ramadan Month on Stock Return Anomalies: Evidence from the Moroccan Stock Market

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Abstract:

The calendar anomalies observed on the stock markets are abnormal returns identified over specific periods of the year, they can take several forms: the January effect, the end-of-month effect, the holiday effect and the seasonality effect, often linked to investor behaviour influenced by psychological, behavioural, cultural and religious factors, thus violating the hypothesis of the efficiency of the financial markets. The objective of this article is to investigate the probability of the existence of calendar anomalies in the Moroccan stock market, in particular, related to the holy month of Ramadan, by analyzing the impact of this effect on returns and conditional volatility. To conduct this study, daily data from the MASI index, the main indicator of the Casablanca Stock Exchange, was selected over a period from 2005 to 2025, in order to capture all variations in returns. These models are calculated from the daily closing prices of the index and modelled using a rigorous econometric approach, using the ARMA (2.1) models for the mean equation and GARCH (1.1) for the variance equation, while incorporating a dummy variable for the days of Ramadan. The results obtained indicate that the average returns observed during the holy month of Ramadan are slightly higher than those observed outside this month. However, the conditional volatility detected shows a significant decrease during this period of Ramadan, thus confirming the stability of the market, and shows that anomalies in the lunar calendar (Ramadan) manifest themselves as a change in risk dynamics rather than an improvement in returns.

Keywords: Ramadan effect; calendar anomaly; Moroccan stock market; ARMA-GARCH; return; volatility.
Classification JEL: G14
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1. Introduction

The Market Efficiency Hypothesis is one of the main theoretical foundations of modern finance, which states that the price of financial assets immediately reflects all available information about the market, making it impossible to predict future prices and achieve abnormal returns in a systematic way (Fama, 1970). When in reality, persistent performance behaviors have been identified thus violating this basic assumption (Karadzic & Backovic-Vulic, 2011).

Here, we are talking about calendar anomalies, which by definition are temporal regularities identified over a specific period of the year(Dhankhar et al., 2025a). These elements are linked to investor sentiment (fear, overconfidence, imitation, risk aversion, etc.) and the trend of investments, thus generating repetitive returns at the same time each year (Maria Caporale & Zakirova, 2017). This contradicts the hypothesis of efficient markets.

This persistent phenomenon leads to a deviation of the financial markets in terms of functioning and informational efficiency. Anomalies take several forms, such as annual and seasonal effects based on repetitive structural events, such as the January effect linked to the end of the fiscal year, or changes in investor behaviour depending on the weather or holiday periods, for example, the Halloween effect. There are also weekly and daily effects that manifest themselves depending on the day of the week or the proximity of a holiday. Investors are influenced by investor psychology, for example, Friday optimism and Monday pessimism, as well as risk management before the market closes at the end of the week. In addition, there are recurring monthly and month-end effects.

In Muslim-majority countries, a specific anomaly is noted, and that is the Ramadan effect, which occupies an important place because of its behavioral and religious dimension (S. Hijazi & I. Tabash, 2020). A significant change has been observed in the pace of life, work habits and psychological state of individuals, thus influencing investor behaviour(Hassan & Kayser, 2019a). For financial markets, this period is often associated with reduced volatility, as well as the emergence of abnormally positive returns (Ali et al., 2017a). however, the extent of the Ramadan effect varies from market to market, depending on their level of development and institutional context(Hassan & Kayser, 2019b).

The study of the effect of Ramadan on the Moroccan stock market is relevant, as an emerging market characterized by a strong cultural and religious dimension, providing fertile ground for comparing returns during and outside of Ramadan (Lekhal & Oubani, 2020). This allows, on the one hand, to test the informational efficiency of the Moroccan stock market, taking into account the effect of cultural and religious seasonality. The objective is to analyze how individuals' lifestyle habits influence investment decisions and modify the level of risk aversion. And on the other hand, to understand the microstructure of the market. In addition, the identification of these anomalies allows managers to optimize their arbitrage strategies and anticipate volatility.

Although several studies have highlighted some forms of informational inefficiency in the Moroccan market, few empirical studies have systematically analyzed the effect of Ramadan as a calendar anomaly on the returns of the MASI, the main indicator of the Casablanca stock exchange, nor its interaction with the usual temporal structure of returns.

As a result, this study revolves around a crucial question: **does the month of Ramadan constitute a significant calendar anomaly affecting the returns of the Moroccan stock market?** This article examines the existence of the Ramadan effect by comparing returns during and outside of Ramadan. We assume that the Ramadan effect is capable of producing abnormal returns compared to those observed outside of Ramadan. This research analyzes the daily returns of the MASI index, the main indicator of the Casablanca Stock Exchange, over several years, in order to study the mobile nature of the lunar calendar of Ramadan. An econometric study was carried out incorporating dummy variables to isolate the specific effect

of each period. We used the ARMA-GARCH model to address conditional heteroscedasticity, an intrinsic property of Casablanca Stock Exchange returns that the simple ARMA model cannot capture. Indeed, financial series in the local market manifest themselves in clusters of volatility, where large price shocks generate phases of persistent instability. GARCH is therefore crucial for measuring the effect of Ramadan on return variance ; This month, redefines investors' perception of risk and nervousness.
The results obtained contribute to a better understanding of the seasonality and efficiency of the Moroccan stock market. In order to present the analyses carried out in a coherent way, the article is structured as follows: first a review of the literature to situate the topic, then a presentation of the research methodology, then the results and discussion, and finally a conclusion that synthesizes the results.

2. Literature Review

Calendar anomalies represent patterns at different time frequencies, changing the performance of financial assets based on specific periods of the year (Villarreal-Samaniego & Santillán, 2023). These anomalies are linked to religious and cultural events, which introduce a behavioral dimension into the process of formation of financial asset prices (Hasan & Al-Najjar, 2025).
The Ramadan effect is a special case in the field of market finance. Unlike solar calendar anomalies, Ramadan obeys the lunar calendar and moves about 11 days per year, which complicates its empirical identification while increasing its analytical relevance (Hassan & Kayser, 2019c).
In order to frame the central question of the literature review which focuses on the effect of Ramadan observed on the Moroccan stock market, through its general index, the MASI. International studies are used for comparative purposes, and the results are interpreted in the light of the adaptive markets hypothesis, with the aim of assessing the transitory or persistent nature of this anomaly.

2.1 Ramadan and investor behaviour.

Behavioural finance is a starting point for understanding the Ramadan effect, the findings state that investment decisions are sometimes irrational, and are sometimes influenced by mood, beliefs and social norms(Cheema & Fianto, 2024b). According to the positive mood hypothesis, developed by (Białkowski et al., 2012). The holy month of Ramadan, characterized by exceptional habituals, is likely to lead to significant changes in the psychological state of investors, thus fostering a climate of well-being and spiritual optimism that can increase risk tolerance, leading to increasing stock market returns and low volatility(Khan, 2018).
Conversely, many studies point out that a reduction in working hours and a change in economic rhythms during this month leads to a decrease in liquidity. In addition, the solidarity and charitable dimension of Ramadan through Zakat is likely to redirect part of the financial flows of the stock market towards social uses (Hassan & Kayser, 2019d).
These elements underline the existence of several transmission channels of this Ramadan effect, distinguishing the potential effects on average returns, on the volatility of returns and on market liquidity. These mechanisms suggest that the Ramadan effect is not limited to influencing returns, but also affects the structure of the market, through liquidity and aggregate investor behavior.

2.2 Synthesis of international empirical studies on the Ramadan effect

The existing empirical literature can be structured in two axes : the first on the effects on average returns, and the second, on the effects on volatility. Some studies provide strong evidence of the existence of abnormally high returns during this period (Białkowski et al., 2012), analysing 11 stock markets in Muslim countries, show that the average returns observed during Ramadan

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are significantly higher than those for the rest of the year, while being associated with lower volatility. Similarly, (Al-Hajieh et al., 2011) identify a positive and statistically significant Ramadan effect in several Middle Eastern markets. This work converges with regard to average returns, suggesting a higher stock market performance during the holy month of Ramadan in several markets.

Conversely, other studies exclude the existence of this anomaly or relativize its field of application. In Pakistan, some studies observe a decrease in volatility without a significant impact on returns, while (Seyyed et al., 2005) conclude, for the Saudi market, that average returns remain stable despite a decrease in volatility during Ramadan. These results converge in terms of volatility becoming low, while the effects on returns remain divergent across markets and time periods.

Overall, the previous literature suggests that the Ramadan effect is not universal or stable over time, but it is highly dependent on the institutional context and market conditions (Tabash et al., 2025).

2.3 Efficiency and specificities of the Moroccan stock market calendar

The Moroccan stock market, via the Casablanca Stock Exchange and its MASI benchmark index, is often described as inefficient in the weak sense (Youness & Saad, 2024). The calendar anomalies identified in many studies show their correlations with stock market returns that lead to a deviation from random walking (Omerani et al., 2022). For the Ramadan effect, the results remain ambiguous. An international study carried out (Sonjaya & Wahyudi, 2016), identifies a significant Ramadan effect in Morocco. In addition to the Ramadan effect, other calendar anomalies were observed, in particular the monthly effect (February, March and October), an often-reversed January effect(Omerani et al., 2022). The existence of anomalies reinforces the need for a specific analysis of the local market, through a rigorous comparison of returns, and volatility during and outside the Ramadan period, in order to understand the dynamics of the MASI index.

2.4 The Adaptive Market

the violation of the hypothesis of the efficiency of financial markets, and the anomalies in the timing that persist, particular attention has been given to adaptive markets, proposed by (Lo, 2004). This concept states that efficient markets are neither absolute nor permanent, but markets that adapt to the needs of investors, to competition and to shocks likely to affect the macroeconomic level (Dhankhar et al., 2025b). The sacred self is a short-lived, ephemeral phenomenon that disappears as investors adapt.

This adaptive behavior, resulting from several past events, whether economic, financial or health, is mainly responsible for the appearance or disappearance of certain anomalies. In this sense, the effect of Ramadan on the MASI is considered a transient anomaly of the calendar, the persistence of which must be evaluated empirically in an adaptive framework.

This adaptive nature states that the Ramadan effect should be reassessed periodically to determine whether it is a persistent anomaly or a transient phenomenon related to specific conditions (Sahu et al., 2024).

The empirical literature on the Ramadan effect emphasizes that the existence and magnitude of returns vary greatly depending on the markets and the periods studied. As a result, a certain consensus shows a decrease in volatility during the month of Ramadan, suggesting a more stable market climate. For the local market, the studies that exist remain few and are based on limited time horizons, which does not allow an effective temporal evaluation of this anomaly.

3. Methodology

The Ramadan effect affects returns, but it is not seen as an anomaly, but rather as a phenomenon that depends on investor sentiments, market liquidity and the time context. This article seeks to test the hypothesis that the holy month has a significant impact on stock market returns. Using daily data from the MASI index and adopting linear regression incorporating dummy variables, in order to reassess the efficiency of the Moroccan market in light of calendar anomalies related to religious effects.

The study is based on daily data from the general index of the Casablanca stock exchange, the MASI, covering the period from 01/01/2006 to 31/12/2025. The choice of an extended time horizon makes it possible to integrate several phases of the stock market cycle, including periods of expansion, slowdown and financial turbulence, and thus to assess the temporal stability of the Ramadan effect. The data mobilized includes the daily closing price of the MASI index, which reflects the overall evolution of the Moroccan stock market. The dates corresponding to the month of Ramadan are identified from the official Hijri calendar and adjusted to the actual days of quotation. Financial data is obtained from the Casablanca Stock Exchange and international financial data providers.

From this data, the daily market return is calculated using a logarithmic transformation of the closing prices of the MASI index, according to the following expression:

$R_t = \ln(MASI_t) - ln(MASI_{t-1})$

MASI-t represents the closing value of the index on day t. This transformation is widely used in the financial literature because of its statistical properties, including temporal additivity and stationarity.

In order to isolate the specific effect of the month of Ramadan, an indicator variable is constructed, taking the value 1 when the day of listing belongs to the month of Ramadan and 0 otherwise. This variable captures the differential impact of this religious period on returns, volatility and trading activity, compared to other periods of the year.

$$Ramadan_t \begin{cases} 1 & if\ the\ t\ belongs\ to\ the\ month\ of\ Ramadan \\ 0 & otherwise \end{cases}$$

Before the estimation of the econometric models, a descriptive analysis is conducted in order to compare the statistical characteristics of returns during the month of Ramadan and outside this period. The statistics of mean, standard deviation, minimum, maximum, asymmetry and kurtosis are examined. The stationality of the series is then tested and validated using the augmented Dickey-Fuller (ADF) test (Appendix 1). The normality of returns is assessed using the Jarque–Bera test, while the presence of autocorrelation is analyzed using the autocorrelation (ACF), partial autocorrelation (PACF) and Ljung–Box tests.

First, the average effect of Ramadan on stock market returns is estimated using a simple linear regression model, in which returns are explained by the dummy variable Ramadan.

$R_t = \alpha 0 + \alpha 1 Ramadan_t + \varepsilon_t$

The coefficient associated with this variable measures the average impact of the month of Ramadan on the daily returns of the Moroccan market. However, as financial returns are often characterized by a time dependence, this first estimate is supplemented by an ARMA model integrating autoregressive and moving average terms.

$$R_t = \alpha_0 + \alpha_1 Ramadan_t \sum_{i=1}^{p} \emptyset_i R_{t-i} + \sum_{j=1}^{q} \theta_j \varepsilon_{t-j} + \varepsilon_t$$

The p and q orders are selected on the basis of the Akaike Information Criteria (AIC) and Schwarz Information Criteria (BIC), as well as the Ljung–Box test.

Beyond the analysis of average returns, the study also looks at the dynamics of volatility. As stock market returns are likely to have a variable conditional variance over time, a model from the GARCH family is adopted to examine the impact of Ramadan on market volatility. The

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GARCH(1,1) model is estimated by integrating the dummy variable Ramadan into the conditional variance equation, which makes it possible to assess whether this religious period is associated with a significant change in the level of volatility.

$$\text{GARCH(1,1)} \begin{cases} R_t = \alpha_0 + \alpha_1 Ramadan_t + \varepsilon_t \\ \varepsilon_t \Omega_{t-1} \sim N(0, h_t) \\ h_t = \omega + \alpha \varepsilon_t^2 + \beta h_{t-1} + \delta Ramadan_t \end{cases}$$

h_t represents the conditional variance. The coefficient captures the impact of Ramadan on market volatility.$h_t \delta$

In order to verify the robustness of the results, alternative models such as ARMA-GARCH are also estimated, allowing to take into account possible asymmetric effects of positive and negative shocks on volatility.

The estimated models are then subjected to several diagnostic tests to verify the validity of the empirical results. The ARCH test is used to detect the presence of conditional heteroscedasticity, while the Ljung–Box test is used to check for the absence of autocorrelation of residues. Stability tests on sub-periods are also carried out in order to examine the evolution of the Ramadan effect over the twenty years studied.

Based on this methodological approach, the study tests the following hypotheses:

H1*: Moroccan stock market returns differ significantly during the month of Ramadan;*

H2*: market volatility is significantly affected by this religious period.*

4. Results

Table 1 presents the descriptive statistics of the daily returns of the MASI for the entire period studied, distinguishing between the days of quotation during Ramadan and the days outside Ramadan. The statistics reported include the mean, the extreme values, the standard deviation, the skewness and flattening (kurtosis) coefficients, as well as the number of observations. This descriptive analysis makes it possible to identify any preliminary differences between the two periods before the estimation of the econometric models.

Table 1: Descriptive statistics and comparison of Ramadan and Hors Ramadan

Period	Mean	Max	Min.	Std. Dev.	Skew.	Kurt.	Obs.
Outside Ramadan (0)	0.000265	0.053054	-0.092317	0.007895	-0.781172	13.99480	4777
Ramadan (1)	0.000379	0.042499	-0.041659	0.007144	-0.406497	12.15169	443
The entire period	0.000275	0.053054	-0.092317	0.007833	-0.758534	13.92628	5220

Source: Eviews, 10.

Descriptive statistics for the period of Ramadan and outside of Ramadan show an average of high returns during Ramadan of 0.000379 in contrast to the non-Ramadan period with a recorded return of 0.00026. As for the standard deviation of returns (Std.dev.), this parameter is lower in Ramadan, 0.007144 against 0.007895. For extreme values, they are more pronounced outside of Ramadan (Min: -092317; Max: 0.053054), unlike the rest of the year (Min: –041659; Max: 0.042499 during Ramadan. This reflects investor caution.

The symmetry coefficients are negative for both periods, reflecting an asymmetric distribution of returns on the left, although this asymmetry is less pronounced during Ramadan (–0.406497) than outside of Ramadan (–0.781172). Moreover, the kurtosis coefficients are much higher than 3, indicating leptokurtic distributions characterized by thick tails, a frequent phenomenon in emerging financial markets.

In order to test the existence of a Ramadan effect on the daily returns of the Moroccan stock market, a simple linear regression is estimated by the ordinary least squares (OLS) method. The daily return is explained by a dummy variable taking the value 1 during the month of Ramadan

and 0 otherwise. This approach makes it possible to identify a possible calendar anomaly associated with Ramadan in terms of average return.

Table 2: Estimated daily returns by linear regression OLS with Ramadan dummy variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000265	0.000113	2.340	0.0193
RAMADAN	0.000113	0.000389	0.292	0.7706
R^2	0.000016	-	-	-
Adj. R^2	-0.000175	-	-	-
S.E.	0.007834	-	-	-
F-stat	0.08505	-	-	0.7706
Durbin-Watson	1.566	-	-	-

Source: Eviews,10.

The results of the OLS regression show that the coefficient associated with the Ramadan variable is positive (0.000113), suggesting a slight increase in the average return during the month of Ramadan. However, this coefficient is not statistically significant, with an associated probability of 0.7706, well above the conventional thresholds of significance.

The constant coefficient is positive and significant at the 5% threshold, indicating a positive average daily return outside the month of Ramadan. On the other hand, the very low value of the R^2 (0.000016) and the negative adjusted R^2 indicate that the Ramadan variable explains a negligible part of the variation in daily returns.

In addition, the overall model test (F-statistic = 0.08505, p = 0.7706) confirms the absence of a statistically significant relationship between the explanatory variable and performance. The Durbin–Watson statistic close to 2 suggests a limited autocorrelation of residuals, although further testing is needed to confirm this hypothesis.

The first linear regression shows that no significant effect is observed on average returns, which necessitates the use of the more advanced models, namely ARMA-GARCH, in order to capture the temporal dependencies and conditional heteroscedasticity of the returns. Returns show a strong leptokurtosis, leading to the rejection of the hypothesis of normality. In the ARMA-GARCH modeling, we assume a normal conditional distribution for the conditional variance, as is common in the financial literature, although alternative distributions may better reflect the observed thick tails. Several ARMA specifications were estimated (ARMA(1,0), ARMA(1,1), ARMA(2,1) and ARMA(2,2)), and the ARMA(2,1) model was selected on the basis of the minimization of the AIC and BIC information criteria, confirming the absence of residual autocorrelation, both in the residues and in their squares. This model is then coupled by GARCH(1,1) in order to model conditional volatility and examine the existence of the Ramadan effect.

Table 3 shows, on the one hand, that the mean equation shows a positivity for the coefficients associated with the Ramadan variable (0.000375). This indicates a slight increase in average returns. On the other hand, it is not statically significant (p = 0.1613), hence the absence of a Ramadan effect on average returns. For the terms AR (2) and MA (1), they are positive and significant, showing a dependence of returns over time. This justifies the use of ARMA modelling to capture the dynamics of uncorrelated residues.

On the other hand, the variance equation indicates that the coefficients (ARCH:0.253 and GARCH:0.679) are positive and significant, hence the presence of conditional heteroscedasticity and a persistence of volatility in the market. Moreover, the sum of these coefficients is close to unity, suggesting that volatility shocks have a lasting effect.

In the variance equation, the coefficient of the variable 'Ramadan' is negative and statistically significant at 5% (p = 0.0329), which shows a decrease in volatility during the holy month of Ramadan. To assess the quality of the model, the information criteria (AIC and BIC) are weak, confirming the adequacy of the model. Whereas, the DW statistic, it shows that there is no

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autocorrelation. In the end, the log-likelihood is high, confirming the relevance of the chosen ARMA–GARCH specification.

Table 3: ARMA (2,1)-GARCH (1,1) estimate with dummy Ramadan

	Variable	Coefficient	Std. Error	z-Statistic	Prob.
Equation of the mean	C	0.000265	0.000093	2.858	0.0043
	RAMADAN	0.000375	0.000268	1.401	0.1613
	AR(2)	0.051319	0.014401	3.564	0.0004
	MA(1)	0.137290	0.014872	9.231	0.0000
Variance equation (GARCH 1,1)	C	5.31E-06	6.62E-07	8.032	0.0000
	RESID(-1)^2	0.253111	0.024034	10.531	0.0000
	GARCH(-1)	0.678559	0.023201	29.248	0.0000
	RAMADAN	-1.77E-06	8.30E-07	-2.134	0.0329
Model Statistics	R^2	0.042426			
	Adjusted R^2	0.041876			
	Log-like	19095.78			
	AIC	-7.315744			
	BIC	-7.304430			
	DW	1.848			

Source : Eviews,10.

5. Discussion

The results obtained using the ARMA (2.1)-GARCH (1.1) model highlight the effect of the month of Ramadan on Moroccan stock market returns. The first results show that the coefficient related to the dummy variable is positive but insignificant, which suggests that average returns are slightly higher during the month of Ramadan; the difference observed cannot be considered significant because it is not robust enough to conclude the existence of a Ramadan effect on the average market performance. This result indicates that investors do not receive abnormal returns during this period, which is consistent with informational efficiency.

Moreover, the variance results show a significant effect of the month of Ramadan on market volatility. In the GARCH model, the variable's coefficient is negative and statically significant, indicating a decrease in volatility during this period, suggesting that the market is less risky during Ramadan, and can be interpreted as a form of anomaly affecting the dynamics of risk rather than the returns themselves.

This specificity is linked to the structural nature of the Moroccan market, often referred to as an emerging market with limited liquidity. The change in working hours observed during Ramadan, the reduction in economic activity and the change in trading behaviour are leading to a decrease in trading volumes, which translates into a decrease in volatility. The impact of Ramadan in Morocco is manifested by a slowdown in market activity and a more cautious attitude of investors, marking that the market is characterized by a significant presence of institutional and individual investors with a long investment horizon, which reduces the sensitivity to fluctuations observed in the short term. In this sense, cultural and religious factors do not directly affect returns, but influence the degree of uncertainty and risk dynamics, resulting in lower volatility.

These observations are consistent with some of the international literature that documents that the Ramadan effect does not influence the returns themselves but rather the market structure and volatility (Seyyed et al., 2005 ; Hassan & Kayser, 2019d). These results confirm the predictions of behavioural finance and are part of the Adaptive Market Hypothesis, according to which calendar anomalies appear temporarily and contextually (Lo, 2004 ; Dhankhar et al., 2025b).

The ARCH and GARCH estimators confirm the presence of a high persistence of volatility in the Moroccan market, and that volatility shocks have a lasting impact, regardless of the time

frame considered. Although the holy month of Ramadan influences risk dynamics, the fundamental structure of volatility remains largely unchanged.
Overall, the Ramadan-related calendar anomaly is manifested by a change in the risk profile of the market rather than an improvement in average returns. This dissociation between the mean equation and the variance shows a form of partial efficiency of the Moroccan market. These results are part of the Adaptive Market Hypothesis, in which calendar anomalies appear in a transitory manner reflecting a process of gradual adaptation of market participants.
And finally, on a practical level, Ramadan is associated with a temporarily less volatile market environment. For investors and portfolio managers, lower risk is factored into tactical allocation and risk management, while for regulators, this effect requires monitoring seasonal changes in liquidity without interpreting them as warning signals or market failure.

6. Conclusion

The objective of this study was to examine the existence of the Ramadan effect, considered a calendar anomaly, on the Moroccan stock market. The analysis touches on both average returns and conditional volatility, based on the closing prices of the MASI index, and using econometric modeling using ARMA (2,1) for the mean equation and GARCH (1,1) for the variance equation, while incorporating a dummy variable.
The results show that during Ramadan, there is no statistically significant effect on average returns, and that they are lower than those recorded outside Ramadan, this difference does not allow the conclusion of the existence of abnormal returns, reinforcing the hypothesis of efficacy in terms of return, even in the presence of a specific religious calendar.
On the positive side, the coefficient associated with the dummy variable "Ramadan" is negative, can be explained by the cautious behavior of investors, the slowdown in stock market activity or a more stable market climate during the month of Ramadan.
These results suggest that the anomaly in the Ramadan calendar manifests itself as a change in risk dynamics rather than an improvement in returns.
Finally, this study opens up prospects for future research. Work could incorporate trading volume, test volatility asymmetry, or compare the effect of Ramadan between different emerging and developed markets.

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Appendix

Stationarity test

Null Hypothesis: RETURN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=32)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-57.97256	0.0001
Test critical values:	1% level	-3.431421	
	5% level	-2.861898	
	10% level	-2.567003	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RETURN)
Method: Least Squares
Date: 02/05/26 Time: 23:53
Sample (adjusted): 3 5226
Included observations: 5224 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETURN(-1)	-0.783238	0.013510	-57.97256	0.0000
C	0.000216	0.000106	2.037311	0.0417

R-squared	0.391575	Mean dependent var	3.15E-06
Adjusted R-squared	0.391459	S.D. dependent var	0.009800
S.E. of regression	0.007645	Akaike info criterion	-6.909157
Sum squared resid	0.305202	Schwarz criterion	-6.906645
Log likelihood	18048.72	Hannan-Quinn criter.	-6.908279
F-statistic	3360.818	Durbin-Watson stat	2.010091
Prob(F-statistic)	0.000000		